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TABLE OF CONTENTS

TABLE OF CONTENTS

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Factors Associated with the Need for Breastfeeding Information Among Women with Gestational Diabetes Mellitus: A Cross-sectional Study

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ABSTRACT (ENGLISH)

Purpose

Analyzing information based on individual needs can maximize the effectiveness of education, leading to changes in personal health behaviors. This cross-sectional descriptive survey study aimed to identify the characteristics of mothers who experienced gestational diabetes mellitus and correlate the factors associated with their information needs.

Methods

The participants were 298 women between the ages of 20 and 49 years who were pregnant and diagnosed with gestational diabetes at the time of the study, or who were diagnosed with gestational diabetes mellitus within five years after delivery. The average age of the participants was 34.28 years. After comparing participants' demographics, diabetes, and breastfeeding-related characteristics according to their need for information on breastfeeding, a multiple logistic regression analysis was performed.

Results

Factors associated with participants' need for information on breastfeeding were economic conditions, usual body mass index, current pregnancy, and experience of breastfeeding.

Conclusion

The findings can be used to implement programs that meet the needs of these women and help improve maternal and pediatric health and quality of life.

FULL TEXT

Introduction

In 2019, the International Diabetes Federation (IDF) estimated that 20.4 million pregnant women had hyperglycemia. In 83.6% of these cases, the underlying reason was gestational diabetes mellitus (GDM). The prevalence of GDM increases with age, resulting in a 37% occurrence in the 45–49 age group and a 50.1% occurrence in women under the age of 30 years [1]. In the 1990s, the prevalence of GDM in Korea ranged from 1.7% to 3.9%; however, a systematic review from 2000 to 2016 revealed that its prevalence in Korea increased to approximately 7.2% [2,3]. The risk of type 2 diabetes and obesity in both mothers and newborns increases if pregnant women with GDM do not receive timely treatment; thus, diabetes-related knowledge and management skills are essential for this population [4]. Of the various methods to decrease the risk of diabetes, breastfeeding has been found to be one of the most beneficial since it can also reduce the incidence of other diseases and improve women's health [5–7]. Being breastfed as a newborn also plays a role in adult life. Specifically, in a population-based birth cohort study of 3493 newborns in Pelotas, Brazil in 1982, breastfeeding was linked to an increase in intelligence quotient 30 years later, which helped influence educational performance and income growth during adulthood [8].

However, there are a number of factors that lead to early breastfeeding cessation, including problems with breastfeeding at home, early return to work after childbirth (i.e., within three months), inadequate breastfeeding support, cesarean section delivery, low socioeconomic status, and increased body mass index (BMI) [9]. Only a few studies have investigated the need for information on breastfeeding or beliefs related to it among women with GDM, which is important since some diabetes medications taken by mothers can affect the children being breastfed [10]. Technological advancements, the abundance of available resources (i.e., information overload), and information targeting pregnant women do not always accurately reflect the needs of those with GDM [9]. Furthermore, anecdotal information by grandmothers has been found to negatively affect proper breastfeeding [11].

Knowledge, attitudes, and interest can influence the duration a mother breastfeeds; thus, education regarding the benefits and methods of breastfeeding is not only helpful but imperative [12,13]. Information based on an individual's needs that is provided in a timely manner can lead to changes in personal health behaviors [14]. The present study, therefore, aimed to identify the characteristics of mothers who experienced GDM and correlate their information needs. This information will serve as the basis for programs that can be potentially effective and aid mothers with GDM and their children lead healthy lives.

Materials and methods Participants

Potential participants were recruited through an online forum for pregnant women with diabetes in May 2020 and were required to provide information regarding their GDM diagnosis in the form. Participants were then selected based on their self-reports. The inclusion criteria were: (1) women aged 20–49 years who were (2) currently pregnant and diagnosed with GDM or (3) diagnosed with GDM within five years after delivery. Women who were diagnosed with GDM and had type 2 diabetes after delivery were excluded. The data were collected anonymously, and the questionnaire was identified by a serial number, placed in an anonymous envelope, and delivered to individual participants.

The sample size for logistic regression was calculated using G* Power, version 3.14. We considered an odds ratio (OR) of 1.62, Pr of 0.43, significance level of 0.05, alpha of 5%, and two-tailed test with 95% confidence interval (CI) based on self-efficacy. The minimum sample size was determined to be 248; accounting for a potential dropout rate of 20%, a total of 298 women were surveyed.

Variables Need for breastfeeding information

The need for breastfeeding information was assessed by one question: “Do you want to receive information about a breastfeeding program for mothers with GDM?” Participants were then divided into two groups based on their responses (yes or no).

Demographic characteristics

Demographic characteristics included age (26–30 years, 31–35 years, 36–40 years, and ≥41 years), educational level (high school or college/university and above), economic condition (low or above medium), employment status (employed or unemployed), weight (in kg), and height (in cm). Weight and height were used to calculate BMI, which was included in the final analysis. Current pregnancy was classified as “yes” if they were pregnant at the time of the survey and were diagnosed with GDM.

Diabetes-related and breastfeeding experience characteristics

For diabetes-related characteristics, participants provided information on previous illnesses other than diabetes (if any, the number of such diseases), current diabetes medication/s (if any, medication name/s, and type of management), and diabetes duration. The instrument used to assess GDM-related knowledge was developed based on the “Knowledge and Health Beliefs about Gestational Diabetes and Healthy Pregnancy's Breastfeeding Intention” [13]. This tool comprised 15 questions: four on GDM's definition, signs, and symptoms; four on GDM management; five on the adverse outcomes of GDM; and two concerning breastfeeding. The content validity was confirmed by two obstetric-gynecologists and two maternity nursing professors. Fifteen items with a content validity index of 0.8 or higher were extracted, and in a previous study, Kuder-Richardson 20 ranged from .75 to .77 [13,15]. Each question was answered as “Yes,” “No,” or “Don't know”; correct answers received 1 point while wrong answers or “Don't know” responses earned 0 points. The knowledge score was converted to a percentile correct answer rate (%), with higher scores indicating greater knowledge. The Kuder-Richardson Formula 20 was .607. The breastfeeding experience was divided into full breastfeeding, mixed breastfeeding, and artificial breastfeeding.

Data analysis

Survey data were processed with SPSS, version 24.0 (IBM Corp., Armonk, NY, USA). The differences in demographics, diabetes-related characteristics, and breastfeeding-related characteristics were analyzed using t-tests and chi-square tests. The correlates of breastfeeding information needs were analyzed through multiple logistic regression.

Ethical considerations

The participants understood the study's purpose, that participation was voluntary, and that the collected data would be used only for research purposes. All participants provided written informed consent. The study was approved by the concerned institutional review board (KBUIRB-202004-SB-003-01).

Results Demographic characteristics

The data of 298 women with GDM were analyzed. Among them, 123 (41%) had information needs, and there was no significant age difference between the groups with and without information needs (mean = 34.28 years). The difference between the two groups concerned economic condition; when the economic level was low, information needs were about 10% higher ($\chi^2 = 4.42$, $p = .036$). Furthermore, the usual BMI in the group with information needs was 25.30 kg/m^2, indicating greater obesity (about 2 kg/m^2) compared to the group without information needs (t = −4.20, p $\chi^2 = 12.79$, p Table 1).

Diabetes-related and breastfeeding experience characteristics

Table 2 presents the characteristics of diabetes and other diseases in terms of participants’ information needs. The group with information needs had an average of 0.40 diseases other than diabetes, which was statistically higher than those without information needs, with an average of 0.26 (t = 7.23, $p = .007$). In other words, 36.6% of the participants with information needs had more than one disease, apart from diabetes. In the groups with and without information needs, the prevalence of use of diabetes medications was 30.1% and 26.3%, respectively, with insulin being the most commonly used drug (24.4% and 13.7%, respectively). However, differences between the groups in use of diabetes medication, duration of diabetes, GDM-related knowledge, and breastfeeding experience were not statistically significant (Table 2).

Factors affecting information needs in participants

To identify the factors influencing information needs in the participants, a logistic regression analysis was performed using demographic, diabetes-related, and pregnancy and breastfeeding experience characteristics as independent variables. The predictors were economic condition (OR = 2.60, 95% CI = 1.14–5.92), usual BMI (OR = 1.11, 95% CI = 1.03–1.20), current pregnancy (OR = 3.57, 95% CI = 1.14–11.11), and breastfeeding experience (OR = 2.38, 95% CI = 1.04–5.45). Thus, the group with a low economic level had 2.60 times higher information needs than the groups with middle or high economic levels; additionally, the higher the usual BMI, the greater the need for information (by 1.11 times). Furthermore, women who were pregnant at the time of the study had a 3.60 times greater need for breastfeeding information than those who were not. The need for breastfeeding information was 2.38 times greater among women who experienced mixed breastfeeding than among those who did not (Table 3).

Discussion

This study aimed to identify factors associated with breastfeeding information needs among pregnant women with GDM. In this study, about 41% of participants had information needs. This result is difficult to collate accurately due to a lack of prior studies on the information needs of mothers with GDM; however, in a previous study of 21 patients who experienced psychological impairment after ICU treatment, 75% of patients had information needs [16]. Among these ICU survivors, only 33% were satisfied with the information provided by the hospital; thus, it can be assumed that 42% still required more information. In another study, a Swedish survey of 542 patients with chronic obstructive pulmonary disease requiring ongoing self-care, reported that further information on self-care and diet was needed in 68% of moderate and 32% of severe grade patients [17]. Another study involving 458 patients diagnosed with hematologic cancer reported a perceived need for information among 40–70% of the patients [18]. As compared to these studies, the participants in the current study had lower medical severity, but similar information needs. However, although the present study investigated the specific information needs of mothers with GDM, follow-up studies are needed to corroborate the information needs among this target population.

Factors associated with the need for breastfeeding information were low economic levels, increased BMI, current pregnancy status, and mixed breastfeeding experiences. Unlike in previous studies [3,8], GDM-related knowledge, complications, and diabetes drug use levels were not correlated with the need for breastfeeding information in the current study. Demographic data, pregnancy status, and breastfeeding experience were found to be more important than diabetes-related characteristics. Low economic levels and increased BMI have previously been known to influence early breastfeeding cessation in mothers with GDM [9]. Therefore, providing adequate breastfeeding information to mothers with GDM, especially among those with the aforementioned risk factors, can help prevent early breastfeeding cessation.

According to the 2018 National Health and Nutrition Survey, approximately 55% of women had breastfeeding experience of over one month; the average breastfeeding duration was about 17 months [19]. The present results indicate that 70.5% of the women who engaged in mixed and complete breastfeeding had a better breastfeeding experience than the domestic average. Furthermore, the group that engaged in mixed breastfeeding had higher information needs than the group that engaged exclusively in artificial feeding.

The first possible reason for these findings is that the participants may have had experiences with GDM and failed to complete breastfeeding for a previous child. In a study among 1323 healthy mothers investigating the reasons for the cessation of breastfeeding within one year, three main factors were found: that the baby began to bite, the baby lost interest in breast milk, and the mother was unable to produce enough milk [20]. To date, few studies have investigated whether there is a difference between breast milk in healthy women and in women with GDM; however, some research indicates that GDM causes elevated sodium levels in breast milk [21], which are associated with insufficient milk supply and malnutrition in infants [22]. Therefore, the possibility that GDM influences breastfeeding cannot be excluded. Moreover, insufficient breast milk production is a concern not only for the mother but also for healthcare providers [23,24]. Hence, prenatal education on topics such as breast massage and maternal health status is necessary to increase breast milk production.

The second possible reason for the findings is that mothers who already have GDM are aware that breastfeeding has many benefits, but the information given to them while they breastfeed may not be what they need or want. Many studies have focused on motivating breastfeeding mothers by investigating the factors that affect the presence or absence of breastfeeding [9,25]. However, there is a lack of research on breastfeeding-related problems among mothers with GDM and their solutions. Throughout the breastfeeding period, it is necessary to ensure that mothers with GDM can have their doubts clarified by experts, receive corrective feedback, and benefit from supportive programs.

In 2015, a qualitative study of 14 African American mothers found that most were using at least one mobile application to obtain breastfeeding information through social media [26], confirming that pregnant women have a high need for information. Therefore, providing information using social media or mobile applications can help those who are currently pregnant and who will be breastfeeding in the near future, to communicate with experts on related topics.

Despite its strengths, this study has the following limitations. First, although social support, such as support from family members, is very important for continued breastfeeding [9,12], this study did not confirm whether it is associated with information needs. Second, in conducting an online survey, we did not consider potential differences in the information needs of mothers with GDM who do not have access to the internet. Third, interactions between variables, such as economic level and BMI, were not confirmed. Finally, research on the information needs of women with GDM is currently limited. Therefore, knowledge on women who refuse to receive breastfeeding information is scarce. This study also did not investigate why these women did not want to receive this information. Further, a qualitative study on the experience of breastfeeding preparation in women with GDM is necessary. In addition, according to previous studies, mothers with GDM who have high self-efficacy are more likely to breastfeed [15]. Therefore, it would be helpful for health care providers to offer information programs to increase self-efficacy.

Conclusions

We identified the correlates of breastfeeding information needs among women with GDM. Healthcare providers should offer information needs–based programs to increase breastfeeding self-efficacy among women with GDM.

Funding

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Conflict of interest

The authors declare that they have no competing interests.

Acknowledgments

S. P., I. S., and D. M. conceived and designed the study, performed the data analysis, and wrote the manuscript. All authors have read and approved the final manuscript.

Variables	Total	Need for information	Difference	(N = 298)
Yes (n = 123)	No (n = 175)	n (%)/M±SD	n (%)/M±SD	n (%)/M±SD
χ^2 or t (p)	Age (years)	34.28 ± 3.73	34.17 ± 3.62	34.35 ± 23.37
0.40 (.686)	26–30	54 (18.1)	22 (17.9)	32 (18.3)
	31–35	136 (45.6)	60 (48.8)	76 (43.4)
	36–40	93 (31.2)	37 (30.1)	56 (32.0)
	≥41	15 (5.1)	4 (3.2)	11 (6.3)
	Educational level			
2.61 (.106)	High school	65 (21.8)	33 (26.8)	32 (18.3)
	≥College/university	233 (78.2)	90 (73.2)	143 (81.7)
	Economic condition			
4.42 (.036)	Low	44 (14.8)	25 (20.3)	19 (10.9)
	≥Medium	254 (85.2)	98 (79.7)	156 (89.1)

	Employment status			
1.12 (.735)	Employed	131 (44.0)	56 (45.5)	75 (42.9)
	Unemployed	167 (56.0)	67 (54.5)	100 (57.1)
	Usual BMI (kg/m^2)	24.19 ± 3.96	25.32 ± 3.89	23.37 ± 3.82
−4.20 (<.001)	Current pregnancy			
12.79 (<.001)	Yes	53 (17.8)	34 (27.6)	19 (10.9)
	No	245 (82.2)	89 (72.4)	156 (89.1)

Variables	Total	Need for information	Difference	(N = 298)
Yes (n = 123)	No (n = 175)	n (%)/M±SD	n (%)/M±SD	n (%)/M±SD
χ^2 or t (p)	Previous illness (except DM)	0.32 ± 0.54	0.40 ± 0.55	0.26 ± 0.52
7.23 (.007)	No	215 (72.1)	78 (63.4)	137 (78.3)
	Yes	83 (27.9)	45 (36.6)	38 (21.7)
	1	72 (24.2)	41 (33.3)	31 (17.7)
	≥2	11 (3.7)	4 (3.3)	7 (4.0)
	Diabetes medication			
0.35 (.556)	No	215 (72.1)	86 (69.9)	129 (73.7)
	Diet and exercise	213 (71.5)	85 (69.1)	128 (73.1)
	Observation	2 (0.6)	1 (0.8)	1 (0.6)

	Yes	83 (27.9)	37 (30.1)	46 (26.3)
	Insulin + OHA	12 (4.1)	2 (1.6)	10 (5.7)
	Insulin only	17 (5.7)	30 (24.4)	24 (13.7)
	OHA only	54 (18.1)	5 (4.1)	12 (6.9)
	Disease period (months)	28.13 ± 21.96	27.67 ± 25.61	28.47 ± 19.03
0.31 (.758)	GDM-related knowledge	11.38 ± 2.51	11.28 ± 2.20	11.44 ± 2.72
0.55 (.586)	Experience of breastfeeding (n = 254)*			
2.20 (.333)	Artificial feeding	44 (14.8)	14 (11.4)	30 (17.1)
	Mixed breastfeeding	145 (48.7)	63 (51.2)	82 (46.9)
	Complete breastfeeding	65 (21.8)	24 (19.5)	41 (23.4)

Variable	Odds ratio	95% CI	p-value
Age (years) (ref: 26–30)			
31–35	1.12	0.48–2.64	.790
36–40	0.87	0.35–2.15	.762
≥41	0.44	0.10–1.99	.287
Educational level (Ref: ≥College/University)			
High school	1.20	0.56–2.57	.633
Economic condition (Ref: ≥Medium)			

Low	2.60	1.14–5.92	.023
Employment status (Ref: Unemployed)			
Yes	1.18	0.67–2.08	.578
Usual BMI	1.11	1.03–1.20	.007
Previous illness (Ref: No)			
1	1.70	0.88–3.30	.115
≥2	0.64	0.13–3.25	.591
Diabetes medication (Ref: No)			
Yes	1.15	0.61–2.17	.671
Disease period (Months)	1.00	0.99–1.01	.976
GDM-related knowledge	0.99	0.88–1.11	.811
Current pregnancy (Ref: No)			
Yes	3.57	1.14–11.11	.028
Experience of breastfeeding (Ref: Artificial)			
Mixed	2.38	1.04–5.45	.041
Complete	1.80	0.70–4.58	.222

DETAILS

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Document 2 of 29

Effects of Home-and-Workplace Combined Exercise for Patients with Ankylosing Spondylitis

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ProQuest document link

ABSTRACT (ENGLISH)

Purpose

The purpose of this study was to investigate the effects of home-and-workplace combined exercise on physical function, depression, and work-related disability in patients with ankylosing spondylitis.

Methods

This study adopted a non-randomized quasi-experimental design. Fifty-two patients were recruited: home-and-workplace combined exercise (n = 17), home exercise (n = 18), and control group (n = 17).

Results

The home-and-workplace combined exercise group showed improvement in spinal mobility and pulmonary function and significantly lower absenteeism and overwork impact than the home-exercise group and control group. The home-and-workplace combined exercise and home exercise groups showed a higher level of activity improvement than the control group.

Conclusion

home-and-workplace combined exercise can be recommended to patients with ankylosing spondylitis to enhance their physical function, including spinal mobility and pulmonary function, and reduce work-related disability.

FULL TEXT

DETAILS

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Document 3 of 29

The Work Experience of Newly Recruited Male Nurses during COVID-19: A Qualitative Study

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ABSTRACT (ENGLISH)

Purpose

This study was to investigate the work experience of newly recruited male nurses during the COVID-19 pandemic.

Methods

With a phenomenological approach, this qualitative study was adopted semistructured interviews by phone or video calls. A total of 9 male nurses newly recruited for the COVID-19 wards in Chinese hospitals were interviewed for this study. And Colaizzi's method was applied for evaluation in the data analysis.

Results

Based on our findings, three themes were extracted. First, the newly recruited male nurses showed negative emotions at the beginning of COVID-19 epidemic, which was caused by changes in working conditions and content, but also prompted the nurses to change the way of coping with the crisis. Second, they gradually mastered the working skills and psychological training to cope with COVID-19 and developed a positive attitude toward life and a high sense of professional responsibility. Finally, we learned about their needs to respond to public health emergencies such as the COVID-19 pandemic.

Conclusion

COVID-19 is a disaster for all of humanity. The newly recruited male nurses are an important force in emergency rescue. Although they suffered from short-term negative emotions, they quickly adapted to the crisis. In order to better prepare for future emergencies, the disaster response capacity of newly recruited male nurses needs to be further improved. In addition, newly recruited male nurses have a strong demand for timely and personalized career development guidance.

FULL TEXT

Introduction

According to the World Health Organization (WHO), the coronavirus disease 2019 (COVID-19) has been identified as a disease caused by a novel coronavirus [1,2], and the first case was reported in Wuhan, China on December 12, 2019 [3]. As of May 1, 2021, there were 150,989,419 confirmed cases of COVID-19 worldwide, including 3,173,576 deaths [4]. And male nurses were considered essential for the care and treatment of COVID-19 patients in response to such a serious public health event. In the face of emergencies, male nurses had strong adaptability and antipressure ability [5], strong physical quality, decisive character, and can undertake heavy physical work to relieve patients' tension and anxiety [6,7]. These qualities could make male nurses indispensable in the healthcare workplace, especially when dealing with medical emergencies [8].

In the early stage of clinical work, these new male nurses were full of curiosity and had a strong thirst for knowledge when they encountered new knowledge or problems at work. In addition, they had strong plasticity and adaptability and often showed high enthusiasm for their work [5]. However, in Asian culture, due to insufficient training, lack of clinical experience, weak safety awareness, and social prejudice [9,10], they were often vulnerable to physical and mental trauma [11–13].

The COVID-19 pandemic with high rates of infection, which leads to heavy work, has put pressure on inexperienced nurses in particular. And nurses, as a line of defense for healthcare, should be considered as people who also need support and attention. Previous studies on male nurses' response to public emergencies were mostly quantitative studies [14,15], which often failed to reflect the psychological experience of new male nurses in the outbreak of infectious diseases.

There have been quantitative studies examining nurses' response to public crisis events. However, most of them were evaluation studies designed to investigate the effects of educational interventions in simulated environments on crisis event prevention, response, and post-disaster management. While these studies may be helpful in identifying key factors in crisis response, they could not provide detailed information about the nurses' experience [16]. As recently observed, quantitative studies often failed to assess the perspectives, intentions, and role awareness of nurses in response to the COVID-19 pandemic [17]. At the same time, the influence of environment, law, and organizational culture on nurses' crisis response ability could not be fully clarified [18]. And qualitative research was considered necessary to advance the understanding of care and public health emergencies. As a commonly used qualitative research method, Colaizzi's phenomenological approach mainly focuses on the experience and feelings of participants and finds common patterns among the research subjects rather than individual characteristics. Therefore, it ensures the authenticity of participants' experience and follows scientific standards, which has been verified in various qualitative nursing studies [19].

In this study, Researchers aimed to understand the work experience of newly recruited male nurses during the COVID-19 pandemic through a well-designed interview and to further reveal the problems and challenges they might encounter in the process of their work. In addition, the identified experience could broaden the information available in the current literature on how nurses respond to public crisis events [20]. Therefore, by exploring the real experience of male nurses in coping with COVID-19, as well as the challenges and problems they faced, this study could provide information for further improving the comprehensive nursing management strategy and enhancing the ability of male nurses to cope with public health emergencies such as COVID-19.

Methods Study design

This is a qualitative exploratory descriptive study, conducted using semistructured interviews, based on phenomenological research methods and Colaizzi's seven-step method. The interview explored the experience of newly recruited male nurses during the COVID-19 pandemic. This study is consistent with the unified standard of qualitative survey [21].

Setting and participants

The study started in March and recruited nursing staff who participated in the fight against COVID-19 in tertiary hospitals in Wuhan and Zhengzhou from January to February 2020. These hospitals were chosen because of their commitment to treating patients with COVID-19. Voluntary participation in this study was carried out by the method of objective sampling. Demographic information included age, educational level, years of nursing experience, and marital status. In order to determine the number of nurses in the sample, data saturation was considered in the qualitative study. A total of 9 nurses were determined to be required to achieve data saturation. The average age of these 9 interviewees was 25 ± 2.0 years old, all of them had a bachelor's degree, and the average time of participating in anti-epidemic work was 17.5 ± 3.1 days.

Ethical consideration

When collecting and storing participant information, researchers paid close attention to confidentiality principles. Therefore, all personnel information was anonymized by using codes (N1, N2 …) during the transcription process. Transcribed text was then fed back to the participants for their approval. Audio recordings, videos, and other interview materials were stored on a password-protected computer. At the end of the study, all acquired data would be deleted. This study was approved by the Ethics Committee of Zhengzhou University (Approval no. 2020-18).

Data collection

Previous relevant reports were studied in this study to formulate an interview outline [22]. The questions were reviewed by a nursing team (including two professors and a research fellow) with expertise in qualitative methodology. In order to adjust the interview outline and complete the interview guidance, three male nurses were selected for pre-interview, followed by a comprehensive survey using the improved interview guidance. The final interview guide consisted of five open-ended questions to explore various aspects of the nurses' experiences in isolation wards: (a) What came to your mind when you learned that you would be working in the COVID-19 patient isolation ward? (b) What has been your previous experience in caring for COVID-19 patients? (c) In your opinion, what are the advantages and disadvantages of male nurses in fighting the epidemic? (d) How do you view your career after this experience? (e) As a newly recruited male nurse, what do you expect from hospital training?

The interview started after the participants were informed of the purpose and significance of the study. Since these interviewees were mostly college classmates or friends of the researcher, the two sides maintained a good trust relationship, which laid the foundation for the smooth conduct of the interview. The interviewer has a master's degree in nursing and experiences in qualitative interview and psychological counseling. Additionally, the interviewer has obtained a Third-Level Psychological Consultant Certificate issued by the Ministry of Human Resources and Social Security of China. Hence, the researcher was qualified to conduct this study independently.

Considering the government's initiative in reducing the risk of infection, the interviews were conducted via video communication (using WeChat program). All interviews were recorded with the consent of the interviewees. Information was recorded simultaneously during the one-on-one interview. Through WeChat video interview, interviewers could clearly see the interviewees' facial expressions and body movements during the interview. Interviewers mainly listened to what the participants were talking about while paying attention to their movements, facial expressions and body language. Each interview lasted about 20 to 40 minutes.

Data analysis

Colaizzi's seven-step analysis was used to analyze the interview data: (1) transcribing recorded interviews verbatim into text and reading the participants' descriptions multiple times; (2) extracting significant statements from each description; (3) formulating meanings from those significant statements; (4) organizing those formulated meanings into themes; (5) integrating the results of the data; analysis into a description of the phenomenon under study; (6) returning the results to the participants for validation; and (7) incorporating any new, relevant data into the fundamental structure of the phenomenon [[23]]. The interview recordings were transcribed within 24 hours after the interview. The transcripts had been carefully checked and reviewed. Previous study from Lincoln and Guba [[24]] suggested that member checking was essential to ensure the credibility of qualitative data. In this study, the researchers gave feedback on emerging explanations, then reached a consensus within the group, and finally formed written materials. Finally, the written materials were emailed to the interviewees for verification. In this study, the interviewees had no disagreement about the completeness and accuracy of the written materials. After a careful reading of the transcript, the key information was highlighted and then properly encoded and subject optimized (Table 1).

Findings

This study conceptualized the attitudes and perspectives of newly recruited male nurses in dealing with COVID-19 based on their work experience. Three themes and several subthemes emerged from the analysis, which are described as below in detail.

I. Impact of the epidemic

COVID-19 is a disaster that threatens people's health and safety, leaving people in fear. Newly recruited male nurses also have negative emotions in the early stages. In order to mitigate the detrimental effects, newly recruited male nurses have to adopt coping strategies to reduce the impact of negative experiences.

Early negative experiences

The COVID-19 outbreak was sudden and highly infectious, with a large number of people infected initially. Under the condition of insufficient medical staff and lack of medical resources, the newly hired male nurses need to wear protective gear to carry out a lot of treatment work. On the other hand, the newly recruited male nurses need to work longer hours in order to address the shortage of medical staff. The physical discomfort caused by the closed protective equipment and the extended work load therefore caused the nurses to have serious physical and psychological fatigue.*Hospital was crowded with early patients. We had to distinguish between the infected and the uninfected (patients) and adopt different treatment methods. One has to do several things at once. We were on the go from morning till night. (Nurse 4)*

The overwhelming number of untreated patients in hospital has also increased the mental fatigue of newly recruited male nurses.*Sometimes at the end of a busy day, we could find that we had even more patients than when we took over. Faced with these circumstances and my mental exhaustion, I really thought my work was futile and probably hopeless. (Nurse 7)*

In addition, witnessing how patients were infected, and in some cases the inevitable death, made newly recruited male nurses worry about their health and safety, as well as their families, increasing their psychological burden and fear of death.*The condition of a severely infected patient was both complicated and serious. Although as a nurse with expertise in respiratory diseases, I felt that my knowledge and experience were insufficient at this time. The rapid change of (patient)'s condition made me unable to determine whether I was doing the right thing and sometimes suspects that I really was not. (Nurse 3)I saw news reports about thousands of medical staffs being infected, which made me worry about my health. At first, infected people were not treated successfully. I could adjust my emotions quickly, but many people die every day and the grief recurs without waiting for you to return. The rescue treatment was good but there was no good result. No mood to eat anything. (Nurse 5)*

Temporary response strategy

In order to alleviate the negative experience caused by the clinical management of COVID-19, the newly recruited male nurses adopted an abstinence attitude, refused to pay attention to their own experiences and avoided expressing their feelings and emotions.*I will play my favorite online games after work, which can relieve my pressure and no longer think about my work experience. (Nurse 1)*

Some psychological cues could help nurses strengthen their mental resilience and stress capacity.*I often tell myself that I am doing a great thing, so I will try to protect myself and save others. It is necessary and meaningful. (Nurse 7)*

II. Gain experience and growth in the fight against the epidemic

With the great achievement in the fight against COVID-19, the newly recruited male nurses obtained a positive outlook on life. The healing and rehabilitation of patients also make them feel the greatness of professionalism, and at the same time improve their professional recognition and enhance their sense of responsibility.

Positive life perception

There is no denying that newly recruited male nurses play an important role in the care of COVID-19 patients. The support and warmth they receive from society and family reassures them and in turn expresses gratitude to those who support them.*The whole society is praising us and supporting us. The whole country is our backing. We only need to treat patients wholeheartedly. (Nurse 6)*

Improve professional recognition and enhance work responsibility

In the early days of the COVID-19 outbreak, there was a shortage of medical supplies, which quickly overwhelmed Wuhan's medical system. The rescue conditions in hospitals were rapidly exhausted, and nurses were faced with high workload and psychological pressure. In this case, the newly recruited male nurses had outstanding physical and psychological advantages in this rescue work.*After the outbreak of the epidemic, I found that being a nurse could save many lives in the first place. Especially, the gratitude of patients for my treatment made me proud of my profession and feel that everything was worthwhile. (Nurse 6)I am proud to be able to come forward when our country and people are in distress. I feel that I have done a great thing. In this particular moment, I feel like a hero. (Nurse 8)*

The newly recruited male nurses felt the appreciation and care from the whole society and were grateful for it.*We were from different departments. At the beginning, I was worried about getting along with everyone, but everyone was enthusiastic, helped each other at work, and cared for each other. I felt warm in the team, and everyone was working together to fight against the disease. (Nurse 3)*

III. Need for nurses in the epidemic

Through the fight against COVID-19, newly recruited male nurses have found themselves lacking in professional knowledge and are eager for psychosocial support and professional guidance in their career development.

Need for more emergency knowledge training

Newly recruited male nurses find themselves lacking in treating COVID-19 patients and wish to improve their knowledge and skills in the future.*Managers should strengthen the training of emergency rescue content in order to respond to unexpected accidents in the future. (Nurse 2)Improve my expertise and master more advanced professional operations. (Nurse 6)*

Need for psychosocial support

The COVID-19 outbreak had led to a rapid increase in the number of infections, and new male nurses faced greater work pressure and psychological burden. Therefore, the way to alleviate this situation was to give them the material and psychological spiritual support they need from all walks of life.*We don't know how to deal with it …I think it would be easier if there are psychologists who can provide psychological counseling …We do need some kind of support from family members or social groups because we are facing high risks. (Nurse 2)*

Hope to get professional care

During the COVID-19 pandemic, society discovered that nurses were prone to burnout from overloaded care. In times like this, however, newly recruited male nurses expressed that social support has been a powerful source of motivation.*Everyone should abandon the traditional ideas in the future, respect us in the hospital and do not discriminate against male nurses. (Nurse 4)*

Discussion

Under the threat of the epidemic, people often feel afraid of their own health and helpless psychologically due to lack of knowledge, which only leads to the aggravation of negative emotions such as fear, exhaustion, and anxiety. COVID-19 is clearly a serious disease of international concern. It was more infectious than SARS, and more people were infected and killed than SARS [25,26]. Like others, newly recruited male nurses were concerned about their lives, health, and job safety in the face of a COVID-19 pandemic. Studies have shown [19] a sharp increase in the number of infections due to the COVID-19 outbreak, a 1.5-2 times increase in nurses' normal working hours and workload, and widespread fatigue. However, in the interview, it was found that the main reason for the fatigue of newly recruited male nurses was not the extension of working hours or the increase of workload, but the change in working conditions and content. Because this is a highly contagious disease, all treatment takes place in isolation wards. Frontline nurses without infectious disease expertise faced many challenges in adapting to a new work environment [27]. In addition, the management of COVID-19 patients needs to be both comprehensive and specific. Many newly recruited male nurses have little clinical experience in infectious intensive care [28]. When the health department is not prepared to deal with outbreaks of infectious diseases, there is an urgent shortage of medical staff. Therefore, there is an urgent need to train and educate newly recruited nurses. The rapid change in work content has also caused newly recruited male nurses to become more stressed and anxious on the job. We found that newly recruited male nurses showed significant anxiety during their first week on the job when they first entered the isolation ward. As working hours lengthen, most nurses experience an increase in fatigue and awareness of their own safety. Therefore, in the early stage of the epidemic, it is particularly important to carry out early psychological intervention for nurses. This could include immediate stress assessment and professional, continuous psychological interventions [29,30] to promote emotional relief and improve the mental health of nurses [31]. In addition, an early support system should be established for newly recruited male nurses working in isolation wards for a long time to ensure adequate supplies and reasonable staffing. Managers should also introduce flexible shift schedules and fixed allocations based on infections, illness, workload, and the number of nursing staff in order to provide a productive working environment for newly recruited male nurses. They should also ensure that nurses have enough time to recuperate to improve the quality of medical care [32].

Previous studies, such as those conducted during SARS, have found that infectious diseases have brought great pain to medical staff, affecting more nurses than doctors [33]. This is due to the nature of their work and their long-term close contact with infected patients. In addition, due to the shortage of staff, nurses also have to handle some of the daily work of the hospital. Therefore, it is interesting to see how nurses respond to the challenges of care and treatment during the COVID-19 outbreak. In the face of a variety of challenges, the newly recruited male nurses have shown great strength and resilience. They actively seek multiple support systems and self-regulation skills to relieve stress because they know that in order to save more lives and protect themselves, they need to take care of themselves and focus on their responsibilities. In terms of psychology, they often gave themselves positive psychological affirmation, defining fighting COVID-19 as a process that supports positive experiences and growth, which was consistent with Sun's findings [19]. Male nurses tend to adopt a certain abstinence attitude, refuse to pay close attention to their own experiences and further avoid expressing their feelings and emotions. For example, they will play online games, watch movies, and listen to music to adjust the unhappy mood at work. Similar to previous studies [19,34], some nurses record their emotions and cognition through electronic diaries or letters, and interact closely with the outside world to obtain social and family information and psychosocial support. Unlike previous research results, newly recruited male nurses did not mind paying attention to the news about COVID-19. They just do not want to recall their experiences in the ward but are still keen on social report on COVID-19. This may be because they come from different regions, hoping to get more information about their hometowns.

Like other medical staffs, male nurses had negative experiences in the early stage of the COVID-19 fight, but they were able to quickly adjust and adapt to working in the isolation zone and continued to develop positive emotions during their work. Overall, respondents were more optimistic and could feel their own peace of mind. They were proud to participate in the epidemic prevention and control work and were full of confidence and expectations for the future work. Newly recruited male nurses have several reasons to be particularly optimistic: (a) they are enthusiastic about their work and are willing to accept challenging things; (b) they believe that participating in the fight against the epidemic has given them a sense of self-worth and accomplishment; (c) team support, social care, and compliments from patients can alleviate their mental stress of patients and reduce the impact of some negative emotions; and (d) in terms of crisis management, men are more likely to choose to tackle impersonal problems that cause specific difficulties and are less likely to focus on emotional issues.Therefore, when dealing with stress, they rarely use emotion-centric coping methods [35].

COVID-19 has been a disaster, creating huge challenges for newly recruited male nurses. However, despite the stress of the epidemic, they had to use their medical and psychological knowledge to make psychological adjustments. At the same time, they were in emergency rescue and infectious disease prevention. The physical and mental recovery and control of the injured after the disaster also gave them good experience in responding to public health crises in the future. Based on our findings, we were able to determine that the majority of newly recruited male nurses grew psychologically and cognitively under stress. They actively reflected on their cognitive thinking and found positive forces, such as greater respect for health and life, increased professional identity and responsibility, and gratitude for social and family support, which was consistent with the findings of Shih *et al.* [36]. Notably, the newly recruited male nurses showed positive altruism and greater solidarity in the face of disaster. The sense of responsibility that comes with a career encouraged them to take an active part in related work, which improved their professionalism and self-esteem [37]. In addition, the collaborative work of nurses from different regions and positions also enabled newly recruited male nurses to participate in a multidisciplinary teamwork. Therefore, during the COVID-19 epidemic, actively guiding and inspiring newly recruited male nurses to realize their own growth, adjusting cognitive evaluation, guiding positive coping styles, and stimulating positive emotions might play a positive role in psychological adaptation and career development.

Our findings indicated that newly recruited male nurses responding to the COVID-19 pandemic need more training in emergency preparedness, psychosocial support, and specialized care. Respondents showed that although they had received training on disaster knowledge during their employment, they mainly focused on emergency drills such as earthquakes and fire. These trainings mainly include first aid techniques, trauma treatment and injury, disposal, and classification of the wounded [38]. However, in the prevention and control of infectious diseases, the newly hired male nurses are still inadequate, such as lack of experience in response. Based on these findings, newly hired male nurses should also play a more important role in the leadership, such as resource allocation, patient transport, and health support for survivors and vulnerable groups [39]. In the future, leaders should pay attention to the construction of the disaster relief team, improve the relevant rules and regulations, and ensure the team construction and talent reserve [40].

Previous studies have shown that [41] lack of psychosocial support is a significant risk factor for negative psychological experiences in all types of disasters. At the same time, positive emotions are related to the support of patients, family members, team members, government, and the whole society. Therefore, psychosocial support is also anessential resource for newly recruited male nurses to fight the epidemic. This study also identified that good psychological adaptability and sufficient social support could ensure that newly hired male nurses could quickly acquire the mental recovery ability under severe stress. Therefore, encouraging various social supports and strengthening the psychological treatment of nurses fighting COVID-19 in the initial phase of the COVID-19 response is critical to ensure the mental health of newly hired male nurses in the aftermath of disasters.

Although we found a further increase in the professional identity and responsibility of newly hired male nurses to participate in the COVID-19 outbreak, there were still many who were not involved in the treatment of COVID-19 patients and might require more professional guidance and care. Men were relatively underrepresented at different levels of employment in most countries, and male nurses were in a minority category [[42]]. Male nurses with less than 4 years of work experience have a higher turnover rate [[43]], which is not conducive to maintaining the diversity of the nursing team.

Male nurses tend to be enthusiastic at the beginning of their work and have high expectations for the development of their nursing career, but often their positions do not match their own conditions, which can only lead to major setbacks for male nurses [[44]]. The training of male nurses mainly includes professional training, continuing education, further training, promotion teaching, and scientific research [[45]]. During the interview, respondents mostly wish to receive more professional and scientific research training. According to the professional ability demand of male nurses, specialized training groups such as pressure ulcer care group and nutrition care group should be set up. Group training should be conducted once a week; furthermore, long-term planning arrangements should be made. Moreover, managers need to take full account of gender differences in the profession and make use of “person-job matching” [[46]], which could help them make full use of their own advantages and meet their career expectations according to their personal situation, professional ability, and personality characteristics of male nurses.

At present, nursing is still a highly gendered occupation. It is deeply influenced by traditional gender discrimination, regional development level, and other factors. In some regions, especially in developing countries, nursing recognition is low, nurses generally have a low social status, and men's participation in nursing is often disingenuously accepted [[47]]. Respondents believe that improving their social status is of far-reaching significance for future career development. Therefore, it is suggested that nursing managers and educators should carry out the concept of “gender neutrality” in nursing work, so as to promote the dedication of male nurses, establish the image of male nurses in society in the new era, and change the public prejudice against male nurses. At the same time, gender-sensitive nursing policy should be made consciously, so that gender-sensitive nursing policy should run through the whole education, practice, supervision, and leadership functions.

Although the newly recruited male nurses were well adapted to this incident, we could not ignore the physical and mental damage they suffered. We called on the family members and the community to provide full support and care to the male nurses in their prevention work. Psychologists should play a greater role in the diagnosis and treatment of male nurses who had completed rescue work.

Limitations

This study has limitations. Our study examined the working experiences of newly recruited male nurses working in major hospitals in several Chinese cities, including the previous epicenter Wuhan city. As a result, we still lack information about male nurses working in other countries and in different cultural contexts. Besides, our findings were based on data from participants who had shared educational experience at undergraduate institutions. Thus, it is necessary to expand the sample size and further study in combination with the investigation.

Conclusion

The COVID-19 outbreak has become a disaster that affects all of humanity. Compared with female nurses, male nurses were more adaptable to COVID-19 (able to make rapid psychological and cognitive adjustments to improve vocational skills and career planning level), but negative emotions were evident in the short term. Therefore, the integration of appropriate medical resources and social support and the establishment of supporting systems are crucial to alleviate the severe physical and mental stress of new male nurses in dealing with COVID-19 in its early stages. Based on these results, nursing managers should further strengthen the disaster rescue ability of newly recruited male nurses and make timely career development guidance to promote the career growth of new male nurses.

Conflict of interest

The authors declared no conflict of interest.

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Quotations	Theme	Subtheme
•One person had to do several tasks at the same time. We were busy from morning till night, without rest. I really thought my work was futile and there might be no hope.	I. Impact of the epidemic	Early negative experiences
•I will play my favorite online games after work, which can relieve me of stress and no longer think about the work experience.	Temporary response strategy	
•I found being a nurse can save many lives in the first place, especially patient’s gratitude to me for treating them makes me proud of my profession and feels that everything is worth it.	II. Gain experience and growth in the fight against the epidemic	Positive life perception
•I am proud to be able to come forward when our country and people are in distress. I feel that I have done a great thing. In this particular moment, I feel like a hero.	Improve professional recognition and enhance work responsibility	
•Managers should strengthen the training of emergency rescue content so that we can respond to unexpected accidents in the future.	III. Need for nurses in the epidemic	Need for more emergency knowledge training
•We don’t know the coping strategies...I think it would be easier if there are psychologists who can provide psychological counselling...	Need for psychosocial supports	•Everyone should abandon traditional ideas in the future, respect us in the hospital and not discriminate against male nurse.

DETAILS

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Behavioral Responses of Pregnant Women to the Early Stage of COVID-19 Pandemic in the Network Era in China: Online Questionnaire Study

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ABSTRACT (ENGLISH)

Purpose

The aim of this study was to examine the behavioral responses of pregnant women during the early stage of Coronavirus Disease 2019 (COVID-19) outbreak.

Methods

We recruited 1,099 women to complete an online questionnaire survey from February 10 to February 25, 2020. The subjects were divided into two groups (the pregnant women group and the control group).

Results

Concerns about infection: most of the participants watched the COVID-19 news at least once a day. Protective behaviors: the utilization rate of pregnant women (often using various measures) was higher than that of nonpregnant women. Exercise: 30.6% of the pregnant women continued to exercise at home, whereas in the control group, this percentage was 8.4%. Spouse relationship: 38.8% of the subjects' relationship improved, whereas only 2.3% thought the relationship was getting worse.

Conclusion

Pregnant women had some unique behavioral responses different from that of nonpregnant women. It is important to understand the behavioral responses of pregnant women in this network era.

FULL TEXT

Introduction

Coronavirus disease (COVID-19) has spread quickly and evolved into a pandemic since December 2019 when it first emerged in Wuhan, China [1]. The World Health Organization (WHO) declared the coronavirus outbreak to be a public health emergency on January 31, 2020 [2]. As of mid-November 2020, COVID-19 has infected more than 54 million people and resulted in the deaths of more than 1.3 million people.

The concerning features of COVID-19 are its apparent ability to spread readily and its propensity to cause severe disease or even death [3,4], which can cause fear and panic in society [5,6]. Nevertheless, the panic of the pregnant women could be doubled due to worries about the safety of themselves and their fetus.

The COVID-19 outbreak occurred 17 years after the 2003 epidemic of severe acute respiratory syndrome (SARS) in China. Currently, with the popularity of smart phones and the development of the network, in addition to the traditional means of obtaining information, such as television, radio, and newspapers, young people are more likely to use smartphones and tablets. The rapid and timely information dissemination has now become the new normal. News and information can influence people's behavior [7]. Petrie et al. conducted a cross-sectional telephone survey and found that the public perceptions could influence the members' behavioral responses in Ebola outbreak [8]. A BBC News posited that hearing a lot of information and news about COVID-19 had affected the public on daily life [9]. However, behavioral studies of epidemic outbreaks tend to focus on nonpregnant women [10–12]. There have been few studies on pregnant women's behavioral responses during disease outbreaks, including SARS, middle east respiratory syndrome coronavirus (MERS), and Ebola. Recent studies found that pregnant women had changes in behavior including self-isolating, changing their method of transportation, and so on in COVID-19 pandemic [13,14]. However, those studies only focused on pregnant women without a control group of nonpregnant women. We wondered if pregnant women would have some special behavior changes different from nonpregnant women. Therefore, we aimed to investigate the behavioral responses of COVID-19 on pregnant women in this network era in mainland China. Its related lifestyle and quality of life among pregnant women within 1 month after travel restrictions were imposed by the Chinese government. The results may assist clinicians in considering pregnant women's behavioral changes and offering early supports during the disease outbreaks.

Methods Study design

This study used a cross-sectional design and convenience sampling.

Setting and samples

Participants were recruited from online consultation according to the following criteria: each individual 1) agreed to participate in the study and gave digital informed consent; 2) ordinarily resided in Hangzhou; 3) was a married woman and living with her husband; 4) first marriage; and 5) had no history of mental diseases.

People can participate in online consultations through WeChat app (one of the most popular apps in China) or another app called the “Mother and Child Health Handbook App,” which is popular among pregnant women. People using the two apps were prompted to answer whether they were willing to complete the psychometric evaluation and the questionnaire. If the participants had any questions during the administration of the questionnaire, they could pose these questions online to the investigator.

The subjects were divided into two groups (the pregnant women group and the control group) according to whether they were pregnant or not. We matched the age and parity to select the control participants after we recruited pregnant women. The pregnant women were further divided into three subgroups: first trimester subgroup (0-13^{+6} weeks), second trimester subgroup (14-27^{+6} weeks), and third trimester subgroup (≥28 weeks).

Ethical considerations

All the study procedures were approved by the ethics committee of Hangzhou Women's Hospital (Hangzhou Maternity and Child Health Care Hospital) (Approval no. 202002-16). The participants gave written consent and were informed about the study objectives, the possibility of discontinuing the study at any time without penalty, and the protection of the confidentiality of personal information.

Measurements

The questionnaire was designed to determine the pregnant women's behavioral responses to the early stage of COVID-19 pandemic. Before designing the questionnaire, we used qualitative methods to examine the experiences of pregnant women during the outbreak.

We conducted a descriptive qualitative study and semistructured individual interviews were conducted at a time convenient for the participants. The Consolidated Criteria for Reporting Qualitative Research (COREQ) were used to report the method used and findings obtained [15]. A purposeful sampling method combined with the maximum variation strategy (for instance, age, trimester, parity, employment status, education level) was used to recruit eligible participants in our hospital. The sample size was determined by data saturation, that is, we stopped data collection at the point where no new themes from participants were emerging [16].

A total of nine women participated in the interviews, which lasted approximately 45 min per person. The audio recordings were transcribed verbatim by two researchers within 24 h of the interviews to ensure the accuracy of the information. The data were analyzed using thematic content analysis. There themes were emerged after data analysis: 1) increasing demand for comprehensive information; 2) more cautious self-protection behavior; and 3) changes in the relationship between spouse.

Based on the themes that were identified, a questionnaire was constructed to be used in the later quantitative survey. The questionnaire included six items in total: a. the frequency of watching the COVID-19 news (single-choice question: "hardly ever," "1-2 times a week," "once a day," or "more than once a day"); b. preferred social media platform (single-choice question: "WeChat," "Weibo (a platform similar to Facebook)," "Video apps (youku etc.)," "Zhihu," "Douban," or "Others"); c. the methods they used for preventing COVID-19 infection (multiple-choice question: "wearing masks," "wearing gloves," "wearing eyewear," "wearing protective clothing," and/or "using disinfectants"); d. the most commonly used means of transportation when going out (single-choice question: "driving a car," "taxi," "public transportation," or "walking or cycling"); e. continuing exercise habits (single-choice question: "keep doing," "reduce," or "hardly ever"); and f. relationship between spouse (single-choice question: "better," "worse," or "same").

Data collection

Data were collected between February 10, 2020 and February 25, 2020 in Hangzhou City, Zhejiang Province. This was a study to explore potential differences between the two groups, and there was no quantifiable hypothesis to test in advance. It seemed impossible to directly estimate the sample size. Thus, we referred to a rough estimation method with 5-10 times the number of variables to calculate the sample size [17]. A total of 14 variables were included in the study; therefore, the required sample size was 70 (14 × 5). Considering a sample loss of 20.0%, the minimum sample size required for this study was 88 participants. We recruited as many eligible subjects as possible. In total, 1,099 respondents who completed the questionnaires were included in the final analysis (1,099/1,200, 91.6% response rate), including 565 pregnant women and 534 controls.

Data analysis

Continuous data were compared using the independent-sample *t*-test and analysis of variance. Chi-squared analysis was used for categorical variables. A one-sample, Kolmogorov–Smirnov test was used to test nonparametric variables. We used the SAS System for Windows 9.4 software (SAS Institute Inc, Cary, NC), and *p*

Results Characteristics of the study population

A total of 1,099 participants completed all the procedures in the study. As shown in Table 1, of 565 pregnant women, 146 were in the first trimester, 212 were in the second trimester, and 207 were in the third trimester. Overall, no significant differences were observed between the pregnant women and control groups in terms of mean age, parity, employment status, education level, and time taken to complete the questionnaire. There were also no significant differences in those characteristics among the three subgroups (Table 1). No one was infected with COVID-19 at the end of the study.

Behavioral responses to the COVID-19 pandemic

We used Cronbach' α to determine the reliability of the questionnaire. The value was .76, which indicated that the study questionnaire is reliable.

Response of watching the COVID-19 news

Most of the participants (91.3% in the pregnant women group vs. 92.5% in the control group) watched the COVID-19 news at least once a day. There was no significant difference in the frequency of watching the COVID-19 news between the two groups ($p > .05$) (Table 2).

All of the participants chose smart devices, including smart phones and tablets, as the preferred way of getting news. Therefore, we further investigated their preferred social media platform. As shown in Table 2, WeChat was the most popular platform to acquire information about COVID-19, followed by Weibo. There was no significant difference between the two groups ($p > .05$).

Response of the protection methods selection

To mitigate the risk of infection, 100.0% of the subjects wore masks, and 40.0% of the pregnant women wore gloves, which was higher than the percentage in the control group (*p* p p p Table 3).

Response of the transportation means selection

There were 79.5% of the participants used self-driving car to reduce the risk of contracting the virus when going out. The use of cars was higher, while walking or cycling was lower, in the pregnant women group than in the control group. There was significant difference between the two groups (*p* Table 4).

Response of exercising

People spent most of their time at home during the outbreak in China, which would affect their exercise. There was significant difference between the two groups (*p* Table 4). There were 30.6% of the pregnant women continued to exercise at home, whereas in the control group, this percentage was 8.4%. Among those who hardly ever exercise, the rate in the pregnant women group (about 30%) was lower than that in the control group (about 40%).

Response of the spouse relationship

Staying at home may also affect relationships between the spouse. We found that 38.8% of the subjects' relationship improved, whereas only 2.3% thought the relationship was getting worse. There were no significant differences between the two groups ($p > .05$) ($^{\text{Table 4}}$).

Behavioral responses to the COVID-19 pandemic in different trimesters

Among the three subgroups of the pregnant women, there were no significant differences in all those items showed above ($^{\text{Table 5}}$).

Discussion

Through the present study, we found that epidemic and pandemics of COVID-19 can have behavioral effects on the population, especially on pregnant women. Our findings could be used as fundamental data for the government to pay close attention to pregnant women (a vulnerable group) in this epidemic and also provide some important information for medical workers to offer early interventions and supports by online manners. To the best of our knowledge, our study was among one of the first studies to investigate behavioral responses of pregnant women to the early stage of COVID-19 pandemic in mainland China.

Studies focus on pregnant women's behavioral state during a disease outbreak has been rare. Lee et al. reported that women in the SARS cohort adopted behavioral strategies, including wearing masks and cleaning hands vigilantly, to mitigate their risk of contracting infection [18]. However, this study compared the changes without a control group of nonpregnant women. A phenomenological research in Hong Kong during the SARS outbreak found that new mothers disrupted daily routines as they tried to eliminate their risk of contracting this disease including information gathering, avoiding places of risk, and washing bags, clothes, and hair after leaving the house [19]. Corbett et al. recruited patients in the second and third trimester of pregnancy and demonstrated that they had major changes in behavior including self-isolating, changing their primary method of transportation, bulk-buying, and so on in COVID-19 pandemic [13]. A cross-sectional, Web-based survey between March 3 and 10, 2020, in China showed that 55.7% of the participants protected themselves from contracting COVID-19 with self-efficacy [14].

However, behavioral studies of epidemic outbreaks still tend to focus on nonpregnant women. A study in Iranian residents demonstrated that social media increase perceived risk and safety behaviors [10]. Zhang et al. investigated the quality of life among local residents in Liaoning Province, China, and found that the participants changed exercising time and relax time in the COVID-19 pandemic [11]. Another study in China showed that the three most commonly used prevention measures were making fewer trips outside and avoiding contact, wearing a mask, and hand hygiene, which was similar to the results of our control group [12]. Among college students, a wide variety of behaviors, including increased phone usage, decreased physical activity, and fewer locations visited, were associated with fluctuations in COVID-19 news reporting in the United States [20]. Similar results were observed in children and adolescents. The data revealed a substantial decrease in physical activity increase in screen time during the COVID-19 pandemic [21]. However, compared with the youngers, older men reported relatively less worry and the fewest total number of behavior changes [22]. The issues related to this emerging global event may evolve into long-lasting health problems, which merits further investigation.

Epidemics and pandemics, such as those of SARS and MERS, have unique characteristics in terms of progression and control measures. The Spring Festival holiday occurred during 24–30 January, 2020, in China. The Chinese government–imposed traffic restrictions and extended the national holidays to control the outbreak during this time. At the time when this study was conducted, our city, Hangzhou, Zhejiang Province was also locked down. As of February 25, the deadline of our study enrollment, Zhejiang Province was one of the second-high epidemic areas in mainland China. Additionally, at that time, there was insufficient understanding of the new coronavirus and the epidemic situation. People were staying at home and self-isolating to avoid contracting or spreading the disease, which inevitably disrupted daily routines and decreased the quality of life. Staying at home with family and reducing recreational activities were considered to be safer ways to prevent virus infection. Our study investigated the changes in exercise and the relationship with spouse. Surprisingly, nearly one-third of pregnant women continued to exercise at home, which was obviously higher than that of nonpregnant women. Currently, using health education and popular science news, doctors suggest that pregnant women exercise properly, which is beneficial to both mothers and fetuses. Therefore, for the sake of fetal health, pregnant women themselves and their families may supervise and urge them to keep exercising. The time couples spent together increased during the epidemic period. The results were similar in the pregnant women and the control group and showed that about 40% of the subjects' relationships became better, whereas only about 3% thought their relationships were getting worse. However, Dodgson et al. demonstrated relationship difficulties in the women who became mothers during the SARS outbreak with their spouse [[19]], which was not consistent with our findings.

Overall, the Internet was currently the first choice for health information acquisition by the general public during the COVID-19 epidemic in China. A retrospective analysis showed that the peak of Internet searches and social media data about the COVID-19 outbreak occurred 10–14 days earlier than the peak of daily incidences, with which Internet searches and social media data had high correlation with daily incidences in China [[23]]. In our study, more than 90% of the subjects paid close attention to the latest information on the number of cases in the local area, the availability and effectiveness of medicines, the advice on prevention and so on. As something unthinkable, most social media platforms had not yet been born 20 years ago. Now people used social media platforms to gain information about COVID-19 for its convenience, and WeChat has become one of the most popular apps on smartphones in our participants.

The experiences of the SARS epidemic changed the attitude of the general public towards precautionary measures. The official guidance of the Chinese government advises that people should wear masks if they are going out and use disinfectants in a timely manner. People began to care more about their health. Nevertheless, they were more likely to read information from their friends through WeChat or Weibo, instead of using the official webpage [[24]]. Many people were also unable to discern, which information on social media was true. Research has shown that fake news and misinformation can have detrimental effects on public health [[11],[25]]. In China, the genuine or fake news of "the increasing number of patients and suspected cases nearby," "the shortage of masks and disinfectants," etc. influenced people's behavior. The utilization rate of pregnant women (often using various measures) was higher than that of nonpregnant women. One hundred percent of the subjects wore masks. This finding was anticipated because wearing masks is a common practice when people are sick or to counter urban pollution or haze in China [[26],[27]]. In terms of transportation, more than 70% of the participants used cars to minimize their contact with others. Pregnant women seldom walked or rode, possibly because pregnancy made those options inconvenient.

The possible reason for those behavioral responses might have been related to the fear of COVID-19 infection, which may be related to the body's normal protective responses. We also found that pregnant women were most concerned about their fetus being infected, followed by their family members and themselves. In the control group, the trends of worrying were similar (data not shown). Although there was no evidence of in utero transmission [[28]], pregnant women were naturally concerned about the safety of their fetuses. However, related data on COVID-19 are still rare. We may infer that if the pregnant women themselves were infected, they would further worry about spreading to the fetus, which would result in more protection responses.

The prevalence of prenatal psychological reaction could be different during the trimesters of pregnancy [29,30], which may lead to different behavioral responses. It is also controversial whether perinatal anxiety or depression is higher in a particular trimester during pregnancy [31,32]. In our study, there were no significant differences in all the behavioral items among the pregnant women in the three trimesters. This finding may be because the impact of epidemic stress on pregnant women exceeds the stress of the trimester itself, although a further study is necessary.

Study limitation

This study also has some limitations. First, the participants who wished to participate in this study were recruited though online consultation manner, which might narrow the recruitment of participants. Second, the questionnaire was designed by our team, and there was no other research to measure the effectiveness of the questionnaire. However, the questionnaire was designed based on a qualitative study and it was a collection of questions on how people react to COVID-19. The questionnaire has contributed to this research and merits use. Third, the study lacks longitudinal follow-up. The arduous situation would gradually improve, and the behavioral state of the pregnant women might also improve. Thus, we will further investigate the of long-term follow-up of the participants, including pregnancy outcomes.

Conclusion

Pregnant women had some unique behavioral responses different form that of nonpregnant women. It is important to understand the behavioral responses of pregnant women in this network era. This will then provide some important information for government and medical workers to provide early interventions and supports by online manners.

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Conflict of interest

The authors reported no conflict of interest. All authors have contributed significantly.

	Pregnant women group (n = 565)	Different trimesters	Control group (n = 534)	t or χ^2	p	First trimester subgroup (n = 146)	Second trimester subgroup (n = 212)

Third trimester subgroup (n = 207)	Age (years)	29.96 ± 3.37	30.02 ± 3.31	29.84 ± 3.44	30.05 ± 3.35	29.90 ± 3.38	0.10
.747	Gestational age (weeks)	22.62 ± 10.56	8.12 ± 2.24	21.88 ± 4.11	33.61 ± 3.70		
	Parity [n (%)]:	Nulliparous	372 (65.8)	93 (63.7)	140 (66.0)	139 (67.1)	358 (67.0)
0.18	0.674	Married [n (%)]	565 (100.0)	146 (100.0)	212 (100.0)	207 (100.0)	534 (100.0)
NA	NA	Marriage length (years):					
3.89	0.143	<5	440 (77.9)	114 (78.1)	162 (76.4)	164 (79.2)	410 (76.8)
		5 to 9	105 (18.6)	26 (17.8)	46 (21.7)	33 (16.0)	114 (21.3)
		≥10	20 (3.5)	6 (4.1)	4 (1.9)	10 (4.8)	10 (1.9)
		Employment status [n (%)]:					

0.84	.657	Full-time	445 (78.8)	116 (79.4)	168 (79.3)	161 (77.8)	430 (80.5)
		Part-time	86 (15.2)	22 (15.1)	31 (14.6)	33 (15.9)	78 (14.6)
Unemployed	34 (6.0)	8 (5.5)	13 (6.1)	13 (6.3)	26 (4.9)	Education [n (%)]:	
				0.60	.897	Less than middle school	28 (5.0)
9 (6.2)	12 (5.7)	12 (5.8)	30 (5.6)			Middle school	57 (10.1)
13 (8.9)	19 (8.9)	22 (10.7)	49 (9.2)	Bachelor	451 (79.8)	117 (80.1)	169 (79.7)
163 (78.7)	430 (80.5)	More than bachelor	29 (5.1)	7 (4.8)	12 (5.7)	10 (4.8)	25 (4.7)

Time for completing the questionnaire (seconds)	321.02 ± 125.11	311.83 ± 131.59	321.21 ± 127.55	327.33 ± 117.91	330.05 ± 128.03	1.40	.238

	Pregnant women group (n = 565)	Control group (n = 534)	χ^2	p
Frequency of watching the COVID-19 news [n (%)]:			5.63	.131
Hardly ever	5 (0.9)	11 (2.1)		
1-2 times a week	44 (7.8)	29 (5.4)	Once a day	256 (45.3)
258 (48.3)	More than once a day	260 (46.0)	236 (44.2)	Preferred social media platform [n (%)]:
		1.91	.862	WeChat
425 (75.2)	398 (74.5)			Weibo
83 (14.7)	84 (15.7)	Video apps (youku etc.)	48 (8.4)	39 (7.3)
Zhihu	5 (0.9)	6 (1.1)	Douban	2 (0.4)

	Pregnant women group (n = 565)	Control group (n = 534)	χ^2	p

Methods of preventing the COVID-19 infection [n (%)] :	Wearing masks	565 (100.0)	534 (100.0)	NA
NA	Wearing gloves	226 (40.0)	111 (20.8)	47.67
<.001**	Wearing eyewear	35 (6.2)	11 (2.1)	11.70
<.001**	Wearing protective clothing	8 (1.4)	1 (0.2)	5.10
.024*	Using disinfectants	300 (53.1)	222 (41.6)	14.62

	Pregnant women group (n = 565)	Control group (n = 534)	χ^2	p
Means of transportation [n (%)] :			12.68	.005**
Self-driving car	449 (79.5)	382 (71.5)		
Taxi	48 (8.5)	49 (9.2)	Public transportation	31 (5.5)
39 (7.3)	Walking or cycling	37 (6.5)	64 (12.0)	Exercise [n (%)] :
		86.14	<.001**	Keep doing
173 (30.6)	45 (8.4)			Reduce
228 (40.4)	267 (50.0)	Hardly ever	164 (29.0)	222 (41.6)

Relationship between the spouse [n (%)] :			3.98	.136
Better	219 (38.8)	231 (43.2)		
Same as before	333 (58.9)	285 (53.4)	Worse	13 (2.3)

	First trimester subgroup (n = 146)	Second trimester subgroup (n = 212)	Third trimester subgroup (n = 207)	χ^2	p
Frequency of watching the COVID-19 news [n (%)] : (single-choice question)				5.10	.531
Hardly ever	1 (0.7)	2 (0.9)	2 (1.0)		
1-2 times a week	8 (5.5)	18 (8.5)	18 (8.7)	Once a day	63 (43.1)
90 (42.5)	103 (49.7)	More than once a day	74 (50.7)	102 (48.1)	84 (40.6)
Preferred social media platforms [n (%)] : (single-choice question)				6.17	.801
WeChat	108 (74.0)	160 (75.5)	157 (75.8)		

Weibo	24 (16.4)	34 (16.0)	25 (12.1)	Video apps (youku etc.)	10 (6.8)
17 (8.0)	21 (10.1)	Zhihu	2 (1.4)	1 (0.5)	2 (1.0)
Douban	1 (0.7)	0 (0.0)	1 (0.5)	Others	1 (0.7)
0 (0.0)	1 (0.5)	Methods of preventing the COVID-19 infection [n (%)]：(multiple-choice question)			
		Wearing masks	146 (100.0)	212 (100.0)	207 (100.0)
NA	NA	Wearing gloves	64 (43.8)	85 (40.1)	77 (37.2)
1.57	.455	Wearing eyewear	8 (5.5)	17 (8.0)	10 (4.8)
2.01	.367	Wearing protective clothing	4 (2.7)	2 (0.9)	2 (1.0)

2.47	.291	Using disinfectants	82 (56.2)	111 (52.4)	107 (51.7)
0.76	.565	Means of transportation [n (%)]：(single-choice question)			
3.77	.708	Self-driving car	114 (78.1)	176 (83.0)	159 (76.8)
		Taxi	14 (9.6)	15 (7.1)	19 (9.2)
Public transportation	8 (5.5)	8 (3.8)	15 (7.2)	Walking or cycling	10 (6.8)
13 (6.1)	14 (6.8)	Exercise [n (%)]：(single-choice question)			
2.26	.689	Keep doing	45 (30.8)	60 (28.3)	68 (32.8)
		Reduce	54 (37.0)	91 (42.9)	83 (40.1)

Hardly ever	47 (32.2)	61 (28.8)	56 (27.1)	Relationship between the spouses [n (%)] : (single-choice question)	
		1.51	.825	Better	54 (37.0)
81 (38.2)	84 (40.6)			Same as before	87 (59.6)
127 (59.9)	119 (57.5)	Worse	5 (3.4)	4 (1.9)	4 (1.9)

DETAILS

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Document 5 of 29

Development of a Nomogram for Carbapenem-Resistant Enterobacteriaceae Acquisition Risk Prediction Among Patients in the Intensive Care Unit of a Secondary Referral Hospital

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ProQuest document link

ABSTRACT (ENGLISH)

Purpose

This study aimed to identify the risk factors of carbapenem-resistant *Enterobacteriaceae* (CRE) acquisition to build a nomogram for CRE acquisition risk prediction and evaluate its performance.

Methods

This unmatched case-control study included 352 adult patients (55 patients and 297 controls) admitted to the intensive care unit (ICU) of a 453-bed secondary referral hospital between January 1, 2018, and September 31, 2019, in Busan, South Korea. The nomogram was built with the identified risk factors using multiple logistic regression analysis. Its performance was analyzed using calibration-in-the-large, the slope of the calibration plot, concordance statistic (c-statistic), and the sensitivity and specificity of the training set, subsets, and a new test set.

Results

The risk factors of CRE acquisition among ICU patients at a secondary referral hospital were Acute Physiology and Chronic Health Evaluation II score at the time of admission, use of a central venous catheter and a nasogastric tube, as well as use of cephalosporin antibiotics. At 20.0% of the predicted CRE acquisition risk in the training set, the calibration-in-the-large was 0, slope of the calibration plot was 1, c-statistic was .93, sensitivity was 85.5%, and specificity was 84.8%. The performance was relatively good in the subsets and new test set.

Conclusion

The nomogram can be used to monitor the CRE acquisition risk for ICU patients who have a similar case mix to patients in the study hospitals. Future studies need to involve more rigorous methodology and larger samples.

FULL TEXT

Introduction

Carbapenem-resistant *Enterobacteriaceae* (CRE) is rapidly spreading globally as the horizontal transmission of antibiotic-resistant genes occurs through plasmids to other strains [1,2]. According to the Centers for Disease Control and Prevention (CDC) report, 13 million people are infected with CRE annually, leading to 1100 deaths per year [3]. In South Korea, CRE cases have increased to 15,369 as of 2019 ever since four cases were initially reported in 2010 under sentinel surveillance [4]. As one of the control measures to CRE transmission, active screening testing (AST) is recommended to identify unrecognized CRE colonization among patients who might not be epidemiologically linked to known CRE patients [1,4]. As clinical cultures alone identify only a fraction of CRE patients [5], the majority of unrecognized CRE patients, a potential source of CRE transmission, might not be following contact precautions [1]. However, as a limited application of AST may increase the risk of missing unrecognized CRE patients, early detection of patients at high risk of CRE acquisition at hospital unit admission has been emphasized [6]. A few studies have identified the risk factors of CRE acquisition or proposed CRE acquisition risk prediction model to assess the patients at high risk of CRE acquisition [7–9]. The logistic regression model or Cox's proportional risk model is mainly used to construct predictive models for dichotomous outcome variables such as CRE acquisition, but this statistical prediction model features a complex formula that is difficult to apply in the clinical setting [10]. Nomogram is being considered as a good alternative to the conventional risk prediction model [11], and has been used in medical fields to determine the prognosis of cancer patients [11,12] or predict the development of type 2 diabetes [10]. In particular, several advantages of nomogram have been reported in oncology, so, it may assist decision-making of patients and physicians [12]. It could estimate individualized risk based on patient and disease characteristics, incorporate continuous or dichotomous variables into prediction, was easy to use, and showed better estimation than clinician's judgement [11–13]. Nomogram is a graphical expression of the numerical relationship between an event and its risk factors, and is known to help clinicians easily calculate the risk of an event occurring using a scoring system without requiring complex statistical formulae [12,14]. It is composed of graphical lines of points ranging from 0 to 100, each risk factor, total points, and the risk of an event occurring. The length of each risk factor's line reflects the regression coefficient estimated by multiple logistic regression analysis, and the longest line implies the greatest impact on the risk of the event occurring [10,14]. Regardless of the statistical significance, 100 points are assigned to the variable with the highest beta in the model, and the remaining variables have points proportionally to the highest beta [14]. For example, when we assume that three variables such as “admission by direct transfer” (β = 0.50, *p* = .020), “use of a central venous catheter” (β = 0.30, *p* = .060), and “use of cephalosporin antibiotics” (β = 1.20, *p* admission by direct transfer/$\beta_{\text{use of cephalosporin antibiotics}}$ multiplied by 100), and “use of a central venous catheter” gets 25 points ($\beta_{\text{use of central venous catheter}}$/$\beta_{\text{use of cephalosporin antibiotics}}$ multiplied by 100) [14]. Patients who admit by direct transfer use a central venous catheter and cephalosporin antibiotics will get 166.7 points in total, and will have the CRE acquisition risk matching to the total points [12,14]. As in the model performance, the nomogram performance is assessed in terms of calibration, discrimination, and clinical utility [12].

In South Korea, a CRE risk prediction model has been developed for patients admitted to the intensive care units (ICUs) at a large-sized tertiary general hospital with more than 1000 beds, and showed a relatively good level of calibration, discrimination, and clinical utility [9,15]. However, the model showed poor discrimination and clinical utility in an ICU of a secondary referral hospital because of differences in the case-mix in an external validity study, and new CRE risk prediction models for ICUs in secondary referral hospitals have been recommended [16]. Therefore, this study aimed to develop a new CRE risk prediction model for secondary referral hospitals and propose a nomogram based on the new model. The specific objectives are to: (1) identify the risk factors of CRE acquisition for ICU patients in the secondary referral hospital, (2) build a CRE acquisition risk prediction model and a nomogram from the model, and (3) evaluate the performance of the nomogram (calibration, discrimination, and clinical utility).

Methods Study setting and population

This unmatched case-control study was conducted in a 22-bed medical–surgical ICU at D hospital in Busan, a 453-bed secondary referral hospital. The inclusion criteria were patients admitted to an ICU and who were monitored by active surveillance culture (using rectal swabs) between January 1, 2018, and September 31, 2019. The exclusion criteria were those who were readmitted to the ICU during the same period, did not have a surveillance test at ICU admission and within 7 days of ICU admission, were CRE carriers at ICU admission, and were not confirmed to be CRE acquisition or not.

The sample size of the training set was calculated using Open Source Epidemiologic Statistics for Public Health [17]. We considered a significance level (a) of .05, power (1-β) of .85, percentage of controls exposed of 25.9%, odds ratio (OR) of 2.70 based on a previous study [9], and a case-to-control ratio of 1:5–1:6 [18]. Under the aforementioned condition, a minimum number of 50–52 cases (CRE carriers) and 257–298 controls (non-CRE carriers) are required. Cases refer to patients who were tested negative for CRE in active surveillance culture test on admission, but acquired CRE later during the ICU hospitalization, whereas controls were patients who were tested negative for CRE at admission or on weekly tests until discharge. Cases were retrospectively selected first, whereas controls were selected patients who were hospitalized during the same period. We sorted non-CRE carriers by month, assigned the serial number from 1 to n to the non-CRE carriers, and consecutively generated random numbers using “RAND” function in the Excel version 2016 (Microsoft, Redmond, WA, USA) program. And then, non-CRE carriers with serial numbers corresponding to the first 14 or 15 random numbers were selected as controls.

During the study period, 1031 patients were admitted to the ICU, 483 patients were excluded with the following reasons: readmission (n = 130), no surveillance test at ICU admission (n = 134), no surveillance test within 7 days of ICU admission (n = 195), CRE carriers at ICU admission (n = 14), and were not confirmed to be CRE acquisition or not at the end of the study (n = 10). Of the 548 patients (53.2% of the population) who met the inclusion criteria, 55 patients were CRE carriers and 493 patients were non-CRE carriers. All CRE carriers were selected as cases, and in total, 297 were selected as control (Supplementary Figure 1).

Two types of test sets were established to evaluate the performance of the nomogram for CRE acquisition risk prediction—five subsets of the training set with resampling techniques for internal validation and a new test set with sampling from different but related source populations for external validation [19]. When evaluating the validation by dividing a large sample into a small sample, 10 events per variable is recommended [20]. In this study, 55 cases of the training set were randomly allocated into five groups of 11 people each; the controls were also randomly classified into five groups. The new test set was selected from October 1, 2019, to February 28, 2020, at the same medical center. During this period, a total of 201 patients were admitted to the ICU, of whom 166 subjects (8 CRE carriers and 158 non-CRE carriers) met the selection criteria. All the eight CRE carriers were included as cases and 42 non-CRE carriers were randomly selected as controls.

Study instrument

A structured data collection form was used to extract electronic medical record (EMR) data. The form consisted of the outcome variable (CRE acquisition) and several explanatory variables such as general characteristics, therapeutic procedures, use of indwelling catheters, and use of medication/antibiotics based on previous studies [8,9]. The CRE definition adopted the Korea CDC's recommendation based on the Clinical and Laboratory Standards Institute's recommendation (M100-S27) [21]. Antimicrobial susceptibility to carbapenems was assessed using the disk diffusion and broth diffusion methods. The isolates that were intermediate or resistant to imipenem (≤22 mm, ≥2 μg/mL minimum inhibitory concentration) or ertapenem (≤21 mm, ≥1 μg/mL minimum inhibitory concentration) were considered CRE.

The following general characteristics of the patients were evaluated: age, gender, admission route, length of ICU stay, comorbidities (diabetes and stroke), Charlson comorbidity index (CCI) score, Acute Physiology and Chronic Health Evaluation (APACHE) II score at admission, and multidrug-resistant organisms isolated. Comorbidity was categorized as “Yes” if they were present. Therapeutic procedures included surgery, endoscopy (stomach, bronchial), mechanical ventilation, tracheostomy, and transplantation. Indwelling catheters included a urinary catheter, a central venous catheter, a nasogastric tube, and various drainage tubes. Medications included gastric acid suppressants, immunosuppressants, penicillin, carbapenems, third- or fourth-generation cephalosporins (hereafter cephalosporin), quinolones, vancomycin, tetracyclines, and polymyxin B.

Data collection

For data collection, one author with 3 years of experience in infection control at this study hospital reviewed and extracted EMRs, and verified the accuracy of data extracted from the EMR to the data collection form, using 10 randomly selected cases. Exposure to risk factors was investigated from ICU admission to CRE acquisition for cases and from ICU admission to discharge for controls.

Data analysis

The collected data were analyzed using IBM SPSS Statistics 25.0 for Windows (IBM., Armonk, NY, USA) and R version 3.6.3 (The R Foundation, Vienna, Austria). A two-tailed test was performed with a significance level (α) of .05. The Chi-square (χ^2) test, Fisher exact test, or Mann–Whitney U test was performed to compare the explanatory variables between cases and controls. Variables with *p*

The performance of the logit model and the nomogram were evaluated using a training set, five subsets, and a new test set in terms of calibration, discrimination, and clinical utility. Before the performance analysis, the χ^2 test or Mann–Whitney U test was performed to confirm the homogeneity in the explanatory variables between the training set and the subsets or new test set. The calibration was assessed using the Lemeshow–Hosmer goodness-of-fitness test (L–H test) [[22]], calibration-in-the-large, and the slope of calibration plot [[19],[22],[23]]. When the observed and average predicted risk is perfectly matched, the calibration-in-the-large is 0 and the slope of calibration plot is 1 [[19]]. To evaluate discrimination, concordance statistic (c-statistic) is the same as the area under the receiver operator characteristic curve and 95% CIs were obtained. The c-statistic has a value of 0.5 (not discriminated) from 1.0 (complete discrimination), and the larger the c-statistic, the better the discrimination [[23],[24]]. To evaluate clinical utility, the sensitivity, specificity, positive and negative predictive values, as well as the correct classification rate were calculated using a 2 × 2 decision table between the actual CRE acquisition and predicted CRE acquisition at a 20% CRE acquisition risk that maximized the sensitivity and specificity of the receiver operator characteristic curve.

Ethical considerations

This study was approved by the Dongeui Hospital Institutional Review Board (Approval no. DEMC−2020−02). The requirement for informed consent was waived because the study involved a retrospective review of de-identified data.

Results Comparison of explanatory variables between cases and controls

In [Table 1], we described the characteristics of the sample. For cases, 47.3% were women with a mean age of 73.02 years and a mean length of stay in ICUs of 20.02 days. The mean APACHE II score was 17.76 points, 85.5% had a central venous catheter, and 56.4% and 87.3% of them have used carbapenem and cephalosporin antibiotics, respectively. For controls, 43.4% were women with a mean age of 68.26 years and a mean length of stay in ICUs of 8.24 days. The mean APACHE II score was 10.90 points, 31.6% had a central venous catheter, and 20.5% and 37.7% of them have used carbapenem and cephalosporin antibiotics, respectively. The cases and controls showed significant differences in all characteristics except gender, comorbidities such as diabetes and stroke, invasive procedures such as surgery and endoscopy, use of urinary catheters, and use of fluoroquinolone antibiotics ([Table 1]).

The CRE acquisition risk prediction model and nomogram

Compared with other cases, the risk of CRE colonization was 2.47 times (OR = 2.47, 95% CI = 1.02–5.98, *p* = .044) higher in cases that were admitted by direct transfer, 2.95 times (OR = 2.95, 95% CI = 1.16–7.48, *p* = .023) higher in cases in which a central venous catheter was used, 14.20 times (OR = 14.20, 95% CI = 3.93–51.33, *p* p = .005) higher in cases in which cephalosporin was used, and 1.16 times (OR = 1.16, 95% CI = 1.07–1.25, *p* Table 2). Based on the multiple logistic regression analysis results, the logit model for CRE colonization risk prediction was as follows: E (logit of CRE acquisition) = −7.15 + 0.91 (admission by direct transfer) + 0.15 (APACHE II score at admission) + 1.08 (use of a central venous catheter) + 2.65 (use of nasogastric tube) + 1.368 (use of cephalosporin antibiotics). In the nomogram of the CRE acquisition risk prediction model, points allocated to direct transfer, use of a central venous catheter, use of a nasogastric tube, and use of cephalosporin antibiotics were 0 or 18, 0 or 21, 0 or 51, and 0 or 27, respectively, and 1 point of the APACHE II score at admission was allocated about 2.86 points (range: 0–217 points; [Figure 1]).

Performance of the nomogram for the CRE acquisition risk prediction model

Table 3 shows the performance of the nomogram of the CRE acquisition risk prediction model. The nomogram showed good calibration using the L–H test (*p* = .969), and the calibration-in-the-large was 0 and the slope was 1 (Supplementary Figure 2). The C-statistic was .93 (95% CI, .90–.96) in the training set and was .88–.97 in the subsets and new test set (Figure 2). The sensitivity and specificity of the training set were 85.5% and 84.8%, respectively, when the predicted risk of CRE acquisition was 20.0%. For the subsets and new test set, the calibration-in-the-large was −0.55 to 0.34, the slope was 0.81–1.43, and 0 and 1 were included in the 95% CI, the sensitivity was 72.7%–100.0%, and the specificity was 75.0%–93.2%.

The comparison of the characteristics between the subsets, the new test set, and the training set is shown in Supplementary Table 1. Subsets 1 and 3 differed from the training set in surgery, and subset 5 differed from the training set in admission by direct transfer. The new test set differed from the training set in age, CCI score, use of a central venous catheter and a nasogastric tube, as well as use of penicillin and vancomycin antibiotics.

Discussion

This study aimed to identify the risk factors of CRE acquisition, to build a nomogram for CRE acquisition risk, and to evaluate its performance in a 453-bed secondary referral hospital. The risk factors for CRE acquisition in ICU patients were direct transfer, APACHE II score at admission, as well as use of a central venous catheter, a nasogastric tube, and cephalosporins. And, the nomogram composed of the above five factors was shown good calibration, discrimination, and clinical utility in the training set as well as subsets, and a new test set, which means that internal and external validities have been secured. This nomogram constructed in this study makes the healthcare workers easy to calculate the individual CRE acquisition risk, enables them to frequently assess the change in CRE acquisition risk. Therefore, it is expected to contribute to early detection of high-risk CRE patients, to rapid decision making whether the actual surveillance is needed or not in ICUs of secondary referral hospitals.

In this retrospective investigation of ICU patients of a secondary referral hospital over 21 months, about 10% of patients acquired CRE by the end of the study. This figure was lower than 20% CRE acquisition reported in a large-sized tertiary hospital with 1000 beds and more [[9]], but higher than 5% CRE acquisition reported in a similar-sized hospital in Israeli with 550 beds [[25]]. The difference in the CRE acquisition rate seems to be due to differences in age, subject severity, use of therapeutic procedures or antibiotics, and timing of the investigation.

Considering that the risk factors for CRE acquisition in a previous study in South Korea were the presence of multidrug-resistant organisms, APACHE II scores at admission, as well as use of cephalosporins and carbapenem antibiotics [[9]], APACHE II scores at admission and use of cephalosporins antibiotics are major risk factors for CRE acquisition, regardless of the size of the hospital and case mix. In particular, the APACHE II score at admission showed the longest line in the nomogram, which implies the greatest impact on the CRE acquisition risk [[10],[14]]. As APACHE II score increases by 1 point, the CRE acquisition increases 1.16 times. Therefore, if other factors are the same, those with an APACHE II score of 20 points have 4.4 times higher in CRE acquisition than those with 10 points. However, age and CCI score were associated with CRE acquisition in the univariate analysis only. This finding may be explained that the correlation between age or CCI score and APACHE II score at admission was not enough to cause multicollinearity but weak (r = .38) or moderate (r = .42) correlation, respectively [[26]].

The CRE acquisition increases by approximately 4.0 times with use of cephalosporins in this study, which supports the results of previous case–control studies. The use of cephalosporins was increased CRE-induced bloodstream infection by 7.7 times in patients with neutropenia due to hemato-oncologic cancers [[27]], and the carbapenem-resistant *Klebsiella pneumoniae* (CRKP) infection by 8.0 times [[28]]. However, the use of aminoglycosides or quinolones has been reported as risk factors for CRKP infection in previous studies [[28],[29]], but not in the present study. This may be because the use of aminoglycosides and quinolones in the control and control groups was too low (

In this study, patients who were transferred from acute or non-acute medical centers showed a higher CRE acquisition rate than those who were not. In a study by Goodman et al. [[8]], the presence of CRO at the time of admission to a general hospital was related to a direct transfer from acute or non-acute medical centers. Other studies have reported previous hospitalization instead of transfer as a risk factor of CRE or CRKP infection [29,30], which may be possible because CRE or CRKP acquisition could have occurred during the previous hospitalization and then developed into an infection during the new hospitalization. However, as we intended to identify the risk factors of CRE acquisition not limited to CRE infection, we excluded the patients detected with CRE at ICU admission using surveillance culture tests and included direct transfer instead of previous hospitalization as an explanatory variable of CRE acquisition. The use of a central venous catheter was identified as a risk factor for CRKP infection (OR, 2.30) in a meta-analysis [29]. The risk of acquiring CRE was increased by about 14 times in nasogastric tube users (42%) compared with non-users, which was a key factor influencing CRE acquisition risk in this study. A study of patients in 43 acute and non-acute medical centers in Japan reported a three-fold increase in CRE acquisition risk depending on gastric tube feeding status [31].

In this study, a central venous catheter, a nasogastric tube, or cephalosporin antibiotics was used in more than 40% of the total samples. That is, these can be frequently seen in the ICU settings. Those who have exposure to three factors and an APACHE score of 12 points at admission corresponding to the average score will get 131 points in total and about 30% of CRE acquisition risk. If patients admit by direct transfer, the total points and CRE acquisition risk increase to 149 and more than 50%, respectively. Therefore, nurses working in ICUs need to be aware that the CRE acquisition risk rapidly increases as patients start to use a central venous catheter, a nasogastric tube, and cephalosporin antibiotics without an increase in the APACHE score.

The performance of the nomogram of the CRE acquisition risk prediction model constructed in this study showed good calibration on the L–H test and the calibration plot analysis [19,22] and good discrimination with a c-statistic of >.9 [23,24]. Assuming that 20% risk of CRE acquisition is a cutoff point for deciding CRE acquisition, the correct classification rate, sensitivity, and specificity are about 85%, showing relatively satisfactory clinical utility. However, when we changed 2.86 points to 3 points per 1 point of APACHE II score to facilitate the calculation in the clinical setting, the values of the performance indices of the nomogram were slightly changed, but they still showed good performance (Supplementary Table 2). Therefore, we recommended conversion of the APACHE II score to 3 points for easy use in the clinical setting. In this case, the total points of the nomogram were 0–222. The performance of the nomogram was additionally evaluated using five subsets randomly resampled from the training set and new test set. Although the sets differed significantly in several factors, including direct transfer and use of a central venous catheter and nasogastric tube, they showed relatively good calibration, discrimination, and clinical utility, which implied that the nomogram would have good internal and external validities.

This study is meaningful as it identified the risk factors of CRE acquisition for ICU patients in a secondary referral hospital. Furthermore, we built a nomogram for the CRE acquisition risk prediction model to enable its easy calculation in the clinical setting and evaluated its performance using the training set, subsets, and a new test set to help identify their internal and external validities. However, careful interpretation of the results is required because of the following limitations. First, we adopted an unmatched case–control study design not to exclude demographic characteristics (e.g., gender and age) by matching. However, the case–control study without matching increases the risk of selection bias, so cohort studies or propensity score-matched case–control studies should be considered. Second, the nomogram assumes that the event remains constant over time [12], but the CRE acquisition rate may change over time. Like the event, the distribution of risk factors may change over time. In the nomogram constructed in this study, the APACHE II score at the time of admission was 0–35 points, but some future patients may have scores outside this score range. Hence, the performance of the nomogram may decrease over time, requiring a new nomogram that reflects the change. Third, as this study was performed in a single ICU in a secondary referral hospital, it is difficult to generalize the results to other settings and regions.

Conclusion

The risk factors of CRE acquisition among ICU patients at a secondary referral hospital are APACHE II score at the time of admission, use of a central venous catheter and a nasogastric tube, as well as use of cephalosporin antibiotics. The nomogram for the CRE acquisition risk prediction model was built based on the risk factors, and showed good performance in terms of calibration discrimination and clinical utility for the training set, subsets, and a new test set. Therefore, the nomogram constructed in this study can be used to assess the risk of CRE acquisition and to early detect high-risk CRE patients in secondary referral hospitals. However, considering the limitations of this study, further studies with higher methodological rigor and larger samples in various settings are recommended.

Conflict of interest

The authors declared no conflict of interest.

Appendix A Supplementary data

The following are the Supplementary data to this article:**Multimedia component 1**Multimedia component 1

Multimedia component 2 Multimedia component 2

Appendix A Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.anr.2021.02.005.

Variables	Total (n = 352)	n (%) or Mean ± SD		X^2 or Z	p
Case (n = 55)	Control (n = 297)	General characteristics			
Age (yr)	69.00 ± 13.26	73.02 ± 12.94	68.26 ± 13.21	−2.67	.008[§]
Women	155 (44.0)	26 (47.3)	129 (43.4)	0.28	.598
Admission by direct transfer[†]	49 (13.9)	21 (38.2)	28 (9.4)	32.02	<.001
Length of stay in ICU (days)	10.08 ± 10.99	20.02 ± 13.19	8.24 ± 9.48	−7.80	<.001[§]
Diabetes	118 (33.5)	22 (40.0)	96 (32.3)	1.23	.268
Stroke	68 (19.3)	14 (25.5)	54 (18.2)	1.58	.210
Charlson comorbidity index	3.28 ± 1.86	3.82 ± 1.74	3.18 ± 1.87	−.253	.012[§]
APACHE II at ICU admission	11.97 ± 5.31	17.76 ± 5.27	10.90 ± 4.58	−8.03	<.001[§]
MDROs isolated	60 (17.0)	19 (34.5)	41 (13.8)	14.12	<.001
Invasive procedures					
Surgery	97 (27.6)	12 (21.8)	85 (28.6)	1.08	.300
Endoscopy	5 (1.4)	1 (1.8)	4 (1.3)	0.07	.575[¶]
Bronchoscopy	10 (2.8)	5 (9.1)	5 (1.7)	9.23	.011[¶]
Indwelling catheters use					

Urinary catheter	346 (98.3)	55 (100.0)	291 (98.0)	1.13	.595[¶]
Central venous catheter	141 (40.1)	47 (85.5)	94 (31.6)	55.95	<.001
Mechanical ventilator	47 (13.4)	21 (38.2)	26 (8.8)	34.74	<.001
Tracheostomy	13 (3.7)	10 (18.2)	3 (1.0)	38.47	<.001
Nasogastric tube	148 (42.0)	52 (94.5)	96 (32.3)	73.73	<.001
Drainage tube	76 (21.6)	21 (38.2)	55 (18.5)	10.60	.001
Medication use					
Gastric acid suppressant	128 (36.4)	28 (50.9)	100 (33.7)	5.96	.015
Penicillin	115 (32.7)	42 (76.4)	73 (24.6)	56.57	<.001
Carbapenem	92 (26.1)	31 (56.4)	61 (20.5)	30.85	<.001
Cephalosporin[‡]	160 (45.5)	48 (87.3)	112 (37.7)	45.98	<.001
Aminoglycoside	13 (3.7)	2 (3.6)	11 (3.7)	0.01	1.00[¶]
Fluoroquinolone	34 (9.7)	3 (5.5)	31 (10.4)	1.32	.250
Vancomycin	45 (12.8)	22 (40.0)	23 (7.7)	43.30	<.001

Variables	b	SE	OR (95% CI)	p
Admission by direct transfer[†]	0.91	0.45	2.47 (1.02−5.98)	.044
APACHE score	0.15	0.04	1.16 (1.07−1.25)	<.001
Central venous catheter use	1.08	0.48	2.95 (1.16−7.48)	.023
Nasogastric tube use	2.65	0.66	14.20 (3.93−51.33)	<.001
Cephalosporin antibiotics use[‡]	1.37	0.49	3.93 (1.51−10.22)	.005
Constant	−7.51	0.98		<.001

(Nagelkerke R^2 = 0.562)				

Data set	Calibration			Discrimination	Clinical usefulness (%) at cut point of 20.0%		
X^2 (p) by L–H test	a (95% CI)	b (95% CI)	c (95% CI)	Sen	Spe	CCR	Training data
1 (n = 352)	2.34 (.969)	0.00 (−0.38−0.38)	1.00 (0.74−1.26)	.93 (.90-.96)	85.5	84.8	84.9
Subset of training data							
1 (n = 71)	6.04 (.643)	0.00 (−0.85−0.85)	1.00 (0.42−1.58)	.92 (.85−1.00)	81.8	85.0	84.5
2 (n = 71)	3.86 (.870)	0.00 (−0.79−0.79)	1.00 (0.30−1.70)	.88 (.81-.96)	100.0	75.0	78.9
3 (n = 70)	4.95 (.763)	0.00 (−0.98−0.98)	1.00 (0.45−1.55)	.96 (.90−1.00)	81.8	93.2	91.4
4 (n = 70)	2.35 (.968)	0.00 (−0.78−0.78)	1.00 (0.39−1.61)	.91 (.84-.98)	72.7	84.7	82.9
5 (n = 70)	1.84 (.985)	0.00 (−1.03−1.03)	1.00 (0.36−1.64)	.97 (.92−1.00)	90.9	86.4	87.1
New test set							
1 (n = 50)	2.32 (.940)	0.00 (−0.93−0.93)	1.00 (0.30−1.70)	.88 (.75−1.00)	87.5	78.6	80.0

DETAILS

Subject:	Comorbidity; Hospitals; Variables; Diabetes; Surveillance; CRE bacteria; Performance evaluation; Catheters; Antibiotics; Intensive care; Calibration; Risk factors; Medical referrals

Location:	South Korea
Identifier / keyword:	Calibration; Carbapenem-resistantEnterobacteriaceae; Models, Statistical; Risk factors
Publication title:	Asian Nursing Research; Seoul
Volume:	15
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Section:	Research Article
Publisher:	Elsevier Limited
Place of publication:	Seoul
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Relationship Between the Exposure to Occupation-related Psychosocial and Physical Exertion and Upper Body Musculoskeletal Diseases in Hospital Nurses: A Systematic Review and Meta-analysis

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ProQuest document link

ABSTRACT (ENGLISH)

Purpose

Nurses' musculoskeletal diseases (MSDs) are worldwide prevalent and are considered to be a costly occupational injury. This study aims to investigate the relationship between exposure to occupation-related psychosocial factors, physical workload, and upper body musculoskeletal diseases among hospital nurses.

Methods

An electronic search was implemented using nine databases with June 2019 as the latest search date. English and Chinese studies were chosen, and data were independently and separately extracted by two investigators. Pooled odds ratio (OR) and its 95% confidence interval (CI) were estimated for each subset, using the fixed or random-effects model, following heterogeneity between studies for research synthesis. The source of heterogeneity was explored through subgroup, sensitivity, and meta-analyses.

Results

Eighteen studies were included in the meta-analysis. Most participants were women (51.4%–100.0%), aged between 20 and 60. A correlation was found between high job demand and the prevalence of low back pain (OR = 1.41; 95% CI = 1.23-1.62). Total job strain was related to the risk of low back pain (OR = 1.71; 95% CI = 1.15-2.55), neck pain (OR = 1.67; 95% CI = 1.26-2.20), shoulder pain (OR = 1.62; 95% CI = 1.06-2.48) and back pain (OR = 1.45; 95% CI = 1.10-1.91). Furthermore, the physical workload was significantly associated with the prevalence of low back pain (OR = 1.76; 95% CI = 1.32-2.35), neck pain (OR = 1.17; 95% CI = 1.08-1.27), shoulder pain (OR = 1.59; 95% CI = 1.37-1.85) and back pain (OR = 1.66; 95% CI = 1.45-1.90).

Conclusion

There were significant associations between occupational strain, more physical workload and upper body MSDs, but the evidence advocating a growth risk in MSDs due to low levels of social support is quite weak.

FULL TEXT

Introduction

Musculoskeletal diseases (MSDs) refer to the state of discomfort, disability, damage, or persistent pain in support systems, including the nerves, muscles, bones, joints, ligaments, tendons and blood vessels [1]. Musculoskeletal diseases are widespread worldwide and are considered to be a major occupational injury, both in developed and developing countries [2,3], and the prevalence is especially high among nurses [4,5]. Saberipour B et al. [2] and Habibi E et al. [6] reported a prevalence rate of 84.2% and 87.6% for musculoskeletal diseases among Iranian nurses, respectively. Luan HD et al. reported a prevalence rate of 74.7% for musculoskeletal diseases among nurses in Vietnam [7]. Nutzi M et al. in Switzerland reported a prevalence of MSD of 66% among nurses [8]. Similarly, numerous studies have also been carried out across the other countries such as Bakola H et al. [4]in Greece, Yan P et al. [5] in China and Kasa AS et al. [9] in Africa that respectively reported a prevalence rate of 74.9%, 62.7% and 68.5%, for MSDs among studied nurses.

Musculoskeletal diseases can lead to severe complications such as carpal tunnel inflammation, tendonitis, chest outlet syndrome, etc., and massive economic losses. In work, they are the main reason for sickness absenteeism in the United States and Brazil [10], as well as western European countries [11], in which, regardless of productivity losses and social costs, musculoskeletal diseases cost about 2% of its gross domestic product (GDP) [12]. In Japan, work-related MSDs account for more than 62% of the causes of sick leaves longer than four days [13]. In recent years, studies have shown that the prevalence of MSDs in China remains high, including various environments and reaching over 85.7% in some industries, which has caused huge economic losses [14].

According to scientific reports, the significant correlation of MSDs can be attributed to facts that nurses experience greater occupational strain, such as high job demands, low job control or low social support [15,16] and events of the physical work overload that occurred during the patient’s transferring activity. These duties, which are exposed to changing clothes, transferring, moving, cleaning, injection postures and handling of patients before and after surgeries, have been recognized to be a significant source of hospital nurses’ musculoskeletal diseases [17,18].

Musculoskeletal diseases occur in different parts of the body; however, the upper body areas are more frequently more problematic than the lower extremities [17,19,20]. In other words, nurses are more prone to experience MSD in the upper body than in the lower body [17,21,22]. Although the effect of MSD on the lower-limbs region may be as important as the effect on the upper body area, there is limited research that supports lower-limbs disorders as a symptom [17,22]. Studies reported that discomfort was mostly felt in the shoulders, neck, and lower back [22–24]. For example, recent research conducted by Lin et al. indicated that the greatest prevalence of MSD symptoms among hospital nurses was found in the right shoulder (85.8%), left shoulder (80.9%), neck (62.4%) and lower back (60.4%) [22].

It is obvious that nurses’ mental and physical health problems with musculoskeletal diseases and vocational stressors are key factors in reducing the quantity and quality of their work performance, especially patient care. Concomitantly, poor job performance can result in psychosocial and physical problems that could lead to depression [23]. Therefore, the prevalence of MSDs in nurses and their association with some personal and professional factors need to be studied to prevent and treat them in this sensitive group.

Many psychosocial and physical factors play a significant role in the occurrence of musculoskeletal diseases [25–27]. The relationship among occupation-related psychosocial stressors and musculoskeletal diseases, physical workload, and musculoskeletal diseases has been studied in several reviews. However, most of these are narrative reviews rather than systematic, and thus, perhaps not as comprehensive or transparent. Bernal et al. [28] conducted a systematic review and a meta-analysis to examine the relationship between work-related psychosocial factors and musculoskeletal diseases, which identified associations between high psychosocial demands with prevalent and incident low back pain, prevalent shoulder pain, and low social support with incident back pain. However, correlations between work-related low social support and prevalent or incident neck pain, shoulder pain, and low back pain were not revealed. Additionally, Koohpayehzadeh et al. [24] found that low or high psychological workload was not linked to the prevalence of shoulder or neck complaints, although correlation with high physical workload was significant.

The mechanical workload of workers can generate muscular tension, which, in turn, may induce pain or aggravate pre-existing discomfort [29]. Soroush et al. [19] reviewed and analyzed the prevalence of musculoskeletal diseases as common problems among Iranian nurses and found a strong relationship between musculoskeletal diseases and inappropriate body mechanics, such as working while bending or twisting the waist, uncomfortable postures, bending to lift an item from floor level, among others. Because of the close connection between physical workload and musculoskeletal diseases, it has been argued that vocational psychosocial and physical opportunities must be taken into account when analyzing the risk factors of career-oriented musculoskeletal diseases [30]. Although some studies have reported strong associations between physical risk factors in the workplace and musculoskeletal diseases in hospital nurses [24,26,27], to the best of our knowledge, no meta-analysis has specifically addressed the relationship between psychological, physical, and social factors on MSDs.

The purpose of the current study is to present an up-to-date meta-analysis based on cross-sectional and longitudinal study data on the relationship between occupation-related psychosocial factors, physical workload, and musculoskeletal diseases of the upper body among hospital nurses to comprehensively and systematically evaluate and quantify associations. The results of this study can provide a reference for nursing administrators and policymakers to take measures to reduce musculoskeletal diseases among nurses to promote their health, and thus, boost the quality and performance of patient care.

Methods Search strategy

An electronic search was implemented using Web of Science, PubMed, PubMed Central, MEDLINE (OVID), Springer link, EBSCO host, CNKI, Wan Fang, SinoMed from June 15 to August 15, 2019. Our information retrieval strategy was similarly applied to all databases and incorporated three main blocks to acquire diverse aspects of our review: exposure, outcome, study population, and June 2019 as the latest search date, exploiting a combination of search criteria. The search words used were: (“Work-related stress” or “Work-related strain” or “job stress” or “work stress” or “occupational stress” or “occupational strain” or “stress at work” or “strain at work” or “effort-reward imbalance” or “psychological strain” or “job strain” or “work strain” or “mental workload” or “psychosocial risk” or “job content” or “workload” or “physical overload”) AND (“work-related musculoskeletal diseases” or “back pain*” or “shoulder pain*” or “neck pain*” or “wrist pain*” or “elbow pain*” or “hand pain*” or “arm pain” or “musculoskeletal pain*”) AND (“hospital patient care workers” or “nurse”).

Study selection and eligibility criteria Inclusion criteria

Inclusion criteria were (1) cross-sectional, prospective cohort, case-control studies, randomized controlled trials, published in English or Chinese, evaluating the relationship between musculoskeletal diseases and occupationally psychosocial or physical risk factors among hospital nurses; (2) types of interventions, including coaching interventions for coping with work stressors, work-place stress management and prevention programs involving psychological intervention; types of controls, including general physical exercise programs, physical training programs and physiotherapy; types of outcome measures, including incidence and location of pain; (3) nurses' occupational stress and workload, including the number, incidence and prevalence of musculoskeletal diseases with each anatomic site among groups.

Exclusion criteria

(1) Unpublished documents (e.g., dissertation) or studies that lacked detailed instruction for either exposure or outcome, incidence or prevalence of MSDs, odds ratios (OR), and 95% confidence intervals (95% CI) were excluded; (2) along with studies that considered a wide range of hospital occupation workers, but in which data for hospital nurses were not separately analyzed.

Literature screening was independently undertaken by two researchers according to retrieval strategy and selection criteria. After duplicates were removed, the titles and abstracts were browsed to finish the record screening, then full-text articles assessed for disqualification and irrelevance were eliminated. Accordingly, the required detailed information was collected by two reviewers concerning the full text of the publications. In case of inconsistencies, a consensus meeting is held by a third reviewer or an arbitration panel to resolve conflict. As shown in Figure 1, out of 1,968 potential articles were included through database searching and other sources. A total of 532 articles were screened based on their titles and abstracts and 93 of full-text articles assessed for eligibility. Among the 93 articles, 5 that were not English or Chinese publication, 8 without specific measurement or job strain or MSD, 32 irrelevant, 25 odds ratio absent and 5 of inadequate quality were excluded. Finally, 18 publications [3,15,17,18,20,24–26,31–40] that satisfied the selection criteria were analyzed quantitatively and qualitatively. Figure 1 shows the flowchart of the study selection.

Quality assessment of the included studies

The methodological quality of each study that was included in the synthesis was appraised by an adapted version of the checklist for quality assessment developed by Windt et al. [41] and once utilized in a review of epidemiological literature by Bongers et al. [42]. This checklist is built on preexisting systematic reviews of observational studies of occupational risk factors for musculoskeletal discomfort [43]. The checklist contains the quality assessment of prospective cohort (12 items), cross-sectional (11 items), and case-control studies (15 items), including five dimensions of content: study objective, study population, exposure measurements, assessment of the outcome, analysis, and data presentation. Each item was scored as positive if the information was matched, negative (potential bias) if the information was not matched, or unclear when the paper provided insufficient information on a specific item. For each publication, a quality score was quantified according to the sum of items that were rated as positive. Publications were viewed as high-quality (low risk of bias) when the score was above 80% of the maximum possible score, intermediate quality (intermediate risk of bias) when it was between 70% and 79%, and low quality (high risk of bias) when it was below 70% [28].

Statistical analysis

When at least two studies provided data on the same outcome indicators, we conducted a quantitative synthesis. A pooled OR and its 95% CI were estimated for each subset, using fixed or random-effects models, under heterogeneity between papers for research synthesis. Cochran's Q test of heterogeneity and inverse variance (I–V) method with I^2 was performed to detect heterogeneity among the studies. According to the difference in heterogeneity, the random effect and fixed-effect models were used for the estimate, respectively. The value of I^2 is between 0% and 100%, of which 0%, 25%, 50% and 75% means that there is no, low, medium and high heterogeneity, respectively [44]. A choice for a random effect model occurred if $I^2 \geq 50\%$; otherwise, the fixed-effect model was selected to estimate a pooled OR and its 95% CI. In the fixed effect model, the inverse variance weighted average was used to estimate the effect size, whereas, in the random-effect model, it was the inverse variance heterogeneity method. All results were presented as forest plots. We explored the source of heterogeneity through subgroup analyses, sensitivity analysis, and meta-regression to check study location, study design, measurement of outcome, measurement of exposure, mean age of subjects, sample sizes and quality of studies as possible sources of heterogeneity among study findings [28]. In the sensitivity analysis, the influence of each study on the pooled effect was evaluated by excluding one study at a time. Publication bias was estimated via a funnel plot, Egger's linear regression, and Begg's rank correlation. When the funnel plot was significantly asymmetric, it was suggested that there was obvious publication bias. All statistical analyses were conducted using Stata software (version 14.0 MP) with packages METAN, METABIAS6, METANINF and METAREG, and *p* **Results Characteristics of the included studies**

A total of 18 studies were included in our meta-analysis, with the literature consisting of 15 cross-sectional designs, two prospective cohort studies, and one retrospective cohort study. Most volunteers were women (54.1%-100%), between the ages of 20 and 60. The general and methodological information of the included studies are as follows (Table 1): author's name, year of publication, country, research design, response rate, study participants, sample size, mean age, measurement questionnaire, analytical method, adjustment variables and quality evaluation. Furthermore, characteristics of psychosocial risk factors (high job demand, low social support and total job strain) and physical risk factors (physical workload), as well as OR and 95% CI from each study, were collected. The participants were from twelve different countries and areas. Most studies were from Asia (n = 10), seven studies were conducted in Europe, and one in Australia. Fourteen studies investigated the association between psychosocial factors (high job demand, low social support and total job strain) and MSDs, while eleven studies considered physical factors (physical workload). Four anatomic sites (lower back, neck, shoulder and back) were the focus of our included designs. Thirteen studies discussed lower back pain, nine studies considered neck and back pain, and six studies considered shoulder pain. Exposure and outcome were measured using a different questionnaire. Twelve designs used a standardized questionnaire such as the Nordic Questionnaire and Karasek Job Content questionnaire to measure MSDs and psychosocial and physical risk factors, while the other six studies used the other standard scales or questionnaires designed by the researchers.

Methodological Quality

All the included publications were observational studies and were critically appraised using an adapted version of the checklist for quality assessment. Of all the included studies, 10 studies were considered high quality, having a low risk of bias (score ranged between 82.0% and 91.0%), three studies were considered intermediate quality, having an intermediate risk of bias (score ranged between 75.0% and 78.6%), and five studies were considered low quality, having a high risk of bias (score ranged between 63.6% and 69.2%). The results of each study are shown in Table 1, and there is a possibility of risk of bias.

Meta-analysis

Pooled analysis and heterogeneity are summarized in Table 2. In our meta-analysis, psychosocial risk factors were related to high job demand, low social support and total job strain. Positive outcomes were found with the prevalence of low back pain for high job demand (OR = 1.41; 95% CI = 1.23–1.62) and total job strain (OR = 1.71; 95% CI = 1.15–2.55). Exposure to total job strain was also associated with the risk of neck pain (OR = 1.67; 95% CI = 1.26–2.20), shoulder pain (OR = 1.62; 95% CI = 1.06–2.48), and back pain (OR = 1.45; 95% CI = 1.10–1.91). Unexpectedly, no statistically significant results were detected in a subset of low back pain–low social support (OR = 1.23; 95% CI = 0.85–1.78), neck pain (OR = 1.02; 95% CI = 0.97–1.08), shoulder pain (OR = 0.92; 95% CI = 0.53–1.61), and back pain (OR = 1.12; 95% CI = 0.99–1.25). However, the physical workload was significantly associated with the prevalence of low back pain (OR = 1.76; 95% CI = 1.32–2.35), neck pain (OR = 1.17; 95% CI = 1.08–1.27), shoulder pain (OR = 1.59; 95% CI = 1.37–1.85), and back pain (OR = 1.66; 95% CI = 1.45–1.90).

Subgroup analysis

High heterogeneity was found in three subsets of studies (that is, an association between low back pain and low social support; between low back pain and total job strain; and between low back pain and physical workload). Heterogeneous sources were explored via subgroup analysis planned by location, type of design, measurement, mean age, sample size and quality evaluation (Table 3). The subgroup analysis reported that high heterogeneity might stem from the mean age and location in subsets.

Sensitivity analysis

Sensitivity analysis was performed to investigate the possible sources of heterogeneity. Then, two studies created by Feng et al. [20] and Harcombe et al. [26] were ruled out in the subset of low back pain–low social support, and heterogeneity was therefore reduced with the remaining seven studies (I^2 = 45.2%, *p* = .090), while the pooled effect size turned out to become statistically significant (OR = 1.37; 95% CI = 1.09–1.73). High heterogeneity in the subset of low back pain–physical workload was attributed to the study of Harcombe et al. [26] detected by sensitivity analysis. After excluding that paper, heterogeneity remarkably declined (I^2 = 36.7%, *p* = .177), while the association between low back pain and physical workload was still statistically significant with a pooled odds ratio of 1.95 (95% CI = 1.57–2.42). The heterogeneous source of these studies may originate from different study populations, including nursing aides in nursing rooms in the study by Feng et al. [34], while the other investigations only recruited hospital nurses. In the subset of low back pain–total job strain, heterogeneity decreased from 58.8% (*p* = .045) to 48.2% (*p* = .122) after ruling out the study of Smith et al. [33].

Meta-regression

Three subsets with high heterogeneity were also considered for meta-regression. Only variables of “mean age” (β = 0.598, SE = 0.089, R^2_{adj} = 100.0%, *p* = .026) partially explained the high heterogeneity found in subset low back pain–physical workload (data not shown).

Publication bias

Funnel plot, Begg’s and Egger’s tests were conducted to evaluate publication bias in the included studies. No significant publication bias was identified according to the funnel plot in this study. Following Begg’s test and Egger’s test (Table 4), no evidence of publication bias was found for the subsets of high job demand, total strain, and physical workload. However, both studies reported a possible publication bias for the association between low social support and low back pain. Egger’s test indicated publication bias in the relationship between physical workload and back pain. This may be explained by the inclusion criteria since exposure to social support consists of coworker and supervisor support, but some studies include two kinds of support, while others include only one. Moreover, when the heterogeneity is unexplainable, regression to test publication bias may lead to false-positive outcomes.

Discussion

Our meta-analysis assessed the pooled effects of 18 studies on work-related risk factors for upper body MSDs. The quality evaluation of most studies was intermediate or high (ranging from 63.6% to 91.0%). Most of the included studies used standard questionnaires (such as the Nordic Questionnaire [45] based on the Karasek model [46] and Job Content Questionnaire [47]) to measure MSDs, occupationally psychosocial factors, and physical environment, while others used questionnaires designed by investigators or published in previous literature. It is conceivable that different measurement criteria may produce confounding variables, and subgroup analysis did display obvious heterogeneity decreases in groups of both measurement of exposure and outcome with standard scales in the subset of low back pain–physical workload (Table 3).

Exposure to both psychosocial factors and the physical workload was correlated with the prevalence of MSDs [29,30]. Most studies revealed statistically significant associations between high job demand, total job strain, and MSDs. These results are similar to those reported by Bernal et al. [28] Nevertheless, comparing to studies in which low social support was related to the risk of suffering low back pain, neck pain, shoulder pain and pain at any anatomical site, the meta-analysis does not suggest any statistically significant association between low social support and low back pain, neck pain, shoulder pain or back pain. However, these findings were consistent with a cohort study [48], which showed no evidence to indicate the correlation between work-related factors (such as low social support) and low back pain. In fact, Bernal's review included nurses and aids and used random-effect models to analyze the effects of exposure factors on outcomes. We should carefully interpret the results because the high degree of heterogeneity between studies may lead to false-positive results. A possible explanation for this might be that different questionnaires and different definitions of MSDs may contribute to deviations [28]. Moreover, further analysis showed that there was a statistically significant connection between low social support and low back pain after two studies were excluded through sensitivity analysis. Subgroup analyses (Table 3) indicated that location and mean age might be the sources of heterogeneity in the subset low back pain–physical workload. A systematic review suggested a difference in the prevalence of low back pain among nurses in different countries, which may be related to occupational factors [19]. These findings recommend attention to the heterogeneous sources and caution.

The correlation between physical workload and upper body MSDs was identified based on our comprehensive evaluation of 11 relational studies [3,15,17,18,20,24,26,32,33,36,39]. Syntheses reported that higher physical workload was associated with a much greater risk of developing low back pain (random OR = 1.76; 95% CI = 1.32–2.35; I^2 = 62.0%), neck pain (fixed OR = 1.17; 95% CI = 1.08–1.27; I^2 = 44.6%), shoulder pain (fixed OR = 1.59; 95% CI = 1.37–1.85; I^2 = 46.3%), back pain (fixed OR = 1.66; 95% CI = 1.45–1.90; I^2 = 0.0%) among hospital nurses. Therefore, the findings of our study were, to a great degree, in line with other evidence serving to an increased risk of musculoskeletal dysfunction stemming from high physical workload [24,26,35].

In a systematic review of Iran, an enhancing prevalence of musculoskeletal complaints among nurses was reported [19], in agreement with Switzerland's [8], Chinese [43], and Vietnam's [7] studies. Our research showed that high levels of physical workload led to an increase in the risk of lower back, upper back, shoulder, and neck pain by 1.76, 1.66, 1.59 and 1.17 times, respectively, indicating that the lower back is more prone to MSDs when exposed to overload physical conditions. This is consistent with most previous studies [15,19,40]. In Japan, having more than four days of sick leave and work-related low back pain accounted for 62% of cases [21]. Low back, upper back, shoulder and neck pain among the nurses might be physically attributed to recurrent transferring/lifting patients or heavyweights, continual bending and standing, frequent long walk, pulling and pushing, and sudden movements in improper posture, inappropriate body postures that nurses experience given the nature of nursing, particularly of some emergencies in hospital wards [1,28,39].

Repetitive abnormal movements impose compression and shear forces on the spinal column, shoulder joints, and cervical vertebrae, causing back, shoulder and neck damage. Therefore, some nurses, such as those of intensive care units, operating rooms, are more prone to MSDs [32].

Based on these findings, clinical nurses should strengthen their awareness of self-protection and improve their self-protection skills and knowledge level. This can be done in their usual work through the principle of labor-saving when lifting heavy objects or patients is necessary to avoid long-term engagement in forced postures or wrong positions for lifting, which cause musculoskeletal injury. By enhancing their musculoskeletal syndrome-related knowledge, nurses can perceive early warning symptoms of MSDs in a timely manner, reasonably arrange rest time, and take effective measures to deal with high work demands, as well as high occupational stress [[21],[49]].

As far as the hospital is concerned, On the one hand, hospitals should strengthen the training of the principles of labor-saving in the work process of nurses and encourage and provide ergonomics lifting devices for transfers and repositioning, which are more effective to control or prevention of MSDs among nurses. Based on other studies, motivating health care staff to use lifting devices was strongly associated with the decreasing percentage of MSD prevalence during a patient's transfer and repositioning [[49]]. This finding highlights the demand for a plan that allows or encourages nurses to use ergonomic lifting devices when required by ensuring that sufficient lifting devices are available for the number of patients in each ward. The results of other studies corroborate those of the current study; they affirm that more attention is required for preventing and controlling these disorders before they occur [[2],[9],[21]]. On the other hand, hospitals need to take all measures to reduce the occupation-related psychosocial pressure on nurses, to promote the health of nurses, and to ensure that nurses can provide high-quality nursing care for patients.

Limitations and prospects

This study had three main limitations: (1) as the data were collected using self-reported techniques, participant responses may be biased as a result of social desirability to provide favored answers instead of real experiences; (2) cultural (participants from 12 countries, and Asia, Europe, and Australia) and language (English, Chinese)differences may have influenced the individuals' understanding and interpretation of the study items; (3) when the study was restricted mainly to female nurses (51.4%–100.0%), a bias for certain gender and preference parameters might have occurred. For instance, in the psychological domain, females are generally found to have lower decision latitude than men in most populations. Future studies could try to use more objective indicators, conduct subgroup analysis based on culture and language, and recruit more male nurses to reduce bias. (4) Because hospitals around the world have diverse medical delivery systems, size, and manpower, specific departments, and severity of patients and the burden of nurses'' work, there is not enough evidence to conduct a subgroup analysis. In the future, in-depth research can be carried out according to different countries or hospitals. Further limitations can be pointed out. There were 15 cross-sectional studies but only two prospective cohort studies and a retrospective cohort study. More longitudinal research should be conducted to explore the occupational risk factors for upper body MSDs in future work. There was no evidence to indicate the correlation between low social support and low back pain; thus, future studies on this topic are highly recommended. Subgroup analysis, sensitivity analysis and meta-regression were used to explore heterogeneous sources, and a certain degree of heterogeneity may reduce the estimation accuracy. Additionally, using different questionnaires and measurement standards to test the same outcome indicators was unreasonable. Further studies that consider these variables need to be undertaken. Furthermore, our study only focused on psychosocial risk factors and physical workload but ruled out additional interventions that could prevent and reduce the occurrence of MSDs. In future investigations, more theoretical and experimental research could be performed.

Conclusion

To our knowledge, this meta-analysis is the first attempt to comprehensively and systematically identify and critically appraise published studies that explore the relationship between exposure to occupational psychosocial, physical factors, and MSDs in hospital nurses simultaneously; however, most present literature findings included in this review drew the conclusion that there was a significant association between more physical workload and MSDs, as well as occupational strain among hospital nurses. These findings are correspondingly in step with current scientific knowledge, the demonstration advocating a growth risk in upper body MSDs among nurses due to low levels of social support is statistically insignificant. Executing a longitudinal design to validate our explanation and apply it to national prevention programs for health care workers is strongly recommended.

A high prevalence of chronic MSDs will result in low quality, low-efficiency work performance, high medical costs or even job changes. Providing effective preventive measures to reduce nurses' occurrence of MSDs is necessary. These preventions should consider both occupational physical and psychosocial factors, including ergonomics, appropriate exercises and the improvement of the organizational environment.

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Conflict of interest

None declared.

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Study	Country	Design, Response rate	Participants, Sample size, Age	Female (%)	Measure	Analysis, Adjustment variables	Quality (%)	Exposure variables	Anatomic site	OR	95% CI
Alexopoulos (2006)	The Netherlands and Greece	Retrospective cohort 64%	Nurses n = 393 38.6 (9.4) 37.1 (7.3)	93.81	Karasek model, Nordic Questionnaire	Logistic regression, adjusted for physical demands	78.6	Physical workload^{a} Physical workload^{b} Physical workload^{a} Physical workload^{b}	Shoulder^{a} Shoulder^{b} Back^{a} Back^{b}	1.19^{a} 2.08^{b} 1.93^{a} 1.98^{b}	0.62–2.30^{a} 1.25–3.46^{b} 1.23–3.03^{a} 1.19–3.31^{b}
Arsalani (2014)	Iran	Cross sectional 92%	Nurses n = 520 <40: 66.7%	79.4	Copenhagen Psychosocial Questionnaire, Nordic Questionnaire	Logistic regression, adjusted for age and gender	75.0	High job demand, Physical workload, Physical workload,	Low back Low back Neck	1.15 1.18 1.86	0.76–1.73, 0.73–1.88, 1.07–3.23,

Bos (2007)	The Netherlands	Cross sectional 63%	Nurses n = 1977 38 (10)	82	Copenhagen Psychosocial Questionnaire, Nordic Questionnaire	Logistic regression multivariate model, adjusted for physical demands	84.6	Low social support Physical workload Low social support	Neck Neck Back	1.02 0.98 1.10	0.97–1.08 0.75–1.28 0.97–1.24
Choobineh (2006)	Iran	Cross sectional 84%	Nurses n = 641 22–66	84.7	Job Content Questionnaire, Nordic Questionnaire	Logistic regression, adjusted for age, physical demands	63.6	Physical workload Physical workload Physical workload Physical workload	Low back Neck Shoulder Back	2.10 2.09 2.01 2.14	1.50–2.70 1.15–3.80 1.20–3.38 1.24–3.70
Choobineh (2010)	Iran	Cross sectional 80%	Nurses n = 375 19–62	66.4	Job Content Questionnaire, Nordic Questionnaire	Logistic regression, adjusted for age, physical demands	84.6	Physical workload Physical workload Physical workload	Low back Shoulder Back	2.04 3.04 2.25	1.09–5.31 1.65–5.59 1.26–4.01
Dhaini (2016)	Switzerland	Cross sectional 76.6%	Nurses n = 3471 18–50:67% >50: 33%	92.4	Health Professions Stress Inventory	Logistic regression, adjusted for facility and care workers characteristics	63.6	Low social support Physical workload	Low back Back	1.25 1.52	0.78–1.99 1.29–1.79
Elfering (2002)	Switzerland	Prospective cohort 75.8%	Nurses n = 186 23.9 (2.2)	-	Instrument for Stress Oriented Task Analysis, Nordic questionnaire	Logistic regressions, adjusted for age, sex, physical workload, problems at baseline, BMI, leisure time sport, smoking, general health	88.9	Low social support	Low back	5.75	1.27–25.97

Feng (2007)	Taipei, Taiwan	Cross sectional 91.3%	Nursing aides n = 244 43.3 (7.9)	100	Job Content Questionnaire, Nordic Questionnaire	Logistic regression, adjusted for smoking, BMI and care workers characteristics	83.3	High job demand Low social support	Low back Low back	1.46 0.62	1.24–1.73 0.42–0.91
Freimann (2013)	Estonia	Cross sectional 57 %	Nurses n = 237 23–59	100	Nordic Questionnaire, Copenhagen Psychosocial Questionnaire	Logistic regression, adjusted for age and all risk factors	86.0	Total job strain Total job strain	Neck Shoulder	1.40 0.70	0.70–2.80 0.30–1.70
Golabadi (2013)	Iran	Cross sectional 84.5%	Nurses n = 545 32.1 (7)	79.4	Job Content Questionnaire, Nordic Questionnaire	Logistic regression, adjusted for age,sex, Physical demands	84.6	High job demand Total job strain Total job strain	Low back Low back Back	1.73 2.49 1.82	1.18–2.53 1.46–4.26 1.10–3.001
Gonge (2002)	Denmark	Cross sectional 84 %	Nurses n = 200 18–64	100	Whitehall II study, Nordic Questionnaire	Logistic regression, adjusted forage, smoking, neuroticism.	82.0	High job demand Low social support	Low back Low back	1.00 1.20	0.60–1.60 0.70–2.00
Harcombe (2010)	New zealand	Cross sectional 58 %	Nurses n = 280 20–59	-	Whitehall II study, Nordic Questionnaire	Logistic regression, adjusted for occupation, age, sex and Body Mass Index	91.0	Low social support Low social support Total job strain Low social support Total job strain Physical workload	Low back Neck Neck Shoulder Shoulder Shoulder	1.25 1.06 3.46 0.75 2.18 1.41	0.78–1.99 0.62–1.81 1.30–9.21 0.43–1.32 0.76–6.24 1.17–1.69

Koohpayehzadeh (2016)	Iran	Cross sectional 79 %	Nurses n = 405 26–60	51.4	Job Content Questionnaire, Nordic Questionnaire	Logistic regression	63.6	Physical workload	Neck	1.20	1.06–1.30
Smith (2004)	China	Cross sectional 92 %	Nurses n = 282 34(9.2)	100	Nordic Questionnaire	Logistic regression, adjusted for age, total career length and department of employment.	85.7	Low social support Total job strain Low social support Total job strain Physical workload Low social support Total job strain Low social support Total job strain	Low back Low back Neck Neck Neck Shoulder Shoulder Back Back	2.30 1.14 2.52 1.79 0.87 2.00 1.69 1.90 1.24	0.96–6.15 0.68–1.91 1.09–6.23 1.06–3.03 0.49–1.54 0.90–4.59 0.99–2.89 0.85–4.35 0.72–2.13

Smith (2006)	Japan	Cross sectional 72.6%	Nurses n = 844 32.9 (8.8)	100	Nordic Questionnaire	Logistic regression adjusted for age, physical demands	90.9	Low social support Total job strain Physical workload Low social support Total job strain Physical workload Low social support Total job strain Physical workload Low social support Total job strain Physical workload	Low back Low back Low back Neck Neck Neck Shoulder Shoulder Shoulder Back Back Back	0.92 1.12 2.76 1.07 1.53 1.58 0.68 2.07 2.09 1.16 1.37 1.69	0.59–1.45 0.72–1.72 1.50–5.13 0.71–1.60 1.02–2.31 0.86–2.93 0.44–1.06 1.35–3.17 1.11–3.89 0.77–1.74 0.88–2.15 0.85–3.58
Warming (2009)	Italy	Cross sectional 100%	Nurses n = 148 21–60	92	Log book instrument	Logistic regression, adjusted for gender, age, physical demands	76.9	Total job strain Total job strain	Neck Back	1.16 1.17	0.24–5.54 0.27–5.01
Yip (2002)	HongKong, China	Prospective cohort 65%	Nurses n = 236 31.3	84.7	General Health Questionnaire	Logistic regression model, adjusted for physical demands	66.7	Low social support	Low back	1.85	1.00–3.42

Yip (2004)	Hong Kong, China	Prospective cohort 64.3%	Nurses n = 144 31.10	85.5	General Health Questionnaire	Multivariate logistic regression, adjusted for age	69.2	Low social support Physical workload	Low back Low back	2.52 2.76	1.03–5.68 1.06–7.22

Anatomic site	Variables		Studies (n)	OR (95% CI)	Test of ES = 1		Heterogeneity		Studies
z	p	I^2	p	Low back	Psychosocial factors	High job demand	4	1.41 (1.23,1.62)	4.91
<.001	26.9	.251	Arsalani (2014), Feng (2007), Golabadi (2013), Gonge (2002).	Low social support	9	1.23 (0.85, 1.78)	0.34	.737	70.8

.001	Dhaini (2016), Elfering (2002), Feng (2007), Gonge (2002), Harcombe (2010), Smith (2004), Smith (2006), Yip (2002), Yip (2004).	Total job strain	5	1.71 (1.15,2.55)	2.66	.008	58.8	.045	Golabadi (2013), Gonge (2002), Harcombe (2010), Smith (2004), Smith（2006）
Physical factors	Physical workload	6	1.76 (1.32,2.35)	3.85	<.001	62.0	.022	Arsalani (2014), Choobineh (2006), Choobineh (2010), Harcombe (2010), Smith（2006）, Yip (2004).	Neck
Psychosocial factors	Low social support	4	1.02 (0.97,1.08)	0.90	.367	28.3	.243	Bos (2007), Harcombe (2010), Smith (2004), Smith（2006）.	Total job strain

5	1.67 (1.26, 2.20)	3.63	<.001	0.0	.587	Freiman (2013), Harcombe (2010), Smith (2004), Smith (2006), War	Physical factors	Physical workload	7

						ming(2009)				

1.17 (1.08 ,1.27)	3.93	<.001	44.6	.094	Arsalani (2014), Bos (2007), Choobineh (2006), Harcombe (2010), Koohpayehzadeh (2016), Smith（2004）, Smith(2006).	Shoulder	Psychosocial factors	Low social support	3

0.92 (0.53,1.61)	0.29	.772	62.9	.067	Harcombe (2010), Smith（2004）, Smith(2006).	Total job strain	4	1.62 (1.06,2.48)	3.54
<.001	40.6	.168	Freiman (2013), Harcombe (2010), Smith (2004), Smith (2006)	Physical factors	Physical workload	6	1.59 (1.37,1.85)	6.11	<.001

46.3	.097	Alexopoulos[a] (2006), Alexopoulos[b] (2006), Choobineh (2006), Choobineh (2010), Harcombe (2010), Smith (2006).	Back	Psychosocial factors	Low social support	3	1.12 (0.99,1.25)	1.87	.062
0.0	.423	Bos (2007), Smith (2004), Smith (2006).	Total job strain	4	1.45 (1.10, 1.91)	2.60	.009	0.0	.742

Golabadi (2013), Smith (2004), Smith (2006), Warming (2009).	Physical factors	Physical workload	6	1.66 (1.45,1.90)	7.30	<.001	0.0	.566	Alexopoulos[a] (2006) ,Alexopoulos[b] (2006) , Choobineh (2006), Choobineh (2010), Dhaini (2016), Smith (2006)

Sub-group		Low back pain-Low social support				Low back pain-Total strain				Low back pain-Physical workload			
n	OR (95% CI)	Heterogeneity		n	OR (95% CI)	Heterogeneity		n	OR (95% CI)	Heterogeneity		I^2	p
I^2	p	I^2	p	Location	Asia	5	1.31 (0.76,2.28)	77.1	.002	3	1.45 (0.88,2.38)	67.0	.048
5	1.95 (1.57,2.42)	36.7	.177		Europe	4	1.17 (0.66,2.08)	69.9	.019	1	2.30 (1.33,3.98)	-	-
0	-	-	-		Australia	0	-	-	-	1	2.85 (1.01,8.04)	-	-
1	1.35 (1.14,1.60)	-	-	Design	Cross-sectional study	6	0.95 (0.68,1.33)	61.1	.025	-	-	-	-

5	1.53 (1.34,1.76)	66.0	.019		Prospective study	3	2.28 (1.42,3.65)	0.0	.379	-	-	-	-
1	2.76 (1.06,7.20)	-	-	Measurement of outcome	Nonstandard questionnaire	3	0.87 (0.60,1.28)	42.0	.178	2	2.41 (1.48,3.92)	0.0	.720
4	1.63 (1.13,2.37)	58.7	.064		Standard scale	6	1.62 (0.91,2.87)	77.3	.001	3	1.45 (0.88,2.38)	67.0	.048
2	2.09 (1.59,2.76)	0.0	.946	Measure of exposure	Nonstandard questionnaire	3	0.87 (0.60,1.28)	42.0	.178	4	1.54 (1.00,2.36)	54.0	.089
2	1.81 (0.91,3.61)	79.3	.028		Standard scale	6	1.62 (0.91,2.87)	77.3	.001	1	2.49 (1.46,4.25)	-	-
4	1.82 (1.28,2.57)	38.9	.178	Mean age	<40	5	1.86 (1.07,3.24)	61.0	.036	3	1.45 (0.88,2.38)	67.0	.048
4	2.22 (1.74,2.84)	0.0	.835		≥40	4	0.85 (0.57,1.28)	64.8	.036	2	2.41 (1.48,3.92)	0.0	.720
2	1.33 (1.13,1.56)	0.0	.600	Sample (n)	<500	6	1.62 (0.90,2.90)	77.2	.001	2	1.61 (0.81,3.20)	70.0	.068
2	2.31 (1.25,4.25)	0.0	.634		500–1000	2	0.76 (0.49,1.17)	34.2	.217	3	1.85 (0.98,3.49)	68.6	.041
4	1.67 (1.20,2.33)	73.3	.010		≥1000	1	1.25 (0.78,1.99)	-	-	-	-	-	-

-	-	-	-	Quality (%)	<70	3	1.61 (1.10,2.35)	15.4	.307	-	-		
2	2.31 (1.25,4.25)	0.0	.634		70–80	0	-	-	-	-	-		
1	1.18 (0.74,1.89)	-	-		≥80	6	1.03 (0.66,1.61)	69.9	.005	5	1.71 (1.15,2.55)	58.8	.045
3	1.86 (1.23,2.80)	80.1	.007	Overall		9	1.23 (0.85,1.78)	70.8	.001	5	1.71 (1.15,2.55)	58.8	.045

Anatomic site	Exposure	Intercept and 95% CI	t	p	Publication bias
Low back pain	High job demand	−1.17 (−7.25,4.90)	−0.83	.493	No
Low social support	4.28 (1.39,7.16)	3.51	.010	Yes	Total job strain
3.39 (−5.26,12.05)	1.25	.301	No	Physical workload	1.63 (−1.34,4.61)
1.52	.203	No	Neck	Low social support	0.92 (−1.97,3.82)
1.37	.305	No	Total job strain	0.48 (−2.91, 3.87)	0.45
.681	No	Physical workload	0.64 (−1.58, 2.88)	0.75	.490
No	Shoulder	Low social support	5.40 (−16.81,27.63)	3.09	.199

No	Total job strain	−1.74 (−10.52,7.02)	−0.86	.482	No
Physical workload	1.6 9 (−0.75,4.14)	1.92	.127	No	Back
Low social support	1.09 (−6.51,8.70)	1.82	.319	No	Total job strain
−0.44 (−5.36,4.47)	−0.39	.735	No	Physical workload	1.33 (0.38,2.28)

DETAILS

Subject:	Occupational stress; Musculoskeletal diseases; Shoulder; Social support; Back pain; Risk factors; Gross Domestic Product--GDP; Neck pain; Psychological aspects; Workloads; Systematic review; Nurses; Meta-analysis
Business indexing term:	Subject: Occupational stress Gross Domestic Product--GDP Workloads
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Identifier / keyword:	Meta-analysis; Musculoskeletal diseases; Physical exertion; Psychology
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Document 7 of 29

A Five-step Systematic Therapy for Treating Plugged Ducts and Mastitis in Breastfeeding Women: A Case–Control Study

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ProQuest document link

ABSTRACT (ENGLISH)

Purpose

This study aimed to describe the clinical response to five-step systematic therapy (FSST) in the management of plugged ducts and mastitis. FSST was a comprehensive milk stasis dredging treatment, which contained five steps to make the milk out of the plugged duct.

Methods

This retrospective study included 922 breastfeeding women, 714 with plugged ducts, and 208 with mastitis who received FSST from June to September 2017. The breast pain score, swelling degree, and range of breast induration were recorded pre-FSST and post-FSST.

Results

After a single FSST, pain score and swelling degree were significantly improved (both $p < .001$) in all cases. After FSST, the mean breast pain relief score was 1.69 ± 0.70, whereas the mean swelling fade away degree was 1.61 ± 0.62. In the subgroup analysis, pain score and swelling degree were significantly improved (both $p < .001$) in the plugged ducts group and the mastitis group. The score of pain relief in the plugged ducts group was less than that in the mastitis group (1.63 ± 0.68 vs. 1.91 ± 0.70, $t = 5.30$; $p < .001$), whereas improvement of swelling fade away was greater in the plugged ducts group than the mastitis group (1.65 ± 0.64 vs. 1.48 ± 0.56, $t = 3.49$; $p = .001$). The composition ratio of changes in induration range between the two groups was statistically different (Pearson $\chi2 = 137.87$, $p < .001$), of which more obvious improvement in the plugged ducts group than the mastitis group ($\chi2 = 25.65$, $p < .001$).

Conclusion

FSST can relieve pain, reduce breast swelling and range of induration, and for plugged ducts or mastitis varied degree differently.

FULL TEXT

DETAILS

Subject:	Edema; Abscesses; Patients; Pain; Inflammation; Breastfeeding &lactation; Lasers; Mothers; Breasts; Womens health; Massage
Location:	China
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Model Setting and Interpretation of Results in Research Using Structural Equation Modeling: A Checklist with Guiding Questions for Reporting

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ProQuest document link

ABSTRACT (ENGLISH)

Purpose

This study develops a checklist with guidelines for the methods and important factors to consider in research using structural equation modeling (SEM).

Method

The paper discusses the factors to consider in the process across the three stages of 1) model setting, 2) model evaluation and modification, and 3) interpretation and reporting of SEM-based studies.

Results

The authors present a checklist for researchers during the stages of model setting, model evaluation and modification, result analysis, and reporting, along with examples of figures and tables with explanations.

Conclusion

A checklist will help to improve the reporting quality of SEM-based studies.

FULL TEXT

Introduction

Structural equation modeling (SEM) is a research method that is widely used to verify complex phenomena in the field of nursing, related to various themes such as humans, health, and the environment. It formalizes the structural relationships between cause-and-effect variables in the area of interest into an equation system. Theories or abstract constructs that cannot be directly measured or observed often serve as research topics in the nursing field to not only understand humans in an integrated manner but also identify the relationships between these concepts [1].

SEM is a data analysis method that is widely used in many fields of study as it has many advantages: First, measurement errors can be controlled. Second, mediating variables can be easily utilized. Third, a statistical evaluation of the theoretical model is possible [2]. In other words, the researcher can evaluate how well the theoretical model constructed by himself/herself fits the actual data and either accept the model as valid, or modify it as necessary.

However, it is difficult to show an appropriate consistent form in reporting the research methods, results, and discussions because the SEM data analysis process is complicated [3]. This is because sufficient data on the model's goodness-of-fit, significance of hypothetical relationships, variances in the structural model, and explanations of how the theoretical model fits the actual data must be provided. Due to such difficulties, a considerable number of studies do not effectively utilize the advantages of SEM [4]; moreover, researchers have been criticized for the inappropriate use of SEM and its resulting problems [1].

This paper presents a checklist with the factors that should be taken into consideration when analyzing data using SEM by dividing the process into the following stages: the model setting stage, the model evaluation and modification stage, and the interpretation and reporting stage. It is hoped that the suggestions put forth will be considered by researchers in their attempts to improve research quality and descriptive narratives.

Checklists and guiding questions when conducting an SEM-based study

Table 1 presents a checklist and guiding questions to address during the stages of model setting, model evaluation and modification, result analysis, and reporting in SEM-based studies. Details on each topic will be explained below.

Model setting

The researcher conducting confirmatory research may have some prior knowledge about the structure of data from existing theories or empirical research results. Thus, he/she may be in a position to state it in a hypothetical form and test the hypothesis through actual data. Such a hypothesis is usually constructed on the basis of specific theories that need to be tested, the given experimental plan, known experimental conditions, and preliminary research results based on big data.

Meanwhile, exploratory research focuses on concisely describing the phenomena of interest, exploring valuable information about the data, and discovering meaningful interpretations, without assuming the aforementioned types of prior knowledge. Of course, the researcher may conduct an exploratory and a confirmatory research concurrently in an actual research situation, rather than clearly distinguishing between the two types of research. However, since SEM is a part of confirmatory research in the sense that it is based on research hypotheses, it is important to establish a valid hypothesis based on theories of and empirical results from the relevant field. For example, determining which variable is the cause and which is the effect in the causal relationship between two variables should be based entirely on the knowledge of the theory and practice in the relevant field. Therefore, sufficient prior research of theories and actual phenomena in the relevant field should be conducted when employing SEM.

In general, SEM includes a number of observed, latent, and error variables. In Figure 1 (A), x_1 and y_1 are observed variables; motivation and satisfaction are latent variables; and δ_1, ε_1, and ζ_1 are error variables. The relationship between these variables is divided into a measurement model and a structural model.

Measurement model

The measurement model defines how latent variables are measured through observed variables. The characteristics of observed variables are of interest because measurement variables construct abstract hypothetical concepts. Here, measurement errors that inevitably occur during the measurement process are also reflected.

The direct analysis targets of SEM are the variance and covariance of the observed variables. Therefore, observed variables should be measured using tools whose validity and reliability have been verified. Tools should be reviewed prior to conducting SEM research because their validity and reliability cannot be evaluated during the course of the research process.

The validity of the measurement model is of primary importance in developing the SEM. Some points to remember are: (1) Observed variables that represent each latent variable must be set. For example, when defining the latent variables of language abilities, we cannot agree whether the observed variables of Korean, English, music, and physical education are selected. If an observed variable that is not valid for a latent variable is selected, SEM results will not be recognized on a logical basis, regardless of their statistical significance. An indirect approach employed in SEM includes latent variables being reflected through the observed variables. From this perspective, the observed variables are called indicators of the latent variables. There are additional considerations when defining latent variables through observed variables [5]. (2) Observed variables that define one latent variable should be able to measure the same concept. (3) A latent variable is not simply a bundle or a description of observed variables. For example, it is meaningless to not only define a latent variable as a “general characteristic” by grouping observed variables such as gender, age, occupation, and education, but also to define a latent variable as a “work characteristic” by grouping them based on wards worked, years of service, positions, and educational background. (4) A latent variable should be defined to represent a single concept. For example, it is not desirable to define a latent variable called a “psychological state” with observed variables of happiness, confidence, depression, and anxiety, since each of these observed variables measures a different concept. (5) Path coefficients should be interpreted with directionality when describing the causal/correlational relationship between latent variables. In other words, they should be able to gauge the size of the latent variables. However, it is difficult to determine whether “general characteristic” or “work characteristic” are large or small.

It is “desirable” to have at least two, but usually “recommended” that there be three to four, observed variables for one latent variable [6,7]. However, inevitably, there are some cases wherein there may be only one observed variable for one latent variable, which means that the observed variable for the latent variable has not been sufficiently secured. In such cases, the theoretical or practical reason should be explained. When a single indicator problem occurs, the method usually employed for model identification involves fixing the variance of the error variable at a specific value. In general, the error variance is fixed at 0. However, it is recommended that it be fixed with “variance of observed variable × (1-reliability)” if the measurement reliability is known, since this reflects the estimates of the measurement error [8].

Structural model

The structural model defines the causal relationships and associations between latent variables. It also includes a description of error variations that are not explained through the model. Of course, setting an appropriate structural model is important. In the path diagram shown in Figure 1 (A), the one-way arrow refers to the researcher's hypothesis that there is a causal relationship between the variables. However, it is important to remember that the hypothesis is reflected even in paths without arrows. As can be seen, there are no arrows between “motivation” and “performance.” This means that the researcher establishes the hypothesis that there is no causal relationship between these two variables. It should also be reiterated that the establishment of this structural model should be based on theories of and empirical results from the relevant field.

Several studies have low goodness-of-fit because they have failed to consider the relationship of exogenous variables [9]. When the relationship between exogenous variables is not established in the structural model, it is the same as assuming independence between them. This will result in a greatly deteriorated goodness-of-fit. Therefore, it is necessary to establish the relationship between exogenous variables when setting up the model, except in cases where there is clear evidence that no relationship exists. Note that the LISREL software automatically establishes the relationship between exogenous variables. AMOS, on the contrary, requires that the user establish these relationships.

Evaluation and modification of model

The primary purpose of SEM is to evaluate how much of the model assumed by the researcher is supported by the data. SEM should be based on the researcher's confirmatory hypothesis as a whole. However, modification is allowed to some extent through actual phenomena.

Goodness-of-fit

Since the goodness-of-fit is an indication of whether the established SEM reflects the data situation well, a poor goodness-of-fit renders the results unreliable. Therefore, model evaluation through the goodness-of-fit indices is a primary process that should be performed when interpreting the results of SEM.

Because there are various goodness-of-fit indices, it is not easy to determine which index to use for an evaluation since each evaluates different aspects of the model fit. The literature recommends the chi-square statistic and degrees of freedom (χ^2/df), goodness-of-fit index (GFI), adjusted goodness of fit index (AGFI), root mean squared error of approximation (RMSEA), and standardized root mean square residual (SRMR) as absolute fit indices; comparative normed fit index (CFI) and Tucker-Lewis index (TLI) as incremental fit indices; parsimony normed fit index (PNFI) as a parsimonious fit index; and expected cross validation index (ECVI) as a predictive fit index [2,6,10,11].

In most cases, the quality of the goodness-of-fit tends to worsen with smaller sample sizes. In such cases, care should be taken when interpreting the goodness-of-fit. In addition, the quality of the goodness-of-fit tends to worsen as the number of observed variables increases. The number of observed variables can be reduced in to simply improve the goodness-of-fit. However, the purpose of the SEM analysis is to verify the hypothetical theory, not to increase the model fit. Attempts to simply increase the goodness-of-fit can lead to incorrect model setting; consequently, the model will not properly reflect reality, and the persuasive power of the researcher's argument will be lost [12].

Goodness-of-fit measures how well the researcher's model reproduces the actual phenomenon presented in the data. However, many researchers often confuse a high degree of fit with a good model. High goodness-of-fit is the most basic of the many necessary requirements for a good model, but is not a necessary and sufficient condition. The evaluation of a good model should be made comprehensively depending on the size of the coefficients, statistical significance, and coefficient of determination (R^2). Even if the goodness-of-fit is high, it is difficult to conclude that a model is good if some coefficient values are much lower than expected or if the coefficient of determination is small.

Another frequently made error arises from confusing the goodness-of-fit with the explanatory power. While the goodness-of-fit is an indication of the appropriateness of the model, the explanatory power represents the strength of the relationship between a specific endogenous variable and explanatory variables. Explanatory power is the degree to which explanatory variables explain the variations of an endogenous variable. In general, the explanatory power of individual endogenous variables in the causal model is measured by the coefficient of determination (R^2).

Model modification

There are two ways by which to modify a model. First, parameters can be added to create a more complex model. A common reason for a poor model fit is that the model is too simple to properly represent the data structure. In such cases, it is necessary to relax the constraints on the model by introducing additional path coefficients or covariances. The modification index can be used to obtain information about which parameters should be added. The criteria for a large modification index are 4 and 10 for a small and a large number of observed variables, respectively. There are cautionary notes when using the modification index: (1) The modification index only suggests a numerical direction, not parameters that need to be added to the model, which should be determined based on theories or hypotheses in the relevant field. It is not right to add parameters simply because the modification index is large. It also does not mean that the parameters should be added in the order of the large modification index values. (2) Modifying the model by adding some parameters affects the estimation and testing of others. Therefore, even if there are several large modification indices, free parameters should not be added at once.

Second, unnecessary parameters can be deleted to create a simpler model. Given that the goal of constructing a statistical model is to simplify and explain the complex data structure, a model that has not attempted to reduce the number of parameters is less valuable in terms of parsimony. The researcher should explain the structure of the data by using a simple model as far as possible. Statistical hypothesis testing results for parameter estimates can be used.

Equivalent model

A problem that researchers often overlook in the model modification stage is the existence of an equivalent model, which refers to a model that produces the same predicted covariance matrix although the established paths between variables may differ. A model that differs only in the direction of causal relationship but has the same df is likely to be an equivalent model. Figure 1 (B) shows an example of equivalent models. Since they have the same goodness-of-fit and df, the former alone cannot determine which of the models is superior to the other. In addition, there may be alternate models rather than an equivalent model that can explain the same phenomenon. Thus, there is the need to acknowledge the existence of such a model and present a theoretical or logical basis for the model selected by the researcher. A model with a similar-sized df and goodness-of-fit is likely to be an alternative model.

Kim (2015) stated that during the model modification and selection process, 9.8% and 18.0% of the nursing papers published in Korean reporting equivalent and alternative models, respectively, needed to be supplemented [1]. All SEMs must have equivalent models in which the relationship between variables with the same data values is arranged in different ways. Thus, there are bound to be several equivalent models in the model set by the researcher, who should be able to present a reasonable basis for the adoption of the chosen model.

Correlation of error variables

SEM contains several error variables. An error variable is a kind of exogenous variable that is introduced into the model as a cause of variation in the endogenous variable, which cannot be explained by the causal relationships included in the model. It is generally assumed that the error variables are independent of each other. In some cases, they can be assumed to be related to each other. The theoretical basis must be presented to explain the relationship between the error variables.

There are two types of error variables: First, measurement error variables may be attached to each observed variable, reflecting the measurement and observation errors of the latent variables corresponding the observed variables. When two observed variables are measured by similar tools, the association between the error observed variables may be established. In Figure 1 (A), when the observed variables x_2 and x_4 are measured by a measurement tool comprising similar content, there may be an association between the corresponding measurement error variables. It is not advisable to add the correlation of measurement errors only to improve the goodness-of-fit or because the modification index is large. Because the correlation of measurement errors is related to the validity of the measurement model, the reasons should be explained and the results should be interpreted and reported [5].

Second, there may be endogenous error variables attached to endogenous variables, reflecting not only exogenous variables missing from the current theoretical structure but also errors in the functional form of the constructed model. The association between endogenous error variables should be interpreted as a partial correlation between endogenous variables in a situation in which the relevant explanatory variables are controlled [5]. In Figure 1 (B)(c), the association between the two error variables indicates the relationship between endogenous variables y_1 and y_2, in the situation in which explanatory variables x_1 and x_2 are controlled. Many researchers face problems because they do not know the concept of partial correlation, neglect to search for partial correlations, or neglect to report the results.

Confirmatory factor model

When the number of observed and latent variables is large and the model has a complex structure, it is often difficult to determine which part to review first for model modification when the model's fit is poor. A good strategy in this case would be to separate the measurement model from the structural model and review them one by one.

The confirmatory factor model considers all latent variables only as exogenous variables. Thus, it refers to a model that is established with an association between all latent variables. No further increase in the goodness-of-fit can be expected in the structural model since all latent variables are associated with each other in the confirmatory factor model. Therefore, if the confirmatory factor model's goodness-of-fit is poor, the scope of model modification can be narrowed by re-examining the relationship between the latent and observed variables in the measurement model. After sufficiently modifying the problems occurring in the measurement model part, the structural model can be reset to its original state, following which the modification index can be used in to review the problems in the structural model part [9].

Although the strategy of separating the measurement and structural models for review by using the confirmatory factor model is very useful, it is not absolutely necessary. In simple models, model modification can be easily made without performing the aforementioned procedure. In addition, some theoretical models have been established with all associations or causal relationships between latent variables, so that they are equivalent to the confirmatory factor model.

Model interpretation and reporting

Here are examples and commonly recommended formats for reporting observed variables, goodness-of-fit, coefficients and mediating effect estimates in measurement models and structural models, in SEM studies.

Descriptive statistics of observed variables

In SEM, the variation and association of observed variables obtained from the given data lead to the inference of causality within the model. In general, the variation is measured by the standard deviation, while the association is measured by the correlation coefficient. Therefore, they should be reviewed in detail before a full-scale analysis.

Table 2 provides an example of the correlation coefficients and standard deviations between observed variables.

Care should be taken if the standard deviation is too large, because outliers may exist. However, if the standard deviation is too small, there may not be much information in the observed variables, therefore the reasons for this should be investigated. It is necessary to examine whether the sign and size of the correlation coefficients match the theoretical empirical expectations. If they are different from what is expected, the analysis results based on this data would not be valid. Each observed variable should have a relatively high correlation coefficient with the variable group defining the same latent variables, particularly when establishing a model with latent variables.

Tabachnick (2007) recommended looking at the size of the correlation coefficient based on the criterion of 0.3. [13]. When the correlation coefficient was ±0.3, ±0.4, and ±0.5, Hair (1995) classified the size as “minimal level,” “important,” and “practically significant,” respectively [14]. On the contrary, if the correlation coefficient is too large, it must be checked whether the absolute value is close to 1. If the correlation coefficient of the two measured variables is close to 1, it may mean that the two variables have the same meaning or information.

Evaluating the validity and reliability of the measurement of observed variables, while also reviewing the mean, standard deviation, skewness, kurtosis, and correlation coefficient, should be completed before applying SEM, otherwise errors occurring in the data will make the subsequent analysis meaningless.

Goodness-of-fit index

Researchers often report only favorable fit indices. However, the chi-square statistic (χ^2), which is the most basic fit index, should be reported along with at least one absolute fit index and one incremental fit index. When comparing two or more models, it is necessary to report parsimonious fit indices or measures based on the information criteria.

Table 3 provides examples of reporting results that mainly use fit indices. For detailed evaluation criteria, refer to [5,11].

Evaluation of the measurement model

Evaluation of the measurement model is crucial as it forms the logical basis for defining latent variables. Kim et al. (2015) pointed out that further extensive reports on the validity of the measurement model in the nursing field are necessary [1].

Table 4 depicts an example of the presentation of main results of the measurement model. Factor loadings, standardized estimates, *p*-values, and squared multiple correlations (SMC) for the measurement model are reported. If an association between measurement error variables is established, this should also be presented. For reference, SMC (R^2) in the measurement model indicates the size of the variation explained by the latent variables for a certain observed variable, and the relationship of ‘measurement error = 1-SMC’.

The convergent validity of the measurement model implies that the observed variables defining the same latent variable should have a relatively high correlation, which is evaluated by the factor loadings. There are several empirical views on the standardized estimate of the factor loadings. Generally, values of at least 0.3 and greater than 0.5 are interpreted as good, while values greater than 0.7 are interpreted as very good.

In addition, it is necessary to review and report whether there is a relatively large modification index for the measurement model part. The discriminant validity of the measurement model implies that there must be a low correlation between the observed variables defining different latent variables. Thus, a relatively large modification index for the measurement model part indicates a problem with discriminant validity.

Estimates of structural model

The researcher's main interest is generally in the structural model. Table 5 provides an example of the presentation of the main results of the structural model. Path coefficient estimates, standardized estimates, *p*-values, SMCs, etc. should be reported, as should the details of the associations between exogenous variables. In addition, it is necessary to provide information on the association between endogenous error variables, if any. In the structural model part, it is also necessary to review and report whether there is a relatively large modification index. For reference, SMC (R^2) indicates the size of the variation explained by other explanatory variables for a certain endogenous variable, which can be interpreted as the size of the explanatory power for each endogenous variable.

Mediating effects of structural model

One of the important features of the path analysis model or the SEM, unlike the general statistical model, is that mediating variables can be introduced. It is necessary to report the direct, indirect, and total effects of the mediating variables. Table 6 presents the standardized estimates in parentheses, along with the size of the effect, as an example of presenting the main results for mediating effects.

The Sobel test and bootstrapping are mainly used as statistical tests for mediating effects. However, the methods may differ slightly depending on the software used. Recently, an increasing number of studies have used the bootstrapping method since several software programs provide this feature.

Conclusion

The concept of SEM encompasses a very wide spectrum of models, including the measurement, regression, path analysis, and factor models. Therefore, researchers are required to have a considerable level of statistical knowledge in order to understand and perform SEM properly. However, it is not easy to understand such concepts clearly. This paper aimed to not only provide a guide to help researchers in their research with SEM, but also address possible problems in the actual data analysis process and provide precautions. We recommend that researchers use the suggested a checklist in the future to improve the reporting and research quality of SEM studies. Researchers should be able to answer “yes” to all of the items on Table 1.

Conflict of interest

The authors declared no conflicts of interest to disclose.

Topic	Item	Guide questions
Model setting	1	Measurement of observed variables–Are the observed variables measured by a valid and reliable measurement tool?
2	Measurement model setting-Do observed variables represent each latent variable?-Do the observed variables that define each latent variable measure the same concept?-Is each latent variable defined to represent a single concept (or meaning)?-Can the sizes of the latent variables be compared? Or, is it possible to compare the size of the measurements of the latent variable? Or, can you tell the size (large/small) of each latent variable?	3

Structural model setting-Are there any missing causal relationships or associations between latent variables?-Are causal relationships or associations between latent variables based on theory and empirical facts or results?	Evaluation and modification of the model	4
Do most GFIs show reasonable fitness?	5	Have all the relatively large modification indices been considered?
6	Has the parsimony of the model been pursued?	7
Have the equivalent and alternative models been considered?	8	Has the relationship between measurement and endogenous error variables been reviewed?
Interpretation and reporting of the model	9	Have all the descriptive statistics and correlation coefficients of the observed variables been reviewed?
10	Have major GFIs been reported?	11
Have the main results of the measurement model been presented appropriately?	12	Were the main results for the structural model adequately presented?

	x1	x2	x3	x4	x5	y1	y2	y3
x1	1							
x2	.43*	1						
x3	.34*	.29*	1					
x4	.25*	.35*	.62*	1				

x5	−.39*	−.41*	−.33*	−.28*	1			
y1	.18*	.22*	.63*	.51*	−.28*	1		
y2	.38*	.35*	.48*	.39*	−.18*	.46*	1	
y3	.23*	.25*	.51*	.40*	−.09*	.48*	.66*	1
S.D.	.99	.93	1.08	1.08	1.84	1.02	1.77	1.53

Model	χ^2	df	GFI	AGFI	RMSEA	SRMR	CFI	TLI	PNFI	ECVI
Hypothetical model	24.5	3	.917	.587	.204	.103	.862	.586	.284	.246
Modified model1	2.0	2	.992	.943	.000	.028	1.000	1.000	.220	.127
Modified model 2	2.2	3	.995	.975	.000	.033	1.000	1.000	.329	.151

A. Estimates of loadings	Latent variables	Measurement variables	Loadings	Standardized estimates	p-value
SMC	Motivation	x1	1.00	0.61	–
0.37		x2	0.98	0.58	<.001
0.34	Self-esteem	x3	1.00	0.89	–
0.80		x4	0.78	0.71	<.001
0.50	Verbal ability	x5	1.00	0.92	–
0.85	Performance	y1	1.00	1.00	–
1.00	Satisfaction	y2	1.00	0.79	–
0.62		y3	0.93	0.84	<.001

A. Regression weights	Endogenous variables	Exploratory variables	Estimate	Standardized estimates	p-value
SMC	Performance	Self-esteem	0.74	0.70	<.001
0.49	Satisfaction	Motivation	2.55	1.10	<.001
0.62		Verbal ability	0.61	0.74	<.001
0.71		Performance	0.44	0.32	.019

Endogenous variables	Exploratory variables	Direct effects	Indirect effects	Total effects
Performance	Self-esteem	0.74 (0.70)*	–	0.74 (0.70)*
Satisfaction	Motivation	2.55 (1.10)*	–	2.55 (1.10)*
	Self-esteem	–	0.32 (0.22)*	0.32 (0.22)*
	Verbal ability	0.61 (0.74)*	–	0.61 (0.74)*
	Performance	0.44 (0.32)*	–	0.44 (0.32)*

DETAILS

Subject: Variables; Data analysis; Research methodology; Validity; Hypotheses; Structural equation modeling

Identifier / keyword: Factor analysis; Goodness of fit index; Latent variable; Measurement model; Structural equation model; Structural model

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Effects of Virtual Reality Simulation Program Regarding High-risk Neonatal Infection Control on Nursing Students

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ABSTRACT (ENGLISH)

Purpose

Virtual reality simulation can give nursing students a safe clinical experience involving high-risk infants where access to neonatal intensive care units is limited. This study aimed to examine the effects of a virtual reality simulation program on Korean nursing students’ knowledge, performance self-efficacy and learner satisfaction.

Methods

A nonequivalent control group design was applied. Senior nursing students were divided into an experimental group (n = 25) experiencing virtual reality simulation and routine neonatal intensive care unit practice and a control group (n = 25) having routine neonatal intensive care unit practice. The program consisted of three scenarios: basic care, feeding management and skin care and environmental management for prevention of neonatal infection. The total execution time for the three scenarios was 40 minutes. The simulation created immersive virtual reality experiences using a head-mounted display with hand-tracking technology. Data were collected from December 9, 2019, to January 17, 2020, and were analyzed using descriptive statistics and the t-test, paired t-tests, Mann-Whitney test and Wilcoxon signed-ranks test.

Results

Compared to the control group, the experimental group showed significantly greater improvements in high-risk neonatal infection control performance self-efficacy (t = −2.16, *p* = .018) and learner satisfaction (t = −5.59, *p* < .001).

Conclusion

The virtual reality simulation program can expand the nursing students’ practice experience in safe virtual spaces and enhance their performance self-efficacy and learning satisfaction.

FULL TEXT

Introduction

The goal of practical clinical education in nursing is to improve the clinical abilities of nursing students by giving them first-hand experience in applying their skills to patients under complex, real-world conditions. However, South Korea lacks legal protections against liability for nursing students’ actions, and the health rights of medical consumers and the importance of patient safety management must be considered [1]. Thus, students’ practical training focuses more on observation and ancillary tasks than on direct skill application to patients, and many obstacles must be overcome to enhance students’ clinical practice abilities. In compensating for these constraints, several forms of simulation education have been developed. These include use of the following scenarios: peer-to-peer learning; partial task trainer models; standardized and simulated patients; computerized task trainers and mannequins; screen-based computer simulations; and more recently, virtual reality (VR) and haptic systems [2,3]. Simulation involves mimicking the reality of clinical environments to demonstrate procedures to students and develop their decision-making and critical thinking skills; specific simulation techniques include role-playing and the use of devices, such as interactive videos or mannequins [4]. Among the simulation learning methods introduced within the past few years, VR simulation involves the creation of an artificial environment experienced through sensory stimuli (such as sights and sounds) provided by a computer, and with high-level VR simulation, the user's actions partially determine changes in the environment [5,6].

Although existing high-fidelity simulations have been proven effective, the VR approach is a user-oriented learning method that is not restricted by limited faculty preparation time, staff or schedules and that allows students to practice clinical techniques in a safe environment [3]. Furthermore, VR simulation is a practical means of circumventing the restrictions imposed by the Coronavirus disease 2019 (COVID-19) pandemic on face-to-face interaction or clinical education and practice in hospitals. Therefore, VR simulation may prove beneficial in circumstances where student access to mannequin-based training or clinical practice is limited [7].

In the neonatal intensive care unit (NICU) setting, providing nursing students with practical clinical education is particularly challenging due to the restrictions on their activities in that environment. Nonetheless, nursing students require extensive practical training for this environment, particularly in the domain of infection control. All newborn infants are prone to nosocomial infections because of their intrinsic susceptibility to infection and the invasive procedures they are subjected to. This is particularly the case for infants born prematurely or with low birth weight [8, 9]. Therefore, infection control is the most important issue in caring for infants during their first week after birth, when their immunity is limited, and protecting infants from infection is a major responsibility of the nurses who care for them [10]. Therefore, to prepare for clinical practice in the NICU, nursing students require thorough and accurate training in neonatal infection management. However, particularly in South Korea, the number of hospitals that have reduced NICU access for students is increasing due to rising rates of premature birth and stricter management policies [11,12]. Due to the infection-related deaths of four infants in a NICU in South Korea in 2017, institutional policies for infection control have grown stricter, and thus, nursing students' ability to develop their clinical skills and gain practice experience with newborns in NICUs is severely limited.

Previous studies have reported on the positive effects of simulation education on nursing and other students' confidence, decision-making ability, communication skills and clinical judgment [2,13–15]; clinical knowledge and performance [16,17]; and self-efficacy or self-confidence, as well as ability to manage anxiety and stress [18]. Insofar as VR simulation is a new learning method, however, the literature around it is limited [5]. According to a recent systematic review of VR simulation programs in nursing education [19], VR studies for nursing students have been conducted in the United States, Canada, Israel, Kuwait and South Korea. These involved VR skill training for urinary catheterization and phlebotomy [20–22], children's postoperative care and medication administration using virtual gaming simulation [23,24], and an intravenous simulator incorporating VR and a haptics device [25]. Furthermore, Williams et al. [3] studied a VR program addressing neonatal resuscitation for midwifery students in Australia. However, no studies that we are aware of have yet examined the effectiveness of a VR simulation program for infection control in the NICU.

Therefore, the objective of this study was to apply a VR simulation program for high-risk neonatal infection control (HirNIC) to evaluate its effects on nursing students' knowledge of neonatal infection control, self-efficacy for infection control performance, and satisfaction with the learning process. The study hypotheses were as follows:**Hypothesis 1**

Participants experiencing the VR simulation program (experimental group) will have a higher level of HirNIC knowledge than the control group who only participated in clinical practice in a NICU (control group).

Hypothesis 2

The experimental group will have a higher level of self-efficacy for infection control performance than the control group.

Hypothesis 3

The experimental group will have a higher level of learner satisfaction than the control group.

Methods Study design

This study used a nonequivalent control group design to evaluate the effectiveness of a HirNIC VR simulation program.

Sample and setting

The target population was Korean senior nursing students, and the study was conducted at a nursing college in J city, Korea. The sample size was calculated using a t-test (one-tailed) and the G * power 3.1 program [26]. Considering that the effect sizes in two previous studies of a similar nature [1,27] were 0.40 and 0.80, we employed a significance level of .05, a power of 0.85, and an effect size of 0.80 for the calculation. A sample size of 48 participants was calculated to be sufficient for this study. In accounting for a potential dropout rate of approximately 5%, 51 participants were recruited from a cohort of 71 senior nursing students by means of convenience sampling.

Procedure Framework for simulation education

The conceptual framework for the simulation program was based on the National League for Nursing (NLN)/Jeffries Simulation Framework [28]. This model identifies five essential concepts of simulation design that support desired student outcomes, including (a) teacher, (b) student, (c) educational practices, (d) simulation design characteristics and (e) outcomes. The central proposition of this model is that student outcomes are influenced by the incorporation of best education practices into the design and implementation of the simulation experience. Furthermore, the model posits that learning depends on the teacher and student interactions, expectations and roles; hence, when the model's teacher, student and educational practices concept variables are considered in simulation design, student satisfaction and performance improve [4]. In the current study, the "teacher" developed a HirNIC VR simulation program based on her more than 10 years of simulation education experience and her clinical practice career in the NICU environment; the teacher then served as facilitator and evaluator during program operation and provided feedback to students. Each "student" was a senior nearing graduation, and the "educational practices" included 4 hours of lecture on neonatal infection control and 45 hours of clinical practice in the NICU. The "simulation design characteristics" included the HirNIC VR simulation consisting of three scenarios and a short prebriefing and debriefing before and after the scenarios. The "outcomes" included HirNIC knowledge, HirNIC performance self-efficacy and learner satisfaction (see Figure 1).

VR simulation program application

The HirNIC VR simulation program employed in this study was developed by Yu and Mann [29]. It consisted of three scenarios representing basic nursing situations related to infection control—basic care, feeding management and skin care and environmental management—that could be easily understood by nursing students (see Table 1). The program user has to perform enteric precautions, skin care, proper disposal of waste (including the gown and soiled diaper) and incubator disinfection following contact precaution guidelines.

The VR program, with its three scenarios, was produced using VR simulation program software developed by SAMWOOimmersion Co., Ltd., of South Korea. The program employed a Vive Pro Full-Kit Head Mounted Display and sensor (HTC VIVETM, USA), a Leap Motion Controller™ (Ultraleap, USA) hand-tracking device with a VR Developer Mount, and a VR kit containing an EliteDesk 800 G4 laptop computer. In the program, the user wearing the HMD enters the VR world and performs the applicable nursing procedures. The controller attached to the HMD is capable of tracking the user's hands within a 3D interactive zone. The user experiences the three VR scenarios consecutively on a single day, and the total execution time is 40 minutes.

During the study, the student participants received a team-based, 30-minute prebriefing, which included an introduction to the scenarios and use of VR before completing the scenarios. They also received a 20-minute debriefing after scenario completion.

Instruments and measures General characteristics

Information on students' gender, age and previous semester grade was collected using a questionnaire created by the first author.

HirNIC knowledge

Student knowledge regarding HirNIC was assessed using the High-Risk Neonatal Infection Control Competency Scale Knowledge (HirNICCS_K) developed by Yu et al. [30]. The HirNICCS_K consists of five subdomains: basic care, skin care, feeding management, medication and invasive procedure management, and environmental management. In this study, we condensed this scale to include 10 items for basic care, 8 items for feeding management and 10 items for skin care and environmental management according to the scenario topics. The possible item responses were "Yes," "No," and "I don't know. " Each correct answer received 1 point, while incorrect answers received 0 points. The total possible score was 28 points, including 10 points for basic care, 8 points for feeding management and 10 points for skin care and environmental management; the higher the total score, the higher the knowledge level. The reliability for the overall scale was KR-20 = .67 in a previous study [30] and .61 in this study.

HirNIC performance self-efficacy

In the education context, self-efficacy refers to “perceived capabilities for learning or performing behaviors in designated levels” [31]. HirNIC performance self-efficacy was assessed using a modified version of a self-efficacy measure employed in a previous nursing student simulation study [32]; the instrument was modified based on the High-Risk Neonatal Infection Control Competency Scale_Performance by Yu et al. (2020) [30]. The original instrument consisted of 17 items addressing self-confidence in caring for patients with gastrointestinal bleeding or acute myocardial infarction. The HirNIC performance self-efficacy scale consisted of 21 items covering three domains: basic care (7 items), feeding management (9 items) and skin care and environmental management (5 items). Each item was rated on a 10-point scale ranging from 0 = “not confident at all” to 10 = “maximum confidence,” with higher scores indicating higher levels of confidence. As to reliability, the original instrument showed a Cronbach’s α of .91 in the previous study [32]. In the present study, the modified instrument had a Cronbach’s α of .96, and the Cronbach’s α values for the basic care, feeding management, and skin care and environmental management domains were .89, .93 and .89, respectively.

Learner satisfaction

Learner satisfaction was measured using three items developed by Cho [33] to examine nursing students’ satisfaction with a root cause analysis education program intended to improve patient safety competencies and modified by the researcher. In the present study, the first item differed for the experimental and control groups: for the experimental group, it was The HirNIC VR simulation program after clinical practice will help me work as a nurse in clinical practice, and for the control group, it was Clinical practice in the NICU will help me work as a nurse in clinical practice.” The second and third items were I want to recommend this program to other nursing students and I think this training is necessary as part of the nursing college curriculum. Each item was rated on a five-point Likert scale ranging from “very unsatisfied” (1 point) to “very satisfied” (5 point). Higher total scores indicated higher levels of satisfaction. The Cronbach’s α for this instrument was .81 in Cho’s study [33] and was .81 in the present study.

Data collection

Data were collected from December 9, 2019, to January 17, 2020. Under the study inclusion criteria, study participants had to be senior nursing students with prior clinical experience and prior high-fidelity simulation training who were willing to volunteer to participate. The 51 participants were divided into six teams, each containing 8 or 9 participants, based on their clinical practice schedules. The three teams that first had clinical practice in the NICU were assigned to the control group, and the next three teams to have clinical practice were assigned to the experimental group. Finally, a total of 25 participants were in the control group and 26 in the experimental group. For both groups, a pretest was administered after lectures related to neonatal infection control. For preventing diffusion of the experiment, the posttest for the control group was administered first, after they completed routine clinical practice in a NICU. After data collection for the control group was completed, the experimental group was enrolled in the VR simulation program performed in the simulation lab, and posttest data were collected immediately after the intervention. The control and experimental groups experienced the same lectures and performed their clinical practice in the NICU. All but one participant completed the study; the single exception in the experimental group did not submit the posttest.

Data analysis

Data were analyzed using the SPSS Statistics 25.0 program (IBM Corp., Armonk, NY, USA). Participants’ general characteristics, HirNIC knowledge and HirNIC performance self-efficacy were analyzed using frequencies, percentages, means and standard deviations. A Chi-square test, independent t-test and Mann-Whitney test were used to verify pretest homogeneity between the two groups. A Shapiro-Wilk test was performed to ensure normal distributions of knowledge and performance self-efficacy data. A paired t-test and Wilcoxon signed-ranks test were used to determine differences in HirNIC performance self-efficacy and HirNIC knowledge between the pretest and posttest within the groups. For determining differences between the groups, an independent t-test was used for HirNIC performance self-efficacy and learner satisfaction, and a Mann-Whitney test was used for HirNIC knowledge.

Ethical considerations

This study was approved by the institutional review board (IRB) of the researcher's university (Approval no. GIRB-A19-Y0077). The participants were provided with a thorough explanation of the study's purpose and procedures and were informed that they could refuse to participate without any impact on their grades. Each participant then provided written informed consent. Additionally, participants were informed that the research data would be used only for the stated research purpose, would be coded to ensure their confidentiality and anonymity, and would be disposed of after completion of the study. A research assistant distributed and collected the presurvey and postsurveys, which took participants 10 to 15 minutes to complete, and after data collection, each participant was compensated with a gift card worth about 10 USD. The collected data were encrypted using an identification code, and all data were stored in a locked cabinet. The data will be stored for no more than 3 years and will then be securely disposed off.

Results General characteristics and homogeneity of study variables

Through homogeneity tests for gender, age and previous semester grade, HirNIC knowledge and performance self-efficacy of the experimental and control groups were determined to be homogeneous ($^{\text{Table 2}}$).

Virtual reality simulation program effects

$^{\text{Table 3}}$ shows the results of the effect verification tests for the HirNIC VR simulation program.

Hypothesis 1

There was no significant difference between the experimental and control groups (U =272.00, *p* = .213) in terms of HirNIC knowledge. Furthermore, there were no significant differences between the groups in the three subdomains of HirNIC knowledge, namely basic care (U =292.50, *p* = .335), feeding management (U =311.00, *p* = .488), and skin care and environmental management (U =271.50, *p* = .205). Therefore, $^{\text{Hypothesis 1}}$ was rejected.

Hypothesis 2

Based on the pretest and posttest results, HirNIC performance self-efficacy significantly increased in both the experimental (t = 10.03, *p* p p = .018). In the domains of basic care (t = –2.73, *p* = .005) and skin care and environmental management (t = –2.28, *p* = .013), the experimental group had significantly higher self-efficacy scores than the control group. The experimental group also showed a higher score in the feeding management domain, but the difference from the control group was not significant (t = –1.28, *p* = .103). Therefore, $^{\text{Hypothesis 2}}$ was partially accepted.

Hypothesis 3

The experimental group showed a significantly higher learner satisfaction score (4.79 ± 0.35 points) than the control group (4.13 ± 0.47 points) (t = –5.59, *p* Hypothesis 3 was accepted.

Discussion

In all healthcare settings, the infection control practices used during patient care are intended to prevent and control the transmission of microorganisms. Particularly in an environment such as the NICU, pathogenic organisms can easily spread. This study applied a VR simulation program that we designed to help nursing students learn infection control processes, as well as to compensate for the inadequate clinical experience they receive due to practical restrictions placed on nursing students in the NICU.

In simulation teaching methods, role-playing and simulation using a mannequin have the disadvantage that the content delivered depends on the instructor's teaching methods and can vary with each learning session [[5],[34]]. In addition, long operating hours and preparation times are required for each session, so more team than individual training often occurs, offering fewer opportunities for students to practice their skills. Compared to screen-based virtual simulation programs such as SecondLife and vSim, the HirNIC VR program applied in this study provides a more immersive virtual experience using the HMD and mobilizes vision, hearing and touch in ways similar to reality. Furthermore, this form of simulation allows the repeated practice of techniques without being greatly affected by the instructor’s time limitations and teaching methods.

The results of the study showed that nursing students’ performance self-efficacy regarding infection control and their satisfaction with the program increased significantly after participating in the HirNIC VR simulation program. However, no significant difference was observed between the experimental and control groups in terms of HirNIC knowledge.

During the application of our VR simulation program, performance self-efficacy levels in the experimental group increased significantly, from a mean score of 5.36 to 8.57 (of 10), and this increase was greater than that observed in the control group. In particular, the experimental group’s mean scores for basic care and skin care, and environmental management increased significantly. These results are similar to those of three previous studies of a high-fidelity patient simulation’s effect on nurses’ self-efficacy [35] and a computer (or screen)-based resuscitation simulation’s effects on nursing students’ self-efficacy [36,37]. Another previous study [23] examined a Canadian VR program related to child care after appendectomies and also observed increased self-efficacy in nursing students due to the program. We know that simulation as a learning method improves cognitive, emotional and psychological abilities in a safe and realistic environment by forming a bridge between theoretical knowledge and practical skills [38]. In particular, the theoretical core of simulation learning is that learning takes place through experience, and thus, simulation helps students to think like nurses by giving them experiences similar to real-life clinical conditions. As this approach allows nursing students to acquire theoretical and practical knowledge while also verifying and integrating previous learning experiences [39], it is not surprising that simulation employing a VR environment increased nursing students’ performance self-efficacy.

The experimental group’s satisfaction with the HirNIC VR program was much higher than the learner satisfaction exhibited by the control group. This result is supported by previous studies. For example, the learning satisfaction of new nurses participating in high-fidelity simulation-based high-risk neonatal care education was higher than that of a nonsimulation group [40]. In another study, participation in a computer-based resuscitation simulation was a significant predictor of learner satisfaction in an emergency nursing clinical course [41]. In the present study, the control group’s satisfaction level after practice averaged 4.13 points (of 5), while the experimental group had an average satisfaction score of 4.79, a significant difference. In particular, among the items, the mean score for “It helped to acquire infection control capability” was 4.04 in the control group and 4.76 in the experimental group. For the item “I want to recommend it to others,” the control group’s mean score was 4.08 points compared to the experimental group’s 4.88 points. Clearly, students who received only clinical practice in the NICU were less satisfied as learners than those in the experimental group, who had the opportunity to further practice their techniques through the VR simulation. In the debriefing following the VR simulation program, students described the program as “fun” and helpful in allowing them to practice nursing skills that they were denied to opportunity to use in the NICU. Many also asserted that other students should experience this program too.

Importantly, however, our posttest results showed no significant difference in HirNIC knowledge between the two groups, although both groups did show a slight increase. This finding differs from Verkuyl et al.‘s [23] study results, which indicated a significant difference in the knowledge of nursing students after the application of a screen-based virtual gaming program. Moreover, Dubovi et al. [24] found that their experimental group’s medication knowledge increased after the application of a screen-based VR program. However, Verkuyl et al. [23] used only posttest measures, while Dubovi et al. [24] employed only a single group of nursing students who used a nonimmersive, screen-based virtual simulation program instead of receiving a full VR experience. Therefore, it is difficult to directly compare the results of those studies with our own. Nevertheless, no significant differences in posttest HirNIC knowledge were visible between our two groups, presumably because both had increased their knowledge through basic clinical practice. Additionally, the debriefing time provided after the VR simulation program may have been inadequate. Debriefing is an important component of the learning process, and it has been found to reduce the learning gap between observers and participants [42]. Therefore, in employing the VR simulation program, it will be necessary to allocate more time for debriefing so that learners can discuss their experiences and further expand their knowledge.

Although nursing knowledge is essential, it alone cannot improve novice nurses' or nursing students' competence. It has to be reinforced by the practice of requisite procedures. Few studies have directly compared clinical practice in the NICU environment to simulation in terms of skill performance. However, considering that simulation observation and effective debriefing have shown benefits similar to scenario participation [42], it is reasonable to assume that nursing students would benefit from closely observing nurses' behavior in clinical practice and engaging in self-reflection similar to a debriefing afterward.

The VR simulation program applied in our study offered nursing students repeated practice in performing such procedures. As nurses play a major role in infection control in all intensive care settings, practical educational programs rooted in simulation theory and nursing knowledge are needed to ensure control of infection and reduce morbidity and mortality in neonates cared for in the NICU [43]. Therefore, in addition to knowledge transfer, VR simulation technology should be exploited to support the accurate application of knowledge related to infection control.

Implications and Limitations

This study has significant implications for nursing education and nursing theory. First, it is noteworthy that our VR simulation program was the first to be applied to neonatal infection management. With the growing popularity of VR simulation, it is inevitable that this technology will become more prominent in neonatal health education, training and research [3], particularly at a time when the COVID-19 pandemic makes in-person instruction problematic. Second, our study was guided by the NLN/Jeffries Simulation Framework, and Lafond and Van Hulle Vincent [44] pointed out that rigorous research is needed to test the relationships among this model's concepts and the associated concept variables. Given that the validation of the concepts of a theory is empirically important to the overall development of nursing theory, this study is also significant in its application and partial verification of the NLN/Jeffries Simulation Framework within nursing education; that is, this study confirmed that VR simulation program can improve learners' self-efficacy, knowledge and satisfaction to a degree similar to other simulations.

This study's limitations should be noted. First, within the NLN/Jeffries Simulation Framework, the effectiveness of learning is posited to be dependent on teacher-student interactions. During VR simulation, however, students solve problems and practice skills without direct interaction with the instructor. Hence, there are some limitations in applying the concept of teacher-student interactions in VR programs. However, in our approach, the prebriefing and debriefing do provide opportunities for instructor-student discussion of questions and observations associated with the simulation scenarios; hence, teacher-student interactions are, in fact, present. Second, the debriefing after the VR simulation was limited to a single 20-minute session addressing all three scenarios. This limited timeframe for sharing of knowledge without repetitive practice may have affected study findings. Third, as the study only involved nursing students at one university, the results may differ with other groups of VR simulation program users. Finally, due to time constraints imposed by the university schedule, the VR simulation program could not be implemented with the control group, which could be considered an ethical limitation.

Conclusion

This study implemented a VR simulation program among nursing students that focused on high-risk neonatal infection control, and we observed improvements in students' performance self-efficacy, as well as greater learner satisfaction compared to nonusers of the program. We demonstrated that VR simulation can help nursing students learn how to solve problems in virtual situations that mimic the real world and can expand their practice of skills in a realistic environment. We also showed that VR simulation facilitates repetitive learning by minimizing environmental constraints such as instructor capacity. In the future, studies will undoubtedly continue to confirm various benefits of VR simulation programs in comparison to traditional simulations. However, one area of need is to develop VR simulation programs and scenarios that build problem-solving skills by means of communication and cooperation between multiple learners in the same virtual space.

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Conflict of interest

The author declared no conflicts of interest.

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Procedure	Topic/Scenario	Contents and Situation	Time expended (minutes)
Prebriefing	Introduction of scenarios	Simulation scenarios are briefly explained, including learning objectives and principles of high-risk neonatal care and infection control.	20
Use of VR and precautions	The simulation lab environment is overviewed, including use of VR equipment such as the HMD and Leap Motion Controller, as well as disposable eye masks for the headset to prevent cross-contamination.	10	VR Simulation
Basic care	A premature infant (34 weeks, 2,750 grams) is transferred from the delivery room to the neonatal intensive care unit. For preventing neonatal infection, initial nursing care is performed.	10	Feeding manageme nt

A premature infant (30 weeks, 1,250 grams) needs to breastfeed through a gastric tube. Frozen breastmilk preparation, gastric tube feeding and actions to prevent aspiration are performed.	15	Skin care and environmental management	A full-term newborn (3,010 grams) with diarrhea is transferred from another hospital due to rotavirus infection and diarrhea. The baby is isolated in an incubator. Enteric precautions, skincare, waste disposal and environmental disinfection are performed according to contact precaution guidelines.
15	Debriefing	Discussion	Students reflect on the simulation experience and exchange feedback with the instructor.

Characteristics	Categories	Total n(%)	Group		$t/\chi^2/U$	p
Control group (n = 25)	Experimental group (n = 25)	Gender	Women	46(92.0)	23(92.0)	23(92.0)
—	>.999	Men	4(8.0)	2(8.0)	2(8.0)	—
—	Age (years)	21–22	31(62.0)	14(56.0)	17(68.0)	0.76
.329	23–25	19(38.0)	11(44.0)	8(32.0)		
Mean ± SD	22.40 ± 1.05	22.36 ± 1.22	22.44 ± .87	−0.27	.791	Previous semester grade[a]
Under 3.0	3(6.0)	1(4.0)	2(8.0)	0.48	>.999	3.0–4.0
33(66.0)	17(68.0)	16(64.0)	—	—	Over 4.0	14(28.0)
7(28.0)	7(28.0)	—	—	HirNIC Knowledge†	Basic care	8.58 ± 1.11
8.40 ± 1.32	8.76 ± 0.83	275.00	.217	Feeding management	7.64 ± 1.48	7.36 ± 1.66
7.92 ± 1.26	261.00	.153	Skin care and environmental management	6.44 ± 1.28	6.48 ± 1.36	6.40 ± 1.22
291.50	.337	Overall	22.42 ± 2.84	22.05 ± 3.31	22.79 ± 2.28	284.00
.288	HirNIC performance self-efficacy	Basic care	5.03 ± 1.60	5.19 ± 1.56	4.86 ± 1.65	0.72

.239	Feeding management	5.32 ± 1.67	5.30 ± 1.54	5.33 ± 1.83	−0.06	.478
Skin care and environmental management	6.13 ± 1.70	6.15 ± 1.54	6.10 ± 1.88	0.10	.461	Overall

Variables	Categories	Group	Pretest	Posttest	Difference between time		Program effect	
Mean ± SD	Mean ± SD	t/z	p	t/U	p	HirNIC knowledge[a]	Basic care	Cont.
8.40 ± 1.32	8.84 ± 0.90	−1.43	.076	292.50	.335	Exp.	8.76 ± 0.83	8.84 ± 0.99
−0.58	.282	—	Feeding management	Cont.	7.36 ± 1.66	8.28 ± 1.46	−2.28	.011

311.00	.488	Exp.	7.92 ± 1.26	8.72 ± 1.10	−2.12	.017	—	Skin care and environmental management
Cont.	6.48 ± 1.36	6.36 ± 0.70	−0.81	.208	271.50	.205	Exp.	6.40 ± 1.22
6.40 ± 1.04	−0.08	.467	—	Overall	Cont.	22.05 ± 3.31	23.29 ± 1.92	−2.12
.017	272.00	.213	Exp.	22.79 ± 2.28	23.44 ± 2.15	−1.45	.074	—

HirNIC performance self-efficacy	Basic care	Cont.	5.19 ± 1.56	7.46 ± 1.34	7.91	<.001	−2.73	.005
Exp.	4.86 ± 1.65	8.36 ± 1.05	10.05	<.001	Feeding management	Cont.	5.30 ± 1.54	7.71 ± 1.54
7.17	<.001	−1.28	.103	Exp.	5.33 ± 1.83	8.35 ± 1.21	8.87	<.001
Skin care and environmental management	Cont.	6.15 ± 1.54	8.12 ± 1.56	5.62	<.001	−2.28	.013	Exp.
6.10 ± 1.88	9.24 ± 0.88	8.35	<.001	Overall	Cont.	5.47 ± 1.47	7.72 ± 1.37	7.48
<.001	−2.16	.018	Exp.	5.36 ± 1.68	8.57 ± 0.98	10.03	<.001	Learner satisfaction
This program will help me work as a nurse in clinical practice	Cont.	—	4.04 ± 0.45	—	—	−5.12	<.001	Exp.

—	4.76 ± 0.44	—	—	This training is necessary as part of the nursing college curriculum	Cont.	—	4.28 ± 0.74	—

—	−2.54	.008	Exp.	—	4.72 ± 0.46	—	—	I want to recommend this program to other nursing students
Cont.	—	4.08 ± 0.57	—	—	−6.05	<.001	Exp.	—
4.88 ± 0.33	—	—	Overall	Cont.	—	4.13 ± 0.47	—	—

DETAILS

Subject:	Simulation; Students; Nursing education; Teaching methods; Clinical medicine; Hypotheses; Training; Premature birth; Nosocomial infections; Knowledge; Skin care; Decision making; Environmental management; Performance evaluation; Coronaviruses; Virtual reality; Learning; Disease control; COVID-19; Skills; Newborn babies
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Document 10 of 29

Evaluation of a Mobile-based Maternal Feeding Education Program for Overweight Prevention in Infants

Ra, Jin Suk

ProQuest document link

ABSTRACT (ENGLISH)

SUMMARYPurpose

The purpose of this study was to evaluate a mobile-based maternal feeding education program for overweight prevention in infants based on breastfeeding attitude, breastfeeding self-efficacy, breastfeeding duration, recognition of hunger and satiety cues of infants, and knowledge regarding providing solids foods.

Methods

A nonequivalent control group pretest-posttest design was used for the study. Participants included 15 primiparas in the experimental group and 14 primiparas in the control group in all the follow-up tests. Using self-reported questionnaires in electronic format, data were collected four times (before the intervention, 1 month after childbirth, 3 months after childbirth, and 6 months after childbirth). Using SPSS 24 version, independent *t*-test and repeated-measures analysis of variance were used to test the effects of the mobile-based maternal feeding education program.

Results

The experimental group showed significantly more positive breastfeeding attitude ($F = 5.28$, $p = .008$), higher breastfeeding self-efficacy ($F = 3.50$, $p = .041$), and increased breastfeeding duration ($t = -2.09$, $p = .046$) than the control group. In addition, the experimental group showed significantly improved knowledge regarding providing solid foods to the infants ($F = 4.86$, $p = .009$) in comparison with the control group. However, for education on recognizing hunger and satiety cues of infants, the mobile-based maternal feeding education program was not effective ($F = 0.23$, $p = .878$).

Conclusion

According to the results of this study, the mobile-based maternal feeding education program has the potential to contribute to overweight prevention in infants.

FULL TEXT

Introduction

Infancy is a developmental stage when the formation of feeding patterns and eating habits causing overweight in childhood [1]. In this regard, rapid weight gain might easily develop in infancy, and rapid weight gain during infancy is significantly associated with the development of overweight and obesity in childhood after infancy [2]. In previous studies, overweight infants had 3.1-fold and 17.5-fold increased likelihood of overweight and obesity in preschool age and adolescence, respectively [3,4]. Therefore, infancy was considered to be a critical period for the early prevention of overweight and obesity in children [5]. In particular, as overweight in infancy resulted from excessive energy intake and overnutrition via feeding [5], Cloutier et al. [6] emphasized the need for a maternal feeding education program for overweight prevention in infancy.

According to a model for the development of an early childhood obesity prevention program, the maternal feeding education program for the prevention of excessive weight gain in infants might increase the maternal positive attitude and self-efficacy in breastfeeding and providing food to the infants by helping recognize and respond sensitively to the hunger and satiety cues of the infants [6]. Infantile feeding and eating patterns for the prevention of excessive weight gain were formed on the basis of the maternal feeding behaviors [6]. In existing family-based and parental programs for overweight prevention of infants, educational content has mainly focused on improving positive breastfeeding attitudes, breastfeeding self-efficacy, sensitivity to recognize hunger and satiety cues of infants, and knowledge about the correct solid foods to be given to infants [7–10]. Therefore, as an early life intervention for the prevention of overweight in infants, maternal feeding education programs should focus on addressing the key factors responsible for the formation of maternal feeding patterns.

According to previous studies, the maternal feeding education programs for the prevention of excessive weight gain of infants were mainly provided by postpartum home visits and face-to-face meetings [8–10]. However, in the Korean health care system, a postpartum home visiting program is not provided for parenting education and health care of mothers and their infants. In addition, Korean mothers traditionally limit contact with other people for approximately 3 months postpartum. Therefore, maternal education based on a home visiting program and face-to-face meetings might be inappropriate intervention strategies during postpartum periods in Korean society.

However, mobile-based parental education programs have been actively developed because most Korean people use smartphones [11,12]. Mobile websites might contain various educational contents, such as pictures, figures, and videos required for modeling a parental education program [13]. The success rates and satisfaction levels with the online education programs were high because of the availability of repeated learning and practice by frequently using mobile websites [13]. In addition, for mothers with newborns who cannot receive education at a fixed place and time [14], mobile-based education programs can prove to be highly user friendly, helping the mothers receive education at a place and time convenient for them.

Therefore, the purpose of this study was the development and evaluation of a mobile-based maternal feeding education program for the prevention of overweight in infants. We proposed the following hypothesis. The mothers who participated in the intervention would have an increased (1) positive breastfeeding attitude, (2) breastfeeding self-efficacy, (3) breastfeeding duration, (4) sensitivity to recognize hunger and satiety cues of their infants, and (5) knowledge regarding providing solid foods for overweight prevention in infants.

Methods Study design

A nonequivalent control group pretest-posttest design was used to test the effects of the mobile-based maternal feeding education program for overweight prevention in infants.

Participants

The participants of the study were first-time pregnant mothers with more than 36 weeks gestational age, recruited from two different obstetrics and gynecology clinics located in Daejeon (metro city), South Korea. We used a convenience sampling method to select the clinics and participants. From each of the clinics, participants for the experimental and control groups were selected according to the inclusion and exclusion criteria. The inclusion criteria were as follows: (1) mothers who gave consent to participate, (2) mothers who were primary caregivers of their infants, and (3) mothers of infants born after more than 37 weeks and weighing more than 2500g at birth. The exclusion criteria were as follows: (1) mothers with twin infants, (2) mothers of infants with congenital deformities (e.g., cleft palate) and other health issues related to feeding difficulties, and (3) mothers who had participated in other maternal feeding education programs for overweight prevention in infants within 1 year of this study.

Using the G-3.1.2 power program, 24 was the required sample size with a medium effect size of 0.25 [15], a significance level of 0.05, statistical power of 0.80, two groups, four measures, and two-way repeated-measures analysis of variance (ANOVA). When considering a 20% dropout rate similar to a previous study with mobile-based health education [11], 29 might be the appropriate number for the final sample size. From July to August 2019, 19 and 14 mothers for the experimental and control groups, respectively, were selected. After the pretest, four mothers in the experimental group refused to participate in this study because of increased burden of caring for infants. Thus, 15 mothers in the experimental group were involved in all follow-up tests. Among the 14 mothers in the control group, there were no dropouts during the study process (Figure 1).

Ethical consideration

All the procedures and methods of this study were approved by the institutional review board of the research institute at the Chungnam National University, where a researcher of this study was involved (Approval no. 201903-SB-034-01). The researcher and a trained research assistant explained the purpose, procedures, methods of the study, informed the participants that the participation was voluntary and they could leave the study at any stage, and that the study respected individual rights and all information collected from the participants would be used confidentially and only for this study. Written informed consent was obtained from all the participants. Approximately 20 US dollars (20,000 won in Korea) was provided at every stage of evaluation, including pretest and follow-up tests.

Measures

To verify homogeneity of characteristics in the experimental and control groups, characteristics of infants and mothers were evaluated with risk factors for overweight in infancy. Characteristics of infants involved sex (female or male), gestational age (weeks), birth weight (grams), and delivery type (vaginal delivery or cesarean section). In addition, maternal characteristics involved current age (years), marital status (married or other), educational level (high school, 2-year and 4-year college, or more than 4-year college), perceived current socioeconomic status of family (high, middle, or low), weight gain during pregnancy (kilograms), smoking experience during pregnancy (yes or no), diagnosed with diabetes mellitus during pregnancy (yes or no), and diagnosed or treated for depression by certified psychiatrist during pregnancy (yes or no).

To evaluate the effects of the mobile-based maternal feeding education program, breastfeeding attitude, breastfeeding self-efficacy, and breastfeeding duration were assessed. In addition, recognition of hunger and satiety cues of infants and knowledge regarding providing solid foods for overweight prevention in infants were assessed with the mothers.

Breastfeeding attitude

Breastfeeding attitude was assessed using the Iowa Infant Feeding Attitude Scale, originally developed by De la Mora and Russell [16] and translated and validated in Korean by Ra and Chae [17]. The instrument consisted of 17 items, and responses toward each item were available on a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). Possible total scores ranged from 15 to 85 points, where a higher score indicates a more positive breastfeeding attitude. Cronbach's α is .86 in a study by De la Mora and Russell [16] and .72 in a study by Ra and Chae [17]. Cronbach's α in this study was .64–.82 according to the follow-up test of experimental and control groups.

Breastfeeding self-efficacy

Breastfeeding self-efficacy was assessed using the Breastfeeding Self-efficacy Scale-Short Form, originally developed by Dennis [18] and translated and validated in Korean by Ra and Chae [19]. The instrument consisted of 14 items, and response toward each item was available on a 5-point Likert scale (1 = *never confident* to 5 = *always confident*). Possible total scores ranged from 14 to 70 points, where a higher score indicated higher breastfeeding self-efficacy. Cronbach's α is .96 in a study by Dennis [18] and .94 in a study by Ra and Chae [19]. Cronbach's α in this study was .84–.92 according to the follow-up test of experimental and control groups.

Breastfeeding duration

Breastfeeding duration was assessed from a single question. Participants were asked to indicate for how many days they had breastfeed until 6 months (180 days) after childbirth.

Recognition of hunger and satiety cues by infants

Recognition of hunger and satiety cues by infants was assessed through four items of the Infant Feeding Questionnaire, originally developed by Baughcum [20] and translated and validated in Korean by Ra, Jeong, and Kim [21]. Response toward each item was available on a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). The mean score per item ranged from 1 to 5 points, where a higher score indicated increased recognition of hunger and satiety cues by infants. Cronbach's α is .70 in a study of Baughcum [20] and 75 in a study by Ra et al [21]. Cronbach's α in this study was .70–.85 according to follow-up test of experimental and control groups.

Knowledge regarding providing solid foods for overweight prevention in infants

Knowledge regarding providing solid foods for overweight prevention in infants was assessed with four items in the instrument, which evaluated infant feeding knowledge of mothers [22]. One correct response for each item scored 1 point, and higher score (ranged 0–4 points) indicated increased knowledge regarding providing the solid foods, which would not cause overweight in infants.

Intervention procedures

Development of mobile-based maternal feeding education program for overweight prevention of infants

Themes, subthemes, and content development of the education program

For the development of themes, subthemes, and the content of the education, a literature review was conducted. According to the review, maternal feeding behaviors associated with overweight in infants was formula feeding with/without breastfeeding [1,23]; regular feeding pattern in fixed schedules and overfeeding without considering hunger and satiety cues of infants [1,24]; early providing of solid foods (25]; and providing of sweet beverage, juices, and high calories snacks with solid foods [1,24]. Thus, breastfeeding, responsive feeding considering hunger and satiety cues of infants, and providing appropriate solid foods were categorized as the themes. In addition, according to the themes, the subthemes and the content were developed, which included textbooks, currently developed educational material that is open to the public, and educational articles (Table 1).

Then, five pediatricians and five professors in child health nursing confirmed the contents’ validity. They suggested the need for educational content for understanding childhood overweight or obesity (e.g., causes, problems because of childhood overweight or obesity, and prevention methods). Consequently, themes, subthemes, and contents of education regarding childhood overweight or obesity were added. Finally, according to content validity from five pediatricians and five professors in child health nursing, the content validity index was calculated as 3.2–4.0 points.

Mobile website construction

For mobile website construction, the researcher developed storyboards including short and core subtitles, pictures, figures, and videos according to the contents. Also, narrations were developed for each storyboard. Pictures, figures, and videos were used from the web with the permission of the copyright holder. If permission was not provided for using of pictures, figures, and video, illustrations replaced them. A total of 58 storyboards were developed, with 53 containing educational content, two for instruction on the program, and three for summary and wrap-up. Three professors in child health nursing and one pediatrician confirmed the content validity of the storyboards and narration.

In initial meetings, two web designers and the researcher designed the web pages, including layout, background color, letter style and colors, and symbols according to the educational contents. Designed web pages were revised several times by the researcher and the web designers, and narration was finally recorded by a professional audiobook narrator for every web page.

Contents of mobile web were mainly categorized into three sections, including the introduction of the program, educational contents, and summary and wrap-up. In the introduction section of the program, the purpose of the program, using methods from the web, and the contact number of the researcher were presented. In the educational contents section, detailed education was provided according to the themes, subthemes, and educational content. Finally, in the summary and wrap-up section, summary and key points were presented according to the themes. Considering the attention span of 10–15 minutes in adults [26], all the educational content was provided within 10-minute blocks (4–9 minutes).

To make the website user friendly, icons representing the main three sections were placed on the homepage. In addition, touch icons for accessing detailed educational contents were provided. To revisit the information, icons for returning to previous pages of the educational contents were provided. In addition, icons for narration were placed to assist repeated hearing of the narration. On every last page, icons representing the educational contents were placed for accessing the subthemes. In addition, on every last page, icons for asking questions and giving opinions were also provided according to the themes. The researcher and two research assistants with doctoral degrees in nursing managed the website and answered any questions and comments from the participants. The web address is https://www. Healthybaby. online.

Through a model operation with three professors in child health nursing, five registered nurses with more than five years of working experience in pediatric wards, two web designers, and five first-time mothers of infants, the benefits, accuracy, comprehension of the website components, functionality, purpose, interactivity, confidentiality, and reliability of the website were evaluated (4.5~4.9 points/5 points) [11].

Implementation and data collection

For the experimental group, the feeding education program for overweight prevention in infants was provided through mobile from 38 weeks gestation to 6 months after childbirth. To ensure better understanding and recall by repetition, the researcher and the research assistants encouraged the mothers to access the website at least once every 2 days, considering that memory from once accessed learning might be maintained up to 24 hours [27]. In addition, they confirmed the mothers' attendance every day and measured their access rates from the initial introduction section to the final summary and wrap-up section to guarantee completion of the entire educational content. For mothers who accessed the same educational contents for 3 days in a row and/or discontinued accessing the educational contents for 3 days, the researcher and research assistants sent text messages to encourage them to access the entire educational contents in the program.

Pamphlets containing information pertaining to basic cardiopulmonary life support for infants and prevention of sudden infant death syndrome were distributed to the control group participants. Using self-reported electronic questionnaires, data collection was conducted four times: before participation in the intervention and 1 month, 3 months, and 6 months after childbirth.

Statistical analysis

Statistical analysis was conducted using SPSS 24 version (IBM Corp., Armonk, NY, USA). Chi-square and independent *t*-tests were used for testing homogeneity characteristics of the participants and baseline breastfeeding attitude, breastfeeding self-efficacy, recognition of hunger and satiety cues of infants, and knowledge regarding providing solid foods for overweight prevention in infants between experimental and control groups, in the pretest. In addition, an independent *t*-test was conducted for comparing the mean values of breastfeeding duration until 6 months (180 days) after childbirth, between the experimental and control groups, in the final follow-up test (6 months after childbirth). A repeated-measures ANOVA was used to compare the changes in mean values of breastfeeding attitude, breastfeeding self-efficacy, recognition of hunger and satiety cues of infants, and knowledge regarding providing solid foods for overweight prevention in infants between the two groups in a pretest and three times in the follow-up test. A *p*-value p-value needed to be**Results Homogeneity of characteristics of infants and mothers and outcome variables between experimental and control groups**

There were no statistically significant differences in the characteristics (of infants and mothers) between the experimental and control groups (Table 2). In addition, in the pretest, there were no statically significant differences in breastfeeding attitude, breastfeeding self-efficacy, breastfeeding duration until 6 months (180 days) after childbirth, recognition of hunger and satiety cues of infants, and knowledge regarding providing solid foods for overweight prevention in infants between the two groups (Table 3) (See Table 4).

Effects of mobile-based maternal feeding education program for overweight prevention in infants

Regarding breastfeeding attitude, statistically significant differences were noticed across time points (*F* = 11.84, *p* F = 5.28, *p* = .008), although there was no significant between-group difference (*F* = 1.09, *p* = .305). According to the Bonferroni test, although breastfeeding attitude score at 1 month after childbirth was significantly lower compared with the baseline score (95% confidential interval [CI]: −4.80 to −1.96, *p* p p

Furthermore, for breastfeeding self-efficacy, statistically significant differences were noted between the groups (*F* = 5.34, *p* = .029) across time points (*F* = 5.64, *p* = .007) and interactions between the groups and times (*F* = 3.50, *p* = .041). According to the Bonferroni test, breastfeeding self-efficacy score at 1 month after childbirth was significantly lower when compared with the baseline score (95% CI: −4.61 to −0.75, *p* = .008). According to the Bonferroni test, breastfeeding self-efficacy score at 1 month after childbirth was significantly lower when compared with the baseline score (95% CI: −4.61 to −0.75, *p* = .008). However, the breastfeeding self-efficacy score significantly increased at 6 months after childbirth (95% CI: 2.17–7.04, *p* = .001) than the score at 1 month after childbirth. In addition, breastfeeding self-efficacy score at 6 months after childbirth increased significantly than the score at 3 months after childbirth (95% CI: 0.59–3.46, *p* = .008).

Regarding breastfeeding duration until 6 months (180 days) after birth, the mean breastfeeding duration of the experimental group (134.27 ± 46.75 days/180 days) significantly increased compared with the control group (94.36 ± 55.95 days/180 days; *t* = −2.09, *p* = .046).

With regard to recognition of hunger and satiety cues of infants, although there was a statistically significant difference across time points (*F* = 27.71, *p* F = 0.17, *p* = .685) and interaction between the groups and times (*F* = 0.23, *p* = .878). According to the Bonferroni test, the score of recognition of hunger and satiety cues of infants significantly increased from the baseline score after the intervention.

Regarding knowledge of providing solid food for overweight prevention in infants, statistically significant differences were noted across time points (*F* = 22.01, *p* F = 4.87, *p* = .009), although there was no significant difference between the groups (*F* = 3.31, *p* = .080). According to the Bonferroni test, knowledge scores regarding appropriate providing of solid foods at 1 month (95% CI: 0.36–1.00, *p* p p p p

Discussion

This study identified the effects of a mobile-based maternal feeding education program developed for overweight prevention in infants. According to the results in this study, the experimental group showed significantly more positive breastfeeding attitude, higher breastfeeding self-efficacy, and increased breastfeeding duration than the control group. In previous maternal education programs using various educational materials including pamphlets and lectures [28,29], breastfeeding education had a significant effect on increased positive breastfeeding attitude, breastfeeding self-efficacy, breastfeeding practice, and longer breastfeeding duration.

According to a conceptual framework explaining maternal breastfeeding practice based on social cognitive theory [30], social support such as advice and educational programs from health care providers can improve knowledge, positive attitude, and self-efficacy toward breastfeeding, leading to increased breastfeeding behaviors. On the same lines, Meedya et al [31] also reported that breastfeeding attitude and self-efficacy were significant modifiable factors influencing breastfeeding intention and duration. In detail, as breastfeeding attitude was a strong predictor of feeding choice, the breastfeeding attitude had maximum effect on the breastfeeding intention of mothers [32]. In addition, maternal breastfeeding attitude was influenced by relationships with significant people in close social networks, including family members and health care providers [33]. In detail, hearing about the benefits of breastfeeding from various sources such as health care providers was associated with increased positive breastfeeding attitude, which led to improved breastfeeding intention [34]. Furthermore, as increased breastfeeding self-efficacy was significantly associated with longer breastfeeding duration for 6 months after childbirth [31], maternal breastfeeding self-efficacy was influenced by increased knowledge, positive breastfeeding attitudes, and social support such as guidance from health care providers that plays an important role in the onset and continuation of breastfeeding [33]. In this context, Parsa et al [35] emphasized the importance of social support for a more positive breastfeeding attitude and increased breast self-efficacy, leading to successful breastfeeding after childbirth. Therefore, the mobile-based maternal feeding education program might improve positive breastfeeding attitude and breastfeeding self-efficacy, which can lead to increased breastfeeding duration with high breastfeeding intention, by providing advice and knowledge regarding breastfeeding methods and benefits of breastfeeding, such as overweight prevention in infants. In particular, the intention to breastfeed by Korean mothers might be influenced by significant family members such as their mothers and mothers-in-law. This is in line with Korean culture, where, as in other Asian countries, parenting practices for young children tend to be followed with advice from grandparents [19]. However, Korean grandparent's knowledge about breastfeeding was less than that of Korean mothers of infants and undergraduate students [36]. Therefore, the mobile-based maternal feeding education program will be helpful in improving breastfeeding attitudes and breastfeeding self-efficacy from increased accurate knowledge, which could lead to increased intention to breastfeed among Korean mothers.

In addition, the experimental group showed significantly increased knowledge regarding providing solid foods for overweight prevention in infants than the control group. According to a previous study, a video-based maternal feeding education for overweight prevention in infants was also effective for improving maternal infant feeding knowledge and behaviors [22]. As parents and primary caregivers, mothers are key people for structuring early feeding; according to the family ecological model, parental practices for obesity prevention of their children were determined by child and parental factors [37]. Among the parental factors, increased parental agreement on weight management of their children with high knowledge about behaviors to reduce obesity risk was a significant factor [37]. In this context, the mobile-based maternal feeding education program containing information regarding providing solid foods for overweight prevention in infants might contribute to maternal feeding practice by improving maternal agreement and behaviors.

However, regarding the improvement of recognition of hunger and satiety cues by infants, the mobile-based maternal feeding education program was not effective. To sensitively recognize the hunger and satiety cues, it is important that infants send clear cues to their mothers, and mothers should distinguish the characteristics of each cue and interpret them accurately [38].

Mothers should acquire the skills to recognize their infant's unique hunger and satiety cues expressed by body movement, facial expressions, and vocalization [39]. However, the mobile-based maternal feeding education program only included education about common and classic hunger and satiety cues. In addition, maternal recognition of their infant's hunger and satiety cues might be improved with high-quality interaction between mothers and infants, which is influenced by various factors, including socioeconomic status, environment, and perception of the infant's weight [39]. Therefore, to develop sensitive recognition of their infant's hunger and satiety cues, mothers might need repeated and varied experiences of interaction with their infants as well as knowledge-based education. In this context, the effectiveness of the mobile-based maternal feeding education program for providing information regarding hunger and satiety cues of infants might be limited.

The study had certain limitations. Owing to the small sample size, statistical power was insufficient. Participants were recruited from only two obstetrics and gynecology clinics located in a metro city. Therefore, further studies are needed with sufficient participants from multiple obstetrics and gynecology clinics from diversely populated urban and rural areas. Next, this study did not test the effects of mobile-based education against other educational material. Therefore, in future studies, which compare educational effects according to educational material, the effects of mobile-based education should be verified. Finally, this study did not confirm the effects related to adiposity of infants. Therefore, further studies might be required for test effects on adiposity of infants, with longer follow-up periods.

Conclusion

The results of this study showed that a mobile-based maternal feeding education program for overweight prevention in infants was effective in improving positive breastfeeding attitudes, breastfeeding self-efficacy, breastfeeding duration, and knowledge regarding providing appropriate solid foods to infants. Furthermore, mobile-based education is an extremely user-friendly method as mothers can access necessary information such as healthy maternal feeding practices without any physical contact and at a place and time convenient for them.

Funding resource

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Conflict of interest

The author declares that they have no conflict of interest.

Themes	Subthemes	Contents
Childhood overweight/obesity	1.Characteristics of childhood overweight/obesity	1)Characteristics of childhood overweight/obesity. (Increased number and size of fat cells)
2)The need for childhood overweight/obesity prevention in early life, including infancy.	2.Diagnosis of childhood overweight/obesity	1)Diagnostic criteria for childhood overweight/obesity.
2)Interpretation methods of children's weight status based on the developmental growth curve.	3.Causes of childhood overweight/obesity.	1)Causes of childhood overweight/obesity.
4.Problems associated with childhood overweight/obesity.	1)Physical, psychological, social health problems associated with childhood overweight/obesity.	Breastfeeding
1.Beneficial effects and methods of breastfeeding.	1)Beneficial effects of breastfeeding for growth and development in infancy.	2)Methods of breastfeeding initiation and maintaining and precautions for breastfeeding.
3)Postures for breastfeeding.	4)Methods to stop breastfeeding.	5)Understanding the satiety cues of breastfed infants.
2.Overweight prevention during breastfeeding in infancy.	1)Overweight prevention effects of breastfeeding, compared with formula feeding, and mixed feeding with formula feeding and breastfeeding.	2)Composition of breast milk for overweight prevention in infants.
3)Improving self-regulation ability via breastfeeding for the prevention of obesity in infants.	4)Overweight prevention effects based on breastfeeding duration.	Responsive feeding
1.Responsive feeding according to hunger and satiety cues of infants.	1)Overweight prevention effects of responsive feeding according to hunger and satiety cues.	2.Hunger and satiety cues.
1)Understanding of hunger cues in infants.	2)Understanding of satiety cues in infants.	3.Similar cues compared with hunger cues.
3)Causes associated with similar cues (crying and irritation) in comparison with hunger cues.	4.Caring according to causes of similar cues, in comparison with hunger cues.	4)Caring according to causes of similar cues (crying and irritation), in comparison with hunger cues.

Providing solid food	1.General methods and precautions for providing solid food.	1)Need for solid food and precautions related to providing solid food.
2)Methods for the provision of solid food according to age in months.	2.Providing solid food for overweight prevention in infants.	1)Significance of solid food for obesity prevention in infants.
2)Association between the early provision of solid food and overweight in infants.	3)Limiting food for overweight prevention in infants when providing solid food.	4)Methods of providing solid food for overweight prevention in infants.

Variables		Exp (n = 15) n (%)/M ± SD	Cont (n = 14) n (%)/M ± SD	t/χ^2	p
Infants' characteristics					
Sex	Boy	6 (40.0)	4 (28.6)	0.42	.518
Girl	9 (60.0)	10 (71.4)			Gestational age (wk)
	39.22 ± 1.22	39.04 ± 1.02	−0.44	.661	Birth weight (g)
	3,066.00 ± 264.60	3,080.93 ± 283.08	0.15	.884	Delivery type
Vaginal delivery	10 (66.7)	6 (42.9)	1.66	.198	Cesarean section
5 (33.3)	8 (57.1)			Maternal characteristics	

Current age (yr)		32.07 ± 4.15	31.14 ± 4.07	−0.69	.499
Marital status	Married	15 (100)	14 (100)		
Others	0 (0.0)	0 (0.0)			Educational level
High school,	0 (0.0)	2 (14.3)	3.19	.363	2-yr and 4-yr college
14 (93.3)	10 (71.4)			More than 4-yr college	1 (6.7)
2 (14.3)			Perceived current socioeconomic status of family	High	2 (13.3)
0 (0.0)	2.17	.338	Middle	11 (73.4)	11 (78.6)
		Low	2 (13.3)	3 (21.4)	
	Weight gain during pregnancy (kg)		10.94 ± 2.77	12.24 ± 4.19	0.99
.329	Smoking experience during pregnancy	Yes	0 (0.0)	0 (0.0)	
	No	15 (100)	14(100)		

Diagnosed or treated for diabetes mellitus during pregnancy	Yes	1 (6.7)	3 (21.4)	1.33	.249
No	14 (93.3)	11 (78.6)			Diagnosed or treated for depression during pregnancy
Yes	0 (0.0)	0 (0.0)			No

Variables	Exp (n = 15), M±SD	Cont (n = 14), M±SD	t	p
Breastfeeding attitude	57.20 ± 4.41	57.79 ± 2.91	0.43	.675
Breastfeeding self-efficacy	44.80 ± 6.99	41.50 ± 12.97	−0.86	.397
Recognition of hunger and satiety cues of infants	2.93 ± 0.40	2.89 ± 0.61	−0.21	.832
Knowledge regarding providing of solids foods	1.60 ± 0.63	1.93 ± 0.73	1.30	.205

Variables	Group	Before intervention	1 mo after child birth	3 mo after child birth	6 mo after child birth	Source	F/t	p
M±SD				Breastfeeding attitude	Exp. (n = 15)	57.20 ± 4.41	52.87 ± 3.23	60.20 ± 4.89

61.27 ± 5.13	Group	1.09	.305	Time	11.84	<.001	Cont. (n = 14)	57.79 ± 2.91
55.36 ± 2.27	57.14 ± 4.42	57.21 ± 4.12	Group × time	5.28	.008	Breastfeeding self-efficacy	Exp. (n = 15)	44.80 ± 6.99
43.87 ± 6.20	47.67 ± 7.10		Group	5.34	.029	Time	5.64	.007
Cont. (n = 14)	41.50 ± 12.97	37.07 ± 9.38	38.43 ± 11.45		Group × time	3.50	.041	Breastfeeding duration (over 180 d)
Exp. (n = 15)	-	-	-	134.27 ± 46.75		−2.09	.046	Cont. (n = 14)

-	-	-	94.36 ± 55.95				Recognition of hunger and satiety cues of infants	Exp. (n = 15)
2.93 ± 0.40	3.17 ± 0.34	3.38 ± 0.43	3.70 ± 0.34	Group	0.17	.685	Time	27.71
<.001	Cont. (n = 14)	2.89 ± 0.61	3.25 ± 0.61	3.43 ± 0.42	3.80 ± 0.32	Group × time	0.23	.878
Knowledge regarding appropriate providing of solids foods	Exp. (n = 15)	1.60 ± 0.63	2.60 ± 0.63	2.73 ± 0.59	3.20 ± 0.56	Group	3.31	.080
Time	22.01	<.001	Cont. (n = 14)	1.93 ± 0.73	2.29 ± 0.61	2.36 ± 0.50	2.50 ± 0.52	Group × time

DETAILS

Subject:	Overweight; Pregnancy; Likert scale; Childbirth &labor; Breastfeeding &lactation; Attitudes; Eating behavior; Prevention; Education; Gestational age; School dropout programs; Variance analysis; Obesity

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Personal Listening Device Use Habits, Listening Belief, and Perceived Change in Hearing Among Adolescents

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ABSTRACT (ENGLISH)

Purpose

This study aimed to identify personal listening device (PLD) usage habits, listening belief, and perceived change in hearing, and to investigate how the variables related to perceived change in hearing among adolescents.

Methods

The participants were 183 middle school students and 233 high school students from Ulsan. Data were collected by self-reported questionnaires from August 1, 2019, to October 22, 2019, and analyzed with descriptive statistics, χ2 test, Mann–Whitney *U* test, and hierarchical multiple logistic regression.

Results

Most students started to use PLDs from elementary school, and mean preferred listening level was 70.13 dB. Mean perceived susceptibility to music-induced hearing loss (MIHL) and perceived barriers to prevent MIHL were 5.18 and 3.40, respectively. Perceived change in hearing was reported on 14.2% of middle school students and 32.2% of high school students, and as the average score of perceived barriers to prevent MIHL increases by one point, the odds of decrease in hearing increase by 2.05 times ($p < .001$) and 1.35 times ($p < .05$), respectively.

Conclusion

Considering that most adolescents are exposed to PLD in elementary schools and about a quarter experienced a decrease in hearing after PLD use, educational programs on hearing conservation are required to start as early as in schools. Particularly, knowledge and skills to overcome barriers to prevent MIHL should be emphasized in educational programs.

FULL TEXT

Introduction

Noise-induced hearing loss is caused by damage to the inner ear sensory cells after prolonged exposure to noise environment [1], and as this damage begins to progress slowly, people do not recognize the hearing damage until a serious irreversible level is reached [2]. It has been mainly related to noise exposure to work, but in recent years, personal noise exposure has been increasing in leisure activities, and health concerns about it have increased [1]. Personal listening devices (PLDs) from cassette tapes to smartphones are major sources of noise during leisure activities [3]. More than 90% of Korean adolescents use mobile phones or smartphones [4], and 98.8% of them enjoy listening to music through the Internet, watching videos, and playing online games as leisure activities [5].

Hearing damage caused by noise is cumulative, so the longer the exposure time to noise, the greater the risk of hearing loss [6], as well as negative consequences impacting individual cognitive function, social well-being or quality of life, and academic achievement or employment opportunities [1,7]. Therefore, adolescents are thought to be especially vulnerable to noise and important period in their life to prevent hearing loss. Most adolescents expose to PLDs daily or several times per week for longer periods [8] and more than half of the PLDs users exceed the daily noise limit [9], but most are unaware of the risk because the negative consequence occurs later [10]. According to a previous study, 17.0% of first-year Korean middle and high school students revealed hearing loss during their hearing screen test in 2016 [11]. Therefore, healthy listening behavior such as PLDs use of safe listening volume is very important for adolescents to prevent hearing loss.

Accordingly, the maximum permissible volume of portable sound systems has been newly amended as per the Noise and Vibration Control Act (Article 45-3) to limit the maximum volume to 100 dB [12], but the peak volume of PLDs released since 2014 was still measured over 100 dB [13,14]. The situation is similar in other countries. For example, in Canada, modern digital audio players tended to exceed the noise exposure limit because the measured maximum volume among modern digital audio players was from 101 to 107 dB [15]. That is, it is necessary but insufficient to enact regulations at the national level to prevent hearing loss among PLDs users. In particular, like most adolescents, although the peak volume levels of PLDs keep under the noise exposure limit, prolonged listening time cannot avoid the risk of hearing loss [16]. Fortunately, PLDs users can minimize the exposure level of noise by adjusting the volume or listening times voluntarily unlike occupational noise sources.

As the risk of hearing loss because of unhealthy listening behaviors with PLDs among adolescents is increasing, a few studies have identified the relationship between personal factors, PLDs usage habits, and hearing loss among adolescents. Besides listening volume [9], hearing loss during leisure activities including PLDs use has known to be related to ear diseases such as tinnitus [8] or ear infection [11], daily exposure time [3,17], exposure duration [18], and headphone use [11]. Recently, cognitive variables such as belief about listening volume (listening belief) have been considered as risk factors of PLDs usage habits. Health beliefs are well-known factors that influence health behaviors, and Health Belief Model [19] has been identified as particularly effective in explaining the relationship between health beliefs and preventative health behaviors [20]. Listening belief was measured using listening habits questionnaire developed according to Health Belief Model [19], and was shown the relation to the preferred listening level (PLL). Adolescents' PLL increased with increasing perceived barriers to prevent music-induced hearing loss (MIHL) and decreased with increasing perceived benefits of preventing MIHL. However, the relationship between listening belief and change in hearing among adolescents has not been reported in the previous study [21]. Even in Korea, the studies to investigate PLDs usage habits, listening belief, and their relation to change in hearing among adolescents are currently very limited.

Under the background, this study was aimed to identify PLDs usage habits, listening belief, and perceived change in hearing, and to investigate how the variables related to perceived change in hearing among adolescents in Korea. Meanwhile, high school students showed more PLDs users, longer listening time, and higher level of volume than middle school students did in previous studies in Korea [17,22]. Considering the differences in PLDs use characteristics according to school level, we tried subgroup analyses according to school level.

Methods Study participants

The participants of this cross-sectional study were first-year students at general middle and high schools in Ulsan, currently listening to music using their PLDs with earphones, who understood the purpose and method of this study, and agreed to participate in it by themselves and their parents. The students of the special purpose of schools and arts high schools were excluded due to different patterns of school life compared to those who attend the general schools. The sample size of this study was calculated using G·Power version 3.1.9.4 [23]. The significance level was set at (α) .05, statistical power at (1-β) .85, and the effect size at $P_1 = .20$, $P_2 = .48$, which is calculated from the previous study that analyzed the relationship between listening levels and hearing loss among 17-year-old Swedish adolescents [8]; the proportion of adolescents exposed to high-level noise above 85 dB was 20.0% in the normal hearing group and 48.0% in the hearing loss group. Likewise, according to a study [11], 17.0% of adolescents reported hearing loss during the Korean adolescent health screening test, and the ratio of the hearing loss group to the normal hearing group was considered to be 1:5. Within this condition, the minimal number of samples required was 167 (normal hearing group: 139; hearing loss group: 28), and considering the 25.0% dropout rate, 208 participants with an additional 42 participants were required. Participants in this study were separately sampled from middle schools and high schools, and this number comprised 2.0% of 10,148 first graders from middle school and

10,308 first graders from high school as of 2019 in Ulsan [24].

The participants were recruited with two stages stratified sampling; school level (middle vs. high) and gender (boy vs. girl). About 60 middle schools and 52 high schools, six middle schools (1 girls', 1 boys', and 4 coeducational schools), and seven high schools (1 girls', 1 boys’, 3 coeducational, and 2 vocational schools) were agreed to participate in the study. One class was randomly selected from each school, and all students in the class were asked to participate in the study. Finally, 183 middle school students (93 boys and 90 girls) and 233 high school students (110 boys and 123 girls) were included in the study.

Study instruments

The tools for this study were a structured self-administered questionnaire composed of explanatory variables (general characteristics, PLDs usage habits, listening belief) and an outcome variable (perceived change in hearing). General characteristics included gender, school level, and history of ear diseases (tinnitus, ear pain, or ear infection) based on the previous studies [8,11]. PLDs usage habits included the number of PLDs, the first time that PLDs was used, the common place of PLDs use, type of earphones, listening days per week and listening hours per day, and PLL. The period of PLDs use was calculated from the difference between age and the first time PLDs were used. The type of earphones is presented with pictures of earphones, over the ear type, earbuds type, and in-ear type, and one selected type of earphone is usually used. The listening time per week was calculated as the product of listening days per week and listening hours per day, which were also presented with a picture of a 24-hour clock to minimize the recall bias. PLL was measured by asking to select their typical setting on the volume control from 1 to 15 steps while listening to the provided music, and the volume at the setting was converted to dB according to Min's [25] study. For measuring PLL, many researchers assessed it using a self-reported questionnaire because of difficulties while listening to music with earphones [11,26]. However, the validity of self-reported method for PLL measurements has not yet been established, and is unclear how well they reflect actual PLL [21]. Although the laboratory measurements using either a microphone-in-real-ear technique [27] or a technique using a manikin with an ear-simulating microphone [28] are more accurate and reliable than self-report measurements, we could not use those measurements because of lack of equipment. Instead, we additionally asked the participants to rate the preferred volume using a 10-point visual analog scale, when the maximum volume of their PLDs was assumed to be 10. For example, if a student usually listens to music at level 6 using a PLD with 12 levels of volume, he/she was asked to mark 5 on the scale. Both methods showed good agreement with .60–.70 of intraclass correlation coefficient [29]. As PLL was not met the normality assumption, in the analysis process, we classified it based on 70 dB (>70 dB and ≤70 dB), which means loud noise [30].

Listening belief was measured with Listening Habit Questionnaire [21]. After obtaining permission from the author, the researcher translated the questionnaire into Korean and two experts, a bilingual English teacher and a nursing professor, reviewed original and Korean translations to evaluate the validity of the translated tools and the appropriateness of words and phrases. After the first preliminary survey with five middle school students and five high school students who were not eligible for the research, the meaning of the Likert score was expressed in Korean to make it clear. Original listening habits questionnaire includes five variables and 26 items; four items of perceived susceptibility to MIHL, six items of perceived severity of MIHL, seven items of perceived benefits to prevent MIHL, four items of perceived barriers to prevent MIHL, and five items of perceived self-efficacy for taking action to prevent MIHL. Each item is a seven-point Likert scale from “Not at all (1 point)” to “Very much so (7 points),” indicating the higher the score, the higher perceived susceptibility, severity, benefits, barriers, and self-efficacy, respectively. The average score for each variable is calculated but not the total sum for all variables [21]. At the listening habits questionnaire development stage, the correlation between the listening level measured by a laboratory test and the self-reported measurement was from .31 to .68, and the Cronbach's α was from .81 to .89 [21]. In this study, Cronbach's α was .63 and .66 for perceived susceptibility, .86 and .92 for perceived severity, .85 and .85 for perceived benefits, .87 and .86 for perceived barriers, and .89 and .87 for perceived self-efficacy for middle school students, and high school students, respectively. After deleting item number 4 item, the Cronbach's α of perceived susceptibility were improved on .71 and .69, respectively. The values were almost recommended level [31

], so we measured perceived susceptibility with 3 items.

Perceived change in hearing was defined as “no change,” “slightly worse,” “worse” to the question, “After PLDs use, have you ever experienced any change in hearing ability?” In the analysis process, “slightly worse” and “worse” were classified as “decreased” (1), and “no change” was classified as “no change” (0).

Data collection

Data were collected from August 1, 2019, to October 22, 2019. The researcher visited the study schools in person and explained the purpose and method of this study to the principals and teachers and asked for cooperation. Schools participating in this study posted notices for recruitment on the first grade bulletin board and school health office bulletin board 1 week before the survey. Students who were willing to take part in the survey were provided with assent and consent forms from the school nurse, and then were asked to read the explanations with their parents at home and sign the consent form. Students who agreed to participate in the study visited the survey site (a school nurse's office or an empty classroom, which was provided by the school) on a prescribed date, submitted the consent form to the researcher, and completed the questionnaire. After completing the questionnaire, the student measured the listening level in the same place. To measure the PLL, the researcher provides in-ear earphones (QuietComfort® 20 of Bose Corporation, Framingham, USA) connected to the smartphone to the student and asked them to wear the earphones, and then while listening to music, Hyuk-Oh's Tom Boy, and asked the student to inform the student of the usually comfortable listening level with raising the level step by step according to student's response. During the measured listening level test, the range of background noise was from 45 to 53 dB, which was measured by a noise meter (TES-53S, Taiwan) within 50 cm of the student in a quiet environment. The collected survey and measured data were encrypted and stored in the locker storage box and the researcher's computer. The students who participated in this study were offered a small gift (school supplies).

Data analysis

The collected data were tested on both sides at significance level (α) .05 using the IBM SPSS win (version 26) program (IBM Corp., Armonk, NY, USA); the specific analysis method is as follows:

1. The variables in the study were analyzed by frequency and percentage or average and standard deviation, and were compared according to school level with χ^2 test and Mann–Whitney *U* test.
2. The relationship between explanatory variables and outcome variable was analyzed using the χ^2 test and Mann–Whitney *U* test according to school level.
3. Hierarchical multiple logistic regression analysis was conducted to identify the related factors of perceived change in hearing according to school level. Multicollinearity was assessed based on the correlation coefficient ≥ .85. Variables were entered into the model in a series of steps, and the order for entry was general characteristics, PLDs usage habits, and listening belief. The relationship between each variable and perceived change in hearing was determined by the odds ratio and 95% confidence intervals.

Ethical consideration

This study was approved by Pusan National University Institutional Review Board (Approval no. 2019-69-HR) and was conducted according to the criteria approved by the committee. Written informed assent and consent were obtained from all participants and their parents after informing them about the possibility of withdrawal from this study, and kept confidentiality of participants’ information.

Results Characteristics of the variables in the study according to school level

The results of analyzing the variables in the study are presented in Table 1. For middle school students, 73.8% of them have had a history of ear diseases, most of them have used a smartphone as PLDs and in-ear type of headphone, mean total period of PLDs use was 3.52 years, and mean listening time per week was 15.34 hours. Mean PLL was 70.57 dB and 31.7% of them showed greater than 70 dB. Mean perceived susceptibility and barriers was 5.02 and

3.02, respectively, and 14.2% of them showed a decrease in hearing after PLDs use. For high school students, 85.8% of them have had a history of ear diseases, most of them have used a smartphone as PLDs and in-ear type of headphone, mean total period of PLDs use was 6.26 years, and mean listening time per week was 20.14 hours. Mean PLL was 69.79 dB and 34.8% of them showed greater than 70 dB. Mean perceived susceptibility and barriers were 5.31 and 3.70, respectively, and 32.2% of them showed a decrease in hearing after PLDs use.

Therefore, middle school students showed a higher mean score of the perceived benefits (*p* = .036), perceived self-efficac p = .004), and lower perceived barriers (*p* p = .002), the period of PLDs used (*p* p p = .012), perceived susceptibility (*p* = .005), and perceived change in hearing (*p* **The relationship between explanatory variables perceived change in hearing**

The results of bivariate analysis between explanatory variables and perceived change in hearing are presented in Table 2. The perceived change in hearing was related to gender (*p* = .034), history of ear diseases (*p* = .027), period of PLDs use (*p* = .002), PLL (*p* = .029), perceived susceptibility (*p* = .008), perceived benefits (*p* = .011), perceived barriers (*p* p p = .048) and perceived barriers (*p* p = .022), perceived barriers (*p* p **The related factors to perceived change in hearing**

According to the results of multiple logistic regression in Table 3, the perceived change in hearing was influenced by perceived susceptibility, perceived severity, and perceived barriers. As the average score of perceived susceptibility and perceived barriers increases by one point, the odds of decrease in hearing increase by 1.83 times (*p* p p p

Discussion

Regarding the PLDs usage habits, the most common PLDs were smartphones, regardless of school level, which reflects the increase in the use of smartphones by teenagers [4]. Most participants started to use PLDs at grades 4–6 of elementary school, therefore, in order to establish healthy PLDs usage habits, appropriate hearing conservation programs should be initiated at least the first year of elementary school. Most adolescents spend about 2.5 hours a day on their PLDs on average, indicating an increase in listening time compared to a previous study [22]. This finding may be explained not only by improving the prolonged battery life of PLDs and large amount of PLDs' storage space [32], but also by a data collection method. That is, we presented a picture of a clock to collect data on the time spent listening to PLDs to minimize the memory bias of the participants and fluctuations by the day of the week for PLDs usage. For listening level, which is a pivotal factor for hearing loss [8], about a third of the middle and high school students selected more than 70 dB as PLL. However, considering that the PLL was measured in a quiet environment in this study, it is expected that most adolescents expose to loud noise level during daily life. The mean PLL in this study were lower than results from Malaysia adolescents using in-ear earphones [22]; and Israel girls with ear-bud earphones [10]. The difference among studies may reflect the actual listening level, but it might be related to the difference in earphone type. PLL decreased significantly as the location of the earphones was far from the eardrum, in the order of headphones, ear-bud earphones, and in-ear earphones [33].

Among the listening belief constructs, perceived severity showed the highest and perceived barriers were the lowest for both middle and high school students, which was the similar order to the previous study in the United States [21]. That is, adolescents strongly agree that hearing loss will make life uncomfortable. By school level, high school students showed higher perceived susceptibility, perceived barriers, as well as lower perceived benefits and perceived self-efficacy than middle school students. Students with severer hearing symptoms (ear pain, tinnitus, and hearing loss) are known to have more concern about their hearing and negative attitude toward the noise [34]. In this study, those who have a history of ear diseases and perceived change in hearing are higher in high school students than middle school students, which seems to be related higher perceived susceptibility in high school students. In addition, high school students became accustomed to loud levels of PLDs with prolonged use, but they have little chances to learn how to prevent MIHL because of lack in educational programs on hearing conservation [35]. According to the serial mediation approach to Health Belief Model, those with exposure to campaign or education to prevent MIHL may perceive fewer barriers, those who perceive fewer barriers may perceive more benefits to prevent MIHL, and those who perceive more benefits may participate in healthy listening behaviors to prevent MIHL [36]. Meanwhile, this study participant felt more susceptible to MIHL than US adolescents in a Portnuff et al.'s study [21], which may be related to cultural difference. Adolescents in the United States expose more diverse noise sources not only music and leisure activities but also shooting/use of firearms and lawn mowing [37], and may feel less susceptible to hearing loss because of listening to music. However, considering the poor internal consistency of perceived susceptibility in this study, and small sample size (n = 26) in Portnuff et al.'s study [21], further studies are recommended to identify the consistency of the findings.

About one in four adolescents perceived change in hearing after PLDs use, which shows higher hearing impairment compared to the 15.6% of health examination in 2016 [11]. However, this study finding depends on the subjective responses, there may be information bias. By school level, high school students had twice as much perceived change in hearing as middle school students. Considering that mean PLL is similar in both groups, it is thought that high school students have been exposed to PLDs for a longer period than middle school students. Regardless of the school level, perceived change in hearing was consistently related to perceived barriers to MIHL. Those who perceive higher barriers to prevent MIHL showed a higher possibility to experience a decrease in hearing after PLDs use. Perceive barriers as one of the components of the Health Belief Model has been used to explain the relation to health behaviors [19,20], and it has been reported that perceived barriers to prevent MIHL is related to PLL in adolescents [21]. In a study with adolescents in Sweden, the barriers to prevent hearing loss can affect the hearing protective behaviors such as use of hearing protector devices [38]. In four meta-analyses assessing the relation between the constructs in the Health Belief Model and health behaviors, perceived barriers have consistently shown as one of the most powerful single related factors to preventive health behaviors [36], and also known to be a related factor to PLL among adolescents [21]. However, few studies have directly investigated the relationship between perceived barriers and a health problem such as hearing loss. As health behaviors are well known to be important to prevent health problems, we can assume that perceived barriers affect health behavior, which in turn affects health problem. That is, the higher adolescents perceive barriers to prevent MIHL, a the lower they do preventive health behaviors such as safe listening level or short-term listening to music, which may result in decrease in hearing. Therefore, hearing conservation programs should include educational interventions to inform them how to overcome the barriers to prevent MIHL. That is, when students were not sure about how to keep their listening level safe in noisy places, they can learn the knowledge and skills on how to overcome barriers through education and apply them in noisy places.

Meanwhile, perceived susceptibility also is one of the important factors of preventive health behaviors [36], and it is known that as the perceived susceptibility increases, the likelihood of taking preventive actions increases [19]. However, in this study, as perceived susceptibility increases, the likelihood of decrease in hearing increases, which is opposite to what we can expect based on the relationship between perceived barriers and change in hearing. This finding may be explained that adolescents who had a higher level of susceptibility to MIHL perceived the change in hearing well. Or, adolescents who have already experienced a decrease in hearing because of listening to loud music perceived the vulnerability to MIHL more than their counterparts [34,39].

Strength and limitations

To the best of our knowledge, studies to investigate PLDs usage habits, listening belief, and their relation to change in hearing among adolescents are currently very limited both domestically and abroad. In particular, this study was the first attempt to measure listening belief using tools that are systematically developed based on the Health Belief Model [19,21] and how it related to perceived change in hearing among adolescents in Korea. And, as we tried to subgroup analysis by school level, these findings can provide basic data to understand their PLDs usage habits and prepare effective interventions for middle and school students. PLL was measured by selecting a volume setting during listening to music. This measurement may have more accurate than other subjective method using a 10-point visual analog scale that the participants experienced difficulties in using during pilot tests. However, this study has several limitations, and needs to have a careful approach in interpreting the results. First, as this study collected data by self-reported questionnaire, it was possible for them to respond in a positive direction. However, it may be minimized by explaining confidentiality during acquiring assent, and by answering a questionnaire individually in a quiet environment. Second, the listening time was intended to improve the accuracy of the answers by presenting a picture of a clock and displaying the time when listening to PLDs, but the risk of recall bias remains. In addition, the listening time per week was calculated as the product of listening days per week, and listening hours per day, which were measured the average amount of time spent listening to PLDs every day for the past week. Although the listening time of adolescents may be different between weekdays with school and weekends without school, we could not adjust this difference to measure the listening time per week. Third, PLL was measured subjectively and in a quiet environment where the background noise was from 45 to 53 dB. So PLL may be less accurate than objective measurements and the actual listening levels may be underestimated. Last, the participants recruited in one region have limitations in generalizability to adolescents in other regions. Last, as this study was performed by a cross-sectional design, it is hard to confirm the temporality and a causal relationship.

Clinical implications

Several interventions such as education, use of hearing protection, and noise control have been identified as components of hearing conservation programs in occupational settings, education is the first step and one of the most important parts of hearing conservation programs for adolescents [34]. Danhauer et al. [40] addressed a hearing conservation program such as hearing health and safe PLDs use for high school students and stated that it should be mandatory education during health classes to prevent hearing loss due to MP3s in the United States. However, considering that none of the contents of the high school health textbooks, developed after the 2015 revised curriculum in Korea, were related to hearing protection [35], the results of this study remind us of the need for hearing protection training for adolescents and are expected to help in preparing effective educational interventions.

Conclusion

The majority of adolescents are exposed to PLDs from their early teens and about a quarter experienced a decrease in hearing after PLDs use. In particular, high school students experience decrease in hearing twice more than middle school students. Therefore, educational programs on hearing conservation are required to start as early as in various levels of schools from elementary to high schools. Particularly, as adolescents with higher perceived barriers to prevent MIHL show higher likelihood of decrease in hearing, knowledge, and skills to overcome barriers should be emphasized in educational programs.

Conflict of interest

The authors declare no conflicts of interest.

Characteristics	Categories	n(%) or mean ± SD	X^2/Z^a	p

Total (n = 416)	Middle school students (n = 183)	High school Students (n = 233)	General characteristics			
Gender	Boys	203 (48.8)	93 (50.8)	110 (47.2)	0.53	.465
Girls	213 (51.2)	90 (49.2)	123 (52.8)			History of ear diseases
	335 (80.5)	135 (73.8)	200 (85.8)	9.52	.002	PLD use habits
Type of PLDs	Smartphone	404 (97.1)	179 (97.8)	225 (96.6)	0.57	.450
(multiple responses)	Laptop/Desktop	162 (38.9)	64 (35.0)	98 (42.1)	2.17	.141
	Tablet PC	69 (16.6)	32 (17.5)	37 (15.9)	0.19	.662
	MP3 player	24 (5.8)	13 (7.1)	11 (4.7)	1.07	.301
Number of PLDs	Mean ± SD	1.58 ± 0.66	1.57 ± 0.67	1.59 ± 0.66	−0.38	.713
First time to use PLDs	Before ES	32 (7.7)	11 (6.0)	21 (9.0)	17.75	<.001
	ES 1 to 3	160 (38.5)	75 (41.0)	85 (36.5)		
	ES 4 to 6	187 (44.9)	92 (50.3)	95 (40.8)		
	Middle school	37 (8.9)	5 (2.7)	32 (13.7)		
Period of PLDs use (years)	Mean ± SD	5.06 ± 2.48	3.52 ± 1.86	6.26 ± 2.22	−11.10	<.001

Place of PLDs use	On the road	238 (57.2)	98 (53.6)	140 (60.1)	1.79	.181
(multiple responses)	At school	93 (22.4)	21 (11.5)	72 (30.9)	22.28	<.001
	At home	367 (88.2)	162 (88.5)	205 (88.0)	0.03	.865
	Others	173 (41.6)	70 (38.3)	103 (44.2)	1.50	.221
Headphone type	In-ear	341 (82.0)	147 (80.3)	194 (83.3)	0.81	.666
	Over-ear	48 (11.5)	24 (13.1)	15 (6.4)		
	Earbud	27 (6.5)	12 (6.6)	24 (10.3)		
Listening time (hours per week)		18.00 ± 17.08	15.34 ± 14.92	20.14 ± 18.42	−2.50	.012
Preferred listening level	≤70	277 (66.6)	125 (68.3)	152 (65.2)	1.61	.448
(dB)[b]	>70, <85	114 (27.4)	50 (27.3)	64 (27.5)		
	≥85	25 (6.0)	8 (4.4)	17 (7.3)		
	Mean ± SD	70.13 ± 8.01	70.57 ± 6.55	69.79 ± 9.00	1.73	.083
Listening belief						
Perceived susceptibility to MIHL		5.18 ± 1.12	5.02 ± 1.15	5.31 ± 1.07	−2.78	.005
Perceived severity of MIHL		6.44 ± 0.86	6.44 ± 0.79	6.44 ± 0.91	−1.39	.165
Perceived benefit to prevent MIHL		5.86 ± 0.87	5.98 ± 0.82	5.77 ± 0.90	−2.10	.036
Perceived barriers to prevent MIHL		3.40 ± 1.52	3.02 ± 1.39	3.70 ± 1.54	−4.35	<.001

Perceived self-efficacy to prevent MIHL		5.48 ± 1.09	5.65 ± 1.02	5.34 ± 1.12	2.89	.004
Outcome variable						
Perceived change in hearing	No change	315 (75.7)	157 (85.8)	158 (67.8)	18.03	<.001
	Decreased	101 (24.3)	26 (14.2)	75 (32.2)		

Characteristics		Total (n = 416) n (%) or mean ± SD		X^2/Z^a	p	Middle school students (n = 183) n (%) or mean ± SD		X^2/Z^a	p	High school students (n = 233) n (%) or mean ± SD		X^2/Z^a	p
No change	Decreased	No change	Decreased	No change	Decreased	General characteristics							
Gender	Boys	163 (51.7)	40 (39.6)	4.51	.034	82 (52.2)	11 (42.3)	0.88	.349	81 (51.3)	29 (38.7)	3.24	.072
	Girls	152 (48.3)	61 (60.4)			75 (47.8)	15 (57.7)			77 (48.7)	46 (61.3)		
History of ear diseases		246 (78.1)	89 (88.1)	4.90	.027	113 (72.0)	22 (84.6)	1.84	.175	133 (84.2)	67 (89.3)	1.11	.292
PLDs use habits													

Number of PLDs	1.57 ± 0.66	1.64 ± 0.67	−1.10	.270	1.55 ± 0.66	1.73 ± 0.72	−1.28	.202	1.58 ± 0.66	1.61 ± 0.66	−0.41	.686
Period of PLDs use (yrars)	4.84 ± 2.49	5.72 ± 2.33	−3.09	.002	3.48 ± 1.91	3.77 ± 1.56	−0.84	.400	6.20 ± 2.25	6.40 ± 2.17	−0.68	.499
PLDs use on the road	174 (55.2)	64 (63.4)	2.06	.151	81 (51.6)	17 (65.4)	1.71	.192	93 (58.9)	47 (62.7)	0.31	.579
In-ear type headphone	255 (81.0)	86 (85.1)	0.91	.340	125 (79.6)	22 (84.6)	0.35	.553	130 (82.3)	64 (85.3)	0.34	.560
Listening time (h/wk)	17.21 ± 16.49	20.45 ± 18.69	−1.53	.126	14.36 ± 13.31	20.71 ± 21.37	−1.32	.187	20.04 ± 18.75	20.36 ± 17.82	−0.37	.709
Preferred listening level (dB)[b]	69.58 ± 7.67	71.85 ± 8.81	−2.19	.029	70.31 ± 6.37	72.10 ± 7.45	−1.17	.241	68.86 ± 8.74	71.76 ± 9.27	−2.29	.022
Listening beliefs												
Perceived susceptibility to MIHL	5.09 ± 1.17	5.47 ± 0.87	−2.66	.008	4.95 ± 1.19	5.45 ± 0.78	−1.98	.048	5.24 ± 1.14	5.47 ± 0.91	−1.30	.194

Perceived severity of MIHL	6.45 ± 0.90	6.41 ± 0.71	−1.60	.109	6.44 ± 0.83	6.44 ± 0.45	−1.23	.219	6.46 ± 0.98	6.40 ± 0.78	−1.47	.141
Perceived benefit to prevent MIHL	5.92 ± 0.89	5.69 ± 0.80	−2.54	.011	6.00 ± 0.87	5.85 ± 0.49	−1.44	.151	5.84 ± 0.91	5.63 ± 0.87	−1.66	.097
Perceived barriers to prevent MIHL	3.12 ± 1.49	4.26 ± 1.27	−6.49	<.001	2.85 ± 1.36	4.07 ± 1.10	−3.92	<.001	3.40 ± 1.55	4.33 ± 1.32	−4.27	<.001
Perceived self-efficacy to prevent MIHL	5.62 ± 1.05	5.03 ± 1.08	−4.55	<.001	5.69 ± 1.05	5.45 ± 0.82	−1.30	.194	5.55 ± 1.05	4.89 ± 1.13	−4.06	<.001

Characteristics	Total (n = 416) OR (95% CI)			Middle school students (n = 183) OR (95% CI)			High school students (n = 233) OR (95% CI)		
Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	General characteristics
Boys	0.65 (0.41–1.02)	0.64 (0.40–1.03)	0.67 (0.40–1.12)	0.74 (0.32–1.74)	0.56 (0.20–1.55)	0.68 (0.23–2.03)	0.61 (0.35–1.07)	0.57 (0.32–1.01)	0.61 (0.33–1.14)
History of ear diseases	1.95 (1.00–3.79)*	1.73 (0.87–3.42)	1.41 (0.67–2.96)	2.01 (0.65–6.26)	1.85 (0.57–5.97)	1.74 (0.45–6.75)	1.52 (0.65–3.56)	1.51 (0.63–3.63)	1.30 (0.50–3.36)
PLDs use habits									

Number of PLDs		1.09 (0.77–1.54)	1.12 (0.76–1.63)		1.22 (0.65–2.27)	1.23 (0.62–2.43)		1.08 (0.70–1.67)	1.08 (0.68–1.71)
Period of PLDs use (yr)		1.11 (1.01–1.23)*	1.09 (0.98–1.22)		0.95 (0.73–1.24)	0.93 (0.69–1.26)		1.02 (0.89–1.16)	1.06 (0.92–1.23)
PLDs use on the road		1.18 (0.71–1.95)	1.19 (0.69–2.06)		1.50 (0.59–3.83)	1.51 (0.53–4.30)		1.19 (0.63–2.22)	1.12 (0.56–2.22)
In-ear type headphone		1.08 (0.57–2.08)	1.03 (0.51–2.08)		0.96 (0.27–3.36)	0.88 (0.22–3.63)		1.08 (0.49–2.38)	1.05 (0.45–2.44)
Listening time (h/wk)		1.00 (0.99–1.02)	1.00 (0.99–1.02)		1.02 (0.99–1.05)	1.02 (0.99–1.05)		0.99 (0.98–1.01)	1.00 (0.98–1.01)
Preferred listening levels (dB)[a]		1.03 (1.00–1.06)*	1.01 (0.98–1.05)		1.03 (0.96–1.11)	1.01 (0.94–1.08)		1.04 (1.01–1.07)*	1.02 (0.98–1.06)
Listening belief									
Perceived susceptibility to MIHL			1.83 (1.36–2.47)***			1.99 (1.15–3.45)*			1.65 (1.14–2.39)**
Perceived severity of MIHL			0.69 (0.48–0.98)*			0.67 (0.31–1.45)			0.73 (0.48–1.11)
Perceived benefit to prevent MIHL			0.88 (0.63–1.23)			0.82 (0.41–1.65)			0.94 (0.63–1.39)

Perceived barriers to prevent MIHL			1.58 (1.30–1.93)***			2.05 (1.37–3.01)***			1.35 (1.06–1.72)*
Perceived self-efficacy to prevent MIHL			0.77 (0.58–1.01)			0.95 (0.55–1.66)			0.70 (0.50–0.97)*
Nagelkerke R^2	.03	.08	.26	.02	.08	.28	.03	.06	.21

DETAILS

Subject:	Music; Smartphones; Ear diseases; Leisure; Hearing protection; Questionnaires; Variables; Girls; Tinnitus; Listening; Noise; Middle school students; Children &youth; Middle schools; Medical screening; Secondary schools; Secondary school students; Teenagers; Hearing loss
Business indexing term:	Subject: Smartphones
Identifier / keyword:	adolescent; auscultation; behavior; hearing loss
Publication title:	Asian Nursing Research; Seoul
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Document 12 of 29

Psychological Resilience of Second-Pregnancy Women in China: A Cross-sectional Study of Influencing Factors

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ProQuest document link

ABSTRACT (ENGLISH)

Purpose

The aim of the study was to evaluate the status of psychological resilience among women in their second pregnancy and to investigate the possible influencing factors.

Methods

A total of 275 women in their second pregnancy and who met the criteria were surveyed from two public hospitals in China from July 2018 to January 2019. The instruments included the General Self-designed Questionnaire, Connor–Davidson Resilience Scale, Social Support Rate Scale, and 36-item Pregnancy Stress Rating Scale.

Results

The total psychological resilience score of second-pregnancy women was relatively low. Multivariate regression analysis identified five factors associated with psychological resilience: intimacy with husbands, social support utilization, gender of the first child, high-risk pregnancy of the first child, and the stress caused by worrying about the health and safety of the mother and fetus.

Conclusion

Women in their second pregnancy represent a unique population, and their low psychological resilience score deserves attention. Identification of factors contributing to decreased psychological resilience may enable us to design prevention and intervention strategies and to deliver specific psychological supports to pregnant women at high risk of developing negative psychology.

FULL TEXT

DETAILS

Subject:	Parents &parenting; Physiology; Womens health; Maternal &child health; Social support; Stress; Mental disorders; Families &family life; Mental depression; Mental health; Pregnancy complications; Family structure; Pregnancy; Anxiety
Location:	China
Identifier / keyword:	factor analysis, statistical; pregnancy; psychology; resilience, psychological
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Document 13 of 29

The Adaptation of the Buddhist Death Acceptance Scale for Vietnamese Persons with Cancer

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ProQuest document link

ABSTRACT (ENGLISH)

Purpose

This study reports on selected psychometric properties of the adapted Buddhist Death Acceptance Scale (BDAS) for Vietnamese persons with cancer.

Methods

The original 13-item BDAS was developed based on Buddhist perspectives toward death and life and was translated from Thai into Vietnamese. Item content checking with five Vietnamese local experts suggested three items of the original BDAS were irrelevant in Vietnamese culture and hence should be excluded. Psychometric properties of the 10-item BDAS Vietnamese version were tested using a convenience sample of 193 Vietnamese Buddhists with cancer.

Results

The internal consistency coefficient of the scale was found to be 0.73. Exploratory factor analysis showed that the 10 items of the BDAS Vietnamese version constituted 2 factors, explaining 51.1% of the variance of death acceptance. The first factor was "acceptance of natural process of death" and the second was "preparing for death." Both factors reflected explicitly Buddhist viewpoints toward death acceptance and were consistent with the original Thai BDAS.

However, although similar factors were found, some items in the Vietnamese BDAS did not load to same factors as in the Thai BDAS.

Conclusions

The BDAS Vietnamese version provides an initial suitable measurement for death acceptance among Vietnamese Buddhists. Its availability will enable cross-cultural research to investigate death acceptance among Buddhist patients with cancer in Vietnam. However, the differences in item loadings between the Thai and Vietnamese scales suggest that further conceptual and empirical works to refine the measurement are needed.

FULL TEXT

DETAILS

Subject:	Cancer; Patients; Buddhists; Quantitative psychology; Buddhism; Nurses; Death &dying
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Effects of Mind–Body Programs on Infertile Women: A Systematic Review and Meta-analysis of Randomized Controlled Trials

Ju-Young, Ha; Seon-Hwa Ban

ProQuest document link

ABSTRACT (ENGLISH)

summaryPurpose

This study was to systematically review randomized controlled trials and conduct a meta analysis. The results of randomized controlled trials were integrated and analyzed to assess the effects of mind-body programs on anxiety, depression, quality of life, and pregnancy rate in infertile women.

Methods

Using electronic databases (i.e., Research Information Sharing Service, Korean Studies Information Service System, Korean Medical Database, National Digital Science Library, Cochrane Library, PubMed, EMBASE, Cumulative Index to Nursing and Allied Health Literature, and PsycARTICLES), 10 of 2,259 studies were included for meta-analysis. To estimate the effect size, a meta-analysis of the studies was performed using RevMan 5.3.

Results

The mind–body program was effective in relieving anxiety [standardized mean difference (SMD) = −3.44; 95% confidence interval (CI) = −5.94, −0.95; *p* = .007; I2 = 69%] and depression (SMD = −5.79; 95% CI = −10.36, −1.22; *p* = .010; I2 = 86%). Furthermore, it was effective in enhancing the quality of life (SMD = 7.40; 95% CI = 2.92, 11.88; *p* = .001; I2 = 53%) and pregnancy rate (SMD = 2.06; 95% CI = 1.08, 3.95; *p* = .030; I2 = 73%). The mind–body program was found to relieve anxiety and depression in infertile women and improve their quality of life, thereby positively affecting the pregnancy rate.

Conclusion

The mind-body program was found to relieve anxiety and depression in infertile women and improve their quality of life, thereby positively affecting the pregnancy rate. The mind-body program needs to be considered to a wider audience for positive effects on emotions and pregnancy outcomes of infertile women.

FULL TEXT

Introduction

While 12.1% of 10,625 married women aged 15–49 years in Korea experienced infertility [1], the number of women diagnosed with infertility increased from 178,000 in 2007 to 198,000 in 2010 and 221,000 in 2016 [2]. In addition to the increase in the number of infertile women, the cost of medical treatment for infertility has more than doubled from 43.42 billion in 2017 to 115.03 billion in 2018 [3]. Despite the increase in the cost of infertility treatment, Korea has a low birth rate, with a total pregnancy rate of 0.92 in 2019 [4].

The emotions that infertile women experience include depression, anxiety, and stress [5], and the increase in these negative emotions can cause a threat to their quality of life [6]. In particular, infertility treatment is a major stressor, comparable with death in the family or divorce [7], and if the procedure fails, depression and anxiety increase to a higher level, remaining high even after 6 months of treatment [8]. Furthermore, because the stress and anxiety experienced by infertile women have a significant effect on their pregnancy rate after fertility treatment [9], it is necessary to take care of these negative emotions actively; this may contribute to enhancing their pregnancy rate.

To alleviate the negative emotions of infertile women and improve their quality of life, various psychosocial interventions have been conducted, including counseling interventions, focused educational interventions, and comprehensive educational programs [10]. The effects of these interventions on anxiety and depression, but not on women's pregnancy rates, were confirmed [10]. However, studies applying the mind–body program for infertile women such as those by Domar et al [11,12] have shown results with significant impact on improvement on pregnancy rate and alleviation of negative emotions. Since then, many countries such as Turkey, China, Iran, Brazil, and Israel are applying the mind–body program for treating infertile women. Mind–body interventions are defined as practices that focus on the interactions among the brain, mind, body, and behavior, with the intent to use the mind to affect physical functioning and promote overall health [13]. As per the National Center for Complementary and Integrative Health, it compasses a large group of therapies such as meditation, tai chi, yoga, and relaxation techniques (progressive relaxation, guided imagery, biofeedback, self-hypnosis, deep breathing exercises, and autogenic training) [14]. Hypnosis, meditation, yoga, biofeedback, tai chi, and visual imagery, which are included in the mind–body program, induce relaxation and enhance the mind's interaction with bodily function, which are considered to positively affect the cognitive, psychological, and physiological aspects in infertile women by causing relaxation in the relationship among the brain, mind, body, and behavior [15,16].

Hämmerli et al [17] conducted a meta-analysis by combining a total of 21 studies including cognitive behavioral therapy, mind–body intervention, counseling, education, and supportive therapy as psychosocial intervention and reported that these interventions did not have any significant effect on alleviation of negative emotions such as anxiety and depression [17]. On the other hand, Frederiksen et al [18] conducted a meta-analysis by combining a total of 39 studies including counseling, cognitive behavioral therapy, mind–body intervention; meditation, hypnosis, breathing, and muscle relaxation; psychoeducation, supportive therapy, and writing intervention as psychological intervention and reported that these interventions caused a significant effect on alleviation of negative emotions such as anxiety and depression, hence showing contrasting results [18] from those of the study by Hämmerli et al [17]. Moreover, both studies conducted by Hämmerli et al [17] and Frederiksen et al [18] targeted both infertile women and men and conducted an analysis by combining various types of psychosocial interventions apart from the mind–body program and also included not only randomized controlled trials (RCTs) but also non-RCTs for analysis. Recently, systematic literature reviews [19] about mind–body intervention for infertile women have been conducted, but as RCTs, non-RCTs, and uncontrolled trials were analyzed altogether, a strict control of confounding variables has not been implemented. In addition, as only the individual effect size of each study is suggested, grasping the synthesized effect size and difference of the studies included in the analysis is limited.

Therefore, this study defined the mind–body program as mediation that includes hypnosis, meditation, yoga, biofeedback, tai chi, and imagery, which have been mentioned in the definition of the mind–body program, or practices with confirmed relaxation effects such as relaxation and breathing techniques and qigong, and this study systematically reviewed RCTs in which mind–body programs were conducted for infertile women. Furthermore, a meta-analysis was performed to assess the effects of mind–body programs on alleviating negative emotions such as anxiety and depression in infertile women and improving their quality of life, along with their effect on pregnancy rates in infertile women, which is expected to provide a basis for possible interventions for infertile women.

The specific objectives are as follows: (1) assess the effect of mind–body programs on anxiety, depression, and quality of life in infertile women and (2) assess the effect of mind–body programs on pregnancy rates in infertile women.

Methods

This is a systematic literature review and meta-analysis, wherein the results of RCTs are integrated and analyzed to investigate the effects of mind–body programs on anxiety, depression, quality of life, and pregnancy rate in infertile women.

Core questions

This study used a PICO-SD (Participants, Intervention, Comparison, Outcomes, Study Design) tool as follows: (1) Population (P), infertile women; (2) Intervention (I), mind–body programs [16,19] (i.e., interventions including meditation, yoga, relaxation and breathing techniques, tai chi, qigong, hypnosis, and biofeedback); (3) Comparison (C), no treatment control group or a placebo group or an alternative group; (4) Outcome (O), anxiety, depression, quality of life, and the pregnancy rate; and (5) Study Design (SD), RCTs.

Search strategy and study selection

Data search was conducted from January 1, 2020, to April 1, 2020, and data were collected for the purpose of analyzing the effectiveness of mind–body programs in infertile women. Using a search engine, domestic studies were searched in the following databases: Research Information Sharing Service, Korean Studies Information Service System, Korean Medical Database, and National Digital Science Library. In addition, entire journals were searched using the websites of nursing-related societies such as the Korean Society of Nursing Science, Korean Society of Adult Nursing, Korean Society of Women Health Nursing, and Korean Academy of Community Health Nursing. International studies were searched in the Cochrane Library, PubMed, EMBASE, Cumulative Index to Nursing and Allied Health Literature, and PsycARTICLES. Keyword selection and search included both medical subject headings (MeSH) and life science term indexes (EMBASE TREE; EMTREE). The target keywords included “Infertility” [MeSH], “Infertile women,” “infertile*,” “Sperm Injections,” “Intracytoplasmic” [MeSH], “ICSI,” “Intracytoplasmic sperm injection,” “Fertilization in Vitro” [MeSH], “IVF” “In vitro fertilization,” “Infertility treatment,” “Assisted reproductive technologies,” and “ART.” Intervention keywords included “Mind-body,” “Body-Mind-Sprit,” “Mindfulness,” “Mindful*,” “Yoga.” “Meditation,” “Relaxation,” “Psychological” [MeSH], “Psycho-social,” “Breathing,” “Tai chi,” “Qigong,” “Hypnosis,” and “Biofeedback.” Outcome variables included “Depression” [MeSH], “Depress*,” “Anxiety” [MeSH], “Anxiety,” “Stress,” “Emotion,” “Quality of life,” “Wellbeing,” “Psycho*,” “Psychia*,” and “Pregnancy rate” or “pregnant,” along with the AND connector for each subject. To search all the researched studies, there was no limit set for the research period, but the studies were limited to human participants, and the language was limited to Korean and English. For domestic studies, the keywords included “Infertility,” “In vitro fertilization,” “Body and mind treatment,” “Mindfulness,” “Yoga,” “Meditation,” “Depression,” “Anxiety,” “Stress,” “Quality of life,” “Well-being,” “Psychology,” and “Emotion.”

The inclusion criteria for the literature were as follows: (1) intervention studies conducted using a mind–body program for infertile women, (2) RCTs, and (3) studies published in English or Korean in a peer-reviewed journal. The exclusion criteria were as follows: (1) unpublished theses, (2) case studies, (3) literature reviews, and (4) pilot studies that were not followed by main studies.

In this study, articles were selected based on core questions and the inclusion and exclusion criteria listed previously. The selection process was described step by step using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart [20]. In the first search, 3,726 studies published in English were found in PubMed (619), Cochrane Library (82), Cumulative Index to Nursing and Allied Health Literature (2,943), and EMBASE (82), but Korean studies on the subject were not found, although searches were made in Research Information Sharing Service, National Digital Science Library, Korean Studies Information Service System, and

Korean Medical Database. In total, 1,467 duplicates were excluded through RefWorks, resulting in a total of 2,259 studies. Subsequently, after they were reviewed with a focus on the title and abstract based on the data inclusion and exclusion criteria, 1,745 studies whose topics were not appropriate for the research topic and 406 duplicated studies were excluded. After a careful reading of the full text of the article in detail, 91 studies and seven reviews did not meet the inclusion criteria, which led to the final inclusion of 10 studies (Figure 1).

Two researchers conducted data selection and review, and they also checked the results after their respective reviews. In case of disagreement between the researchers in this process, a research meeting was convened so that the study in question could be reviewed together.

Quality assessment of the selected studies

The quality of the selected studies was evaluated using a revised tool for assessing risk of bias (RoB) 2.0 (The Cochrane Collaboration, England, London) [21] (Figure 2). RoB 2.0 consists of five domains: “randomization process,” “deviations from intended interventions,” “missing outcome data,” “measurement of the outcome,” and “selection of the reported result,” which are evaluated as “low risk of bias,” “high risk of bias,” or “some concerns” [22]. Studies were graded as follows: (1) “low risk of bias” when a low risk of bias was determined for all domains, (2) “some concerns” if at least one domain was assessed as raising some concerns but not at high risk of bias for any single domain, or (3) “high risk of bias” when high risk of bias was reached for at least one domain or the study judgment included some concerns in multiple domains [22]. The evaluation of the quality of the selected studies was assessed independently by two researchers, and regarding the categories that were not in agreement, the relevant studies were evaluated together until a consensus was reached to draw a conclusion and entered into RevMan (The Cochrane Collaboration, England, London) to present the evaluation results for the risk [23].

Data analysis

The characteristics of the studies included in the systematic literature review were analyzed, and data were selected based on the author, the year of publication, the country of publication, the number of samples, the method used and number of interventions for experimental and comparative groups, and the outcome variables.

The effect size and homogeneity of the interventions in the selected studies were analyzed using RevMan 5.3 version of the Cochrane Collaboration. Heterogeneity for the main variables was tested using the Chi-square null hypothesis test. When I^2 is 0%, it means no heterogeneity; when I^2 is 30–60%, it means moderate heterogeneity, and when I^2 is ≥75%, it means high levels of heterogeneity [21]. In this study, quality of life with a heterogeneity of 0% was analyzed using a fixed-effects model. Variables with a heterogeneity of >60%, including anxiety, depression, and pregnancy rates, were analyzed using a random-effects model. A forest plot was used to confirm the direction of the effect and the confidence interval (CI), and the effect size of the result value was represented by standardized mean difference in case of continuous data such as anxiety, depression, and quality of life and by odds ratio, which is the ratio between the occurrence and nonoccurrence of specific events between groups, in case of binary data such as pregnancy rate. The statistical significance level for effect size was .05, and the CI was set at 95%. Fixed-effects and random-effects models were compared for each variable to conduct sensitivity analysis. Analysis was conducted to identify the differences in results, excluding studies with a large effect size or larger weights compared with other studies included in analysis. Finally, funnel plot analysis was used to examine publication bias to test the validity of the entire study. Egger's regression test was carried out to evaluate the relationship between the effect size and the standard error [24] to check the significance of asymmetry. Regarding the suspicion of publication bias, the trim-and-fill method [25] was used to reanalyze the method to verify its severity. It can eliminate nonsymmetric effect sizes from funnel plot analysis. Afterward, it fills the left and right sides of polled effect sizes symmetrically [25].

Results Characteristics of the selected studies

The characteristics of the studies are indicated in Table 1.

A total of 10 studies were included, and the countries wherein these were conducted are as follows: Israel, four (40%) studies; China, two (20%) studies; Iran, two (20%) studies; and Brazil and Taiwan, one (10%) study, each. The publication years of the studies are as follows: 2000–2010, four (40%) studies and 2010 onward, six (60%) studies. With regard to the number of samples, there were two studies (20%) with ≤100 participants, were six (60%)

studies with 100–200 participants, was one (10%) study with 200–300 participants, and was one (10%) study with >300 participants. In terms of the number of interventions, there were two (20%) studies with 14 interventions, four (40%) with 10 interventions, two (20%) with eight interventions, and two (20%) with four interventions. With regard to the forms of intervention provision, there were eight (80%) studies with groups and two (20%) with individuals. In the measurement variables, there were five (50%) studies on anxiety, four (40%) on depression, five (50%) on pregnancy rates, and two (20%) on quality of life. In all the ten studies, the control groups received routine care.

Quality assessment of the selected studies

The methodological quality evaluation of the ten studies using RoB 2.0 indicated seven (70%) studies that had a low risk of bias with an appropriate method of random assignment. Relevant information on the proper methods of random assignment was not identified in three (30%) studies. There were five (50%) studies in which the assignment order was concealed through sealed envelopes, random numbers, and computer programs, and for the remaining five studies (50%), the appropriateness could not be identified because no clear method was described for concealing the assignment order. All ten studies evaluated baseline differences between intervention groups, which did not matter in the randomization process. Based on the aforementioned results, five studies were evaluated as “low risk of bias” in the randomization process and five studies were evaluated as “some concerns.”

Regarding the area of “deviations from intended interventions,” none of the studies clearly indicated blinding of the research participants and researchers, and ten (100%) studies did not explicitly state the blinding of the participants and researchers. There were five (50%) studies that described the blinding of the result evaluator and five (50%) that did not clearly indicate the blinding of the evaluator.

It was not possible to determine whether blinding of participants, researchers, or evaluators affected the results owing to unclear blinding or whether bias occurred in the study. Based on the aforementioned results, all ten studies were evaluated as “some concerns” in “deviations from intended interventions.”

In the domain of “missing outcome data,” five studies showed no missing data and were evaluated accordingly as “low risk of bias,” and five studies were evaluated as “some concerns” because it was not possible to obtain clear information on whether data excluded from analysis such as missing data affected the existence of bias.

In terms of “measurement of the outcome,” methods of measuring the outcome were appropriate in all ten studies, and measurement or ascertainment of the outcome did not show any difference between intervention groups, which led to an evaluation of all ten studies as “low risk of bias.”

In terms of “selection of the reported result,” all ten studies were analyzed based on a prespecified analysis plan and evaluated as “low risk of bias.”

The overall risk of bias generally corresponds to the worst risk of bias in any of the domains [[22]]. Considering the aforementioned results together, all ten studies were evaluated as “some concerns” in terms of the overall risk of bias.

Effects of the mind–body program Effects of the mind–body program on anxiety

For five studies that reported anxiety in the experimental and control groups participating in the mind–body program, the homogeneity test showed Q (Chi-square) = 12.81, df = 4 (*p* = .010), and I^2 = 69%. The effect size of anxiety was −3.44 (95% CI: −5.94, −0.95), and the anxiety between the experimental group and the control group showed a statistically significant difference (Z = 2.70, *p* = .007).

Effects of mind–body programs on depression

Based on our examination of four studies reporting depression in the experimental and control groups participating in the mind–body program, the homogeneity test showed the following results: Q (Chi-square) = 21.30, df = 3 (*p* 2 = 86%. The effect size of depression was −5.79 (95% CI: −10.36, −1.22), and the difference in depression between the two groups was statistically significant (Z = 2.48, *p* = .010).

Effects of mind–body programs on quality of life

For two studies that reported the quality of life of the experimental and control groups participating in the mind–body program, the homogeneity test showed Q (Chi-square) = 2.13, df = 1 (*p* = .140), and I^2 = 53%. The effect size of quality of life was 7.40 (95% CI: 2.92, 11.88), and the quality of life between the two groups showed a statistically significant difference (Z = 3.24, *p* = .001) (Figure 3).

Effects of mind–body programs on pregnancy rate

For five studies that reported the pregnancy rate of the experimental and control groups participating in mind–body programs, the homogeneity test showed Q (Chi-square) = 14.87, df = 4 (*p* = .005), and I^2 = 73%. The effective size of the pregnancy rate was 2.06 (95% CI: 1.08, 3.95), and there was a statistically significant difference between the experimental and control groups (Z = 2.19, *p* = .030).

Sensitivity analysis

Comparison of random-effects models that form the wider CI with a fixed-effects model to conduct sensitivity analysis revealed that the results of anxiety, depression, quality of life, and pregnancy rates showed no significant difference. The analysis was conducted with studies that analyzed anxiety except for the study by Chan (2006) [A2], with the largest weight among five studies. It showed that the effect size increased from −3.44 to −4.42, and the mind–body program was found to be significantly effective in relieving anxiety (*p* p = .008). Analysis except for that by Kalhori (2020) [A10], which had the largest effect among four studies that analyzed depression, showed that the effect size decreased from −5.79 to −3.58, and the mind–body program was significantly effective with regard to depression (*p* = .010). Analysis except for that by Domar (2000b) [A5], which had the largest effect among five studies that analyzed pregnancy rates, showed that the effect size decreased from 2.06 to 1.46, and the mind–body program was effective with regard to pregnancy rates (*p* = .040). It follows from this sensitivity analysis that the result of meta-analysis conducted in this study shows robustness (Figure 3).

Publication bias

Egger's regression test was conducted to objectively test the publication bias. The results showed that depression (*p* = .824) and the quality of life (*p* = .144) had no publication bias. However, anxiety (*p* = .009) and pregnancy rate (*p* = .003) posed the risk of publication bias. Therefore, the trim-and-fill method was carried out. Because three additional studies were added, the adjusted effect size of anxiety was −1.14 (95% CI: −1.92 to −0.37). The adjusted effect size of the pregnancy rate was 0.31 (95% CI: 0.11–0.52), while there was no additional study. The 95% CI for the adjusted effect size was statistically significant for both variables, so it can be interpreted that they were not errors that could affect the results of this study.

Discussion

A systematic review and meta-analysis were conducted to investigate the effects of mind–body programs on anxiety, depression, quality of life, and pregnancy rate in infertile women. Based on the results of systematic literature review, 10 RCT studies that were conducted in China, Taiwan, Iran, Israel, and Brazil were included in the analysis. At least one relaxation technique was confirmed to have been included in each program in all of the 10 selected studies, and the relaxation techniques used included meditation, breathing technique, tai chi exercise, hypnosis, biofeedback, yoga, and autogenic training. The most commonly included relaxation technique was meditation, and mindfulness meditation, in particular, was being used most commonly in intervention. Based on the evaluation of quality of the literature, explanations about concealment of allocation order and randomized allocation were not clear. Thus, evaluating the relevance of the concealment was often impossible, and explanation about blinding researchers and participants was also unclear, indicating the possibility of performance bias. Therefore, future RCT studies must deal with this aspect for improving the quality of the literature.

The results showed that mind–body programs were found to have a significant effect on anxiety, depression, quality of life, and pregnancy rate in infertile women. Regarding anxiety, mind–body programs selected for analysis in this study included relaxation techniques. These relaxation techniques were found to be effective in relieving anxiety in some meta-analyses [26,27] and also had a significant effect on anxiety in this study. Anxiety is a typical negative emotion in infertile women, and it persists until after pregnancy through successful *in vitro* fertilization [8]; hence, an intervention is needed because anxiety increases the chance of uterine artery resistance, leading to negative outcomes, such as childbirth with low birth weight [28]. Therefore, it is necessary to continuously provide a mind–body program that includes relaxation techniques from before pregnancy through pregnancy to relieve anxiety and bring about a positive pregnancy outcome in infertile women.

With regard to depression, the mind–body program is an integrated intervention that affects cognitive, emotional, and physiological factors; mindfulness meditation, which is included in the mind–body program, strengthens cognitive reappraisal [29], promoting the resolution of negative emotions such as depression [30]. Thus, it was found that mind–body programs reduced depression in infertile women. Depression is associated with proinflammatory conditions during pregnancy [31], and depression during pregnancy may increase the chances of preterm delivery [32]. Therefore, to maintain a physically healthy state during pregnancy and prevent high-risk delivery, it is necessary to provide a mind–body program that includes techniques such as mindfulness meditation so that pregnant women can actively use it to relieve their depression.

The results of this study confirm that mind–body programs implemented for infertile women are effective in improving their quality of life. In a meta-analysis wherein the effect of a mind–body program on quality of life in patients with Parkinson disease was assessed, it was found to have a significant effect on improving quality of life [33], similar to our results. In the study by Kim and Shin [34], in which a model of quality of life was developed for infertile women, depression was the most influential factor affecting the quality of life of infertile women [34]. Because this study showed a significant reduction in depression through mind–body programs, this effect might have positively affected their quality of life. However, there were very few studies in the literature selected in this study that measured quality of life as an outcome variable, and studies that measured quality of life using subjective well-being tools were included. Thus, future studies must investigate the effect of the mind–body program on the quality of life of infertile women.

The results of this study showed that mind–body programs have a significant effect on the actual pregnancy rate and subjective emotions such as anxiety, depression, and quality of life. The increase in depression in infertile women is associated with a low pregnancy rate [35]. Therefore, there is a significant difference in depression between women who are successful and those who are not after *in vitro* fertilization [36]. Relieving negative emotions seems to influence women's pregnancy rate. In addition, the quality of life of infertile women was found to be significantly related to the success rate of *in vitro* fertilization procedures [37], so the improvement of quality of life in infertile women through the mind–body program seems to have affected their pregnancy rate. However, in the literature included in the present study, it was difficult to identify the actual effects of anxiety, depression, and quality of life on pregnancy rate; therefore, there is a need for future studies in this area.

On the other hand, infertility is a highly sensitive issue depending on the cultural context. For Chinese women, maternal instinct plays an essential role in the awareness of self, social status, and identity [38]. In China, carrying on an ancestral name alongside the preference of sons still exists today [38]. Thus, it leads to pressuring women to hide infertility issues from others [39]. Infertile women in North America understand infertility as a secret stigma or an abnormal condition [40]. In Arabian culture, pregnancy is considered an essential task of women, which leads to a lot of pressure for women, thus causing them to want to hide infertility [41]. In addition, in Nigeria, infertility is considered to be entirely an issue of women [42]. Not only in the cultural context but also in developed countries and developing countries, infertility has different meanings. In developing countries, owing to their patriarchal family structures, not having children is considered to be largely an issue of women's social responsibility regardless of the cause of infertility, while the value and identity of women are threatened [43] and criticized [44]. This is due to the fact that children are directly related to the problem of financial survival in later years. Infertile couples end up not participating even in family gatherings or religious events [45]. In a comparative study of Austrian and Moslem immigrants who were diagnosed with polycystic ovarian syndrome, the female Moslem immigrants were reported to have a significantly higher psychological pressure about pregnancy than the Austrian immigrants [46]. Therefore, in developing and applying interventions for Korean infertile women, attention should also be paid to ensure that they are in line with the sociocultural characteristics of Korea.

This study is meaningful in that it has established a basis for interventions for infertile women by verifying the contradictory results of previous meta-analysis studies that have identified the effects of mind–body programs on anxiety and depression in infertile women and by identifying their effect on women's quality of life and pregnancy rates. However, it is difficult to determine the causality because there are not many RCT studies that have conducted mind–body programs for infertile women. In addition, because none of the included studies were conducted in Korea, it is hard to make implication for Korean infertile women. However, because this study confirmed the significant effects of the mind–body program on anxiety, depression, quality of life, and pregnancy rate, it may be necessary to develop a mind–body program suitable for Korean culture and provide it to Korean infertile women. Therefore, it will be necessary to develop mind–body intervention programs for Korean infertile women and conduct RCT studies, examining the effects of the programs on their anxiety, depression, quality of life, and pregnancy rate, in future. Moreover, it will be beneficial to perform meta-analysis studies. In addition, based on the results of this study, improved quality of life and pregnancy rate for infertile women who visit infertility centers or public health centers are expected by providing medical treatment alongside the mind–body program, which includes meditation, relaxation and breathing, tai chi, yoga, and hypnosis. Consequently, it is expected to provide mind–body programs to infertile women who use infertility centers and public health centers and to test their effectiveness. Moreover, based on the results, they can be continuously used in clinical practice.

Conclusion

In the present study, the effects of the mind–body program on anxiety, depression, quality of life, and pregnancy rate in infertile women were found to have a significant effect on all outcome variables. As the effects of a mind–body program could be improved when participants with low physical and psychological risks actively participate, positive effects on pregnancy results and emotions of infertile women could occur if nurses at Korean health centers and infertility centers could provide a mind–body program using various relaxation techniques. Furthermore, this is expected to lead to reduced budget for government support for infertile couples' medical expenses, which dramatically increase annually, and a cost-efficient management of the issue.

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Conflict of interest

The authors declared no conflict of interest.

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None.

Appendix References for studies included in Table 1

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Author, year, country	Group (n), mean age (yr)	Intervention	Format	Outcomes (tool)

Type of treatment	Number of sessions	Intervention duration (weeks)	Session duration (hours)	Abedi et al., 2016, Iran	Experimental group (30); control group (30)	Mindfulness-based program• Mindfulness meditation (eating, body scan, breathing)•Awareness (body, thought, feeling)	8

8	-	Group	Depression (GHQ28); anxiety (GHQ28)	Chan et al., 2006, China	Experimental group (69), age = 36; control group (115), age =	EBMS intervention •Tai chi exercises• Relaxation training (meditation, breathing technique)• Ancient Chinese philosophical writings• Education	4

					35		

4	3	Group	Anxiety (STAI); pregnancy rate	Chan et al., 2012, China	Experimental group (141), age = 34; control group (110), age	EBMS intervention •Relaxation training (breathing exercises, body scan, meditation) •Ancient Chinese philosophical writing• Group activities	4

					= 34	(singing, journal writing, drawing)	

4	3	Group	STAI (anxiety)	Domar et al., 2000a, Israel	Experimental group (20), age = 33; control group (14), age =	Mind–body program• Relaxation training• Cognitive restructuring• Emotional expression• Education (nutrition, exercise)	10

					3 5		

10	2	Group	Depression (BDI); anxiety (STAI)	Domar et al., 2000b, Israel	Experimental group (47), age = 33; control group (48), age =	Mind–body program• Relaxation training (meditation, progressive muscle relaxation, imagery, autogenic training)• Yoga• Cognitive restructu	10

					35	ring• Education (nutrition, exercise)	

10	2	Group	Pregnancy rate	Domar et al., 2011, Israel	Experimental group (46), age = 34; control group (51), age =	Mind–body program• Cognitive therapy• Relaxation training• Negative health behavior modification•Social support	10

					3 4		

10	-	Group	Pregnancy rate	Domar et al., 2015, Israel	Experimental group (70), age = 34; control group (59), age =	Cognitive coping relaxation intervention•Positive reappraisal• Relaxation training (diaphragmatic breathing, breath focus meditation, autog	14

					35	enic training)	

2	-	Individual	Anxiety (STAI); quality of life (FertiQol); pregnancy rate	Lee, 2003, Taiwan	Experimental group (64), age = 31; control group (68), age =	Nursing crisis intervention program.• Self-hypnosis• Muscle relaxation training• Cognitive behavioral counseling	14

					32		

7	-	Individual	Anxiety (STAI); depression (SDS)	Nery et al., 2018, Brazil	Experimental group (62), age = 37; control group (37), age =	Mindfulness-based program• Mindfulness meditation• Relaxation training (autogenic training, guided imagery, biofeedback)	10

					3 7		

10	2	Group	Depression (BDI); quality of life (PGWBI)	Kalhori et al., 2020, Iran	Experimental group (45), age = 30; control group (45), age =	Mindfulness-based program• Mindfulness meditation (breathing, body scan)•Awareness of breathing and body• Emphasizing the percepti	8

					29	on of how to react to thoughts, feelings, and body sensations		

DETAILS

Subject:	Research; Womens health; Information services; In vitro fertilization; Intervention; Biofeedback; Pregnancy; Reproductive technologies; Infertility; Information sharing; Emotions; Yoga; Counseling; Quality of life; Medical databases; Hypnosis; Society; Clinical trials; Behavior modification; Meditation; Sperm; Libraries; Nursing; Meta-analysis; Anxiety
Business indexing term:	Subject: Information sharing
Company / organization:	Name: Cochrane Library; NAICS: 519210
Identifier / keyword:	emotions; infertility; meta-analysis; mind–body therapies; pregnancy rate
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Document 15 of 29

Lived Experiences of Korean Young Adults After Heart Transplantation: A Phenomenological Approach

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ABSTRACT (ENGLISH)

Purpose

This study aimed to explore and describe the lived experience of young adult heart transplant recipients in Korea.

Methods

Fifteen young adult heart transplant recipients participated in this qualitative study. Data were collected from March to August 2019 through in-depth individual interviews and analyzed using Colaizzi's phenomenological method.

Results

Their experiences about the arduous journey of heart transplant surgery and life after surgery were captured in four themes: (1) unwelcome rebirth without vitality, (2) facing unreachable ordinary tasks in life, (3) lifestyle bordering between burdensome and self-valued, and (4) finding the true meaning of a newly given life.

Conclusion

Young adult heart transplant recipients struggled with the burdens of their health problems, which impacted their employment and relationships. The participants' lifelong challenges and psychological turbulence identified in this study provide guidance for health-care providers to understand this population.

FULL TEXT

Introduction

A heart transplant (HT) is the standard treatment for patients with end-stage heart failure. The cases of HT surgery are increasing in Korea owing to improved surgical techniques and immunosuppressive agents, legislation that recognizes brain death as death, and changes in the public's perception of brain death [1,2]. Over the last 10 years, the number of domestic HTs has increased more than 10 times [3].

In terms of age, the number of young adult recipients aged 19–34 years who have undergone HT has increased by approximately 15% over the past 5 years [3]. However, inadequate immunosuppression after transplantation still leads to complications including rejection, infections, malignancies, and chronic kidney disease, and maintaining a balanced immune status remains an important challenge [4]. As a result, HT recipients must take medication for their entire life to prevent rejection after transplantation and require comprehensive health care including infection prevention, lifestyle changes such as exercise and dietary improvements, and regular outpatient visits [5–7].

Studies have shown that HT recipients aged 60 years and older have low levels of negative emotions such as anxiety and depression, mental problems, and stress as well as high levels of social support, which suggests that they adjust well to their lives after HT [8,9]. However, studies have shown that younger recipients do not appear to adjust well after HT [10,11]. Recipients of an HT in their early adulthood experienced fatigue and lethargy owing to the side effects of immunosuppressive medications taken after the cardiac transplant, during the most active period of life [10].

In general, people in their young adult years are the healthiest and reach various social milestones such as marriage, childbirth, employment, and promotion. However, HT recipients do not fully experience these milestones because they are focused on their health [12]. For young people, HT is a major life challenge that causes difficulties in carrying out major life tasks and often requires adjustments in daily living.

Thus far, studies on HTs have mainly focused on the quality of life of the recipients [8], experience with the side effects of immunosuppressants [10], and medication adherence [13], and these studies have used quantitative methods to analyze these factors. Although previous studies have used qualitative methods to examine life experiences of HT recipients in their twenties [11] and older than 50 years [9,14], these studies failed to fully portray the life experiences including various social milestones such as marriage, childbirth, and employment of young adult HT recipients. Therefore, the purpose of this study was to explore and describe the lived experiences of young adult HT recipients.

Methods Study design

This study is a qualitative study using the phenomenological methodology proposed by Colaizzi [15] to understand the lived experiences of young adult HT recipients. The phenomenological methodology is a research method used to understand the meaning and essence of participants' experiences in a specific situation.

Setting and participants

Participants were HT recipients between the age of 19 and 34 years, which was defined as young adulthood [3,16]. Participants were selected as per specific criteria that included those who underwent HT surgery at least 3 months before the study, fully understood the purpose of the study, and voluntarily agreed to participate in the study. The exclusion criteria were those who could not communicate in in-depth interviews or had psychiatric diseases.

The participants were recruited from an outpatient HT clinic in a tertiary hospital in a city. The researchers approached patients in the clinic and determined whether each patient was eligible for the study or not. Those who were eligible and agreed to participate were explained in detail about the study, and informed consent was provided. In addition, more participants were recruited using a snowball technique, through which the participants introduced new patients to the study.

A total of 15 HT recipients participated in this study: seven women and eight men. In terms of diagnosis before HT, 12 patients had dilated cardiomyopathy, two patients had valve diseases, and one patient had congenital heart disease. The average postoperative period was 7.1 years (range: 1.6–13.7 years). The average age of participants at the time of the interview was 31.33 years (range: 25–34 years). Eleven participants were single, and four were married; eight participants were unemployed (Table 1).

Ethical considerations

This study was approved by the institutional review board of the Asan medical center, which the researcher is affiliated to (Approval no. 2019-0217). Before beginning the study, the researcher informed the participants about the purpose, procedures, goal, and plans for disseminating the results; thereafter, they provided written consent. Before the interview, the participants were informed that the interview would be recorded and were provided an accurate explanation of their confidentiality and the intended use of the collected data. Recorded data and transcribed manuscripts were used purely for research purposes and stored in a double-locked secured location. These were shredded and discarded after completion of the study.

Data collection

Having clinical experience as nurses in the cardiology and open-heart surgery units, the researchers had rich experience and knowledge about caring for HT recipients. In addition, the researchers are experts in qualitative research, and their works having been published in peer-reviewed journals. Considering the expertise in cardiology nursing and qualitative research methodology, we tried to elicit and illustrate the vivid experience of the participants as HT recipients.

We collected data from 15 participants from March 12 to August 31, 2019 (Table 1). We created the interview questions based on the previous literature [9,11] and clinical experience. After beginning with a basic question about the participant, the researchers asked semistructured questions such as “Please tell me about your lived experience of pre- and post- HT surgery,” to rule out potential researcher biases during the interview. The main questions were related to life before and after HT, changes in daily living or lifestyle, physical symptoms, current health status, the ways to overcome difficulties, any meaning derived from post-HT life, and so on. The types of interview questions ranged from general questions to specific ones, overall experience to personal ones, and factual observations to subjective inferences. The order of the questions varied to suit the natural flow of the interview (Table 2). Data collection for this qualitative study was conducted until no new information was obtained about a phenomenon, that is, when the content was saturated [17].

We conducted interviews at a time and place that was suitable for each participant. Interviews were conducted at a seminar room in the chosen hospital or a café selected by the participant. We conducted one in-depth interview with each participant individually. Each interview lasted approximately 60–90 minutes. All interviews were digitally recorded and then transcribed.

Data analysis

Following the phenomenological methodology suggested by Colaizzi [15], data collection and analysis were conducted simultaneously. First, to analyze the data, the participants' experiences were described, and we read the participants' descriptions several times to understand the flow of each experience. Second, we found meaningful statements from the participants and listed them. Third, we tried to discover what was hidden in each significant statement and formulated meanings. Fourth, similar meanings, subtopics, were classified, and the main concepts, derived from meaningful phrases and sentences, were identified to derive the final theme. Finally, we validated this study by asking the participants if the findings captured the essence of their experience. During the analysis, we received feedback from two participants.

Rigor of the research

To ensure the qualitative rigor of this study, we aimed to improve credibility, fittingness, auditability, and confirmability as per four evaluation criteria suggested by Sandelowski [18]. To secure credibility, the transcripts were checked for accuracy by comparing recorded interviews with transcripts. In addition, the interview transcripts were confirmed by each participant for precision. For fittingness, two clinical nurses in HT wards and one nursing professor reviewed the interview transcripts and confirmed the experience of the participants that possibly occurred. Third, to improve auditability, the entire process of the study was recorded in detail as audit trails. Finally, to maintain confirmability, we attempted to eliminate bias during the analysis process and held regular data analysis meetings and received feedback from each other.

Results

In this study, 21 meaning units were extracted from the interview data of 15 participants, and these statements were integrated into four themes and ten subthemes ([Table 3]). Four themes were derived as follows.

Theme 1: unwelcome rebirth without vitality

The young adult participants had difficulty breathing because of their nonfunctional hearts. After surgery, the participants did not feel any immediate changes except their breathing. However, the chest scars, appearance changes, fatigue, and lethargy due to immunosuppressants have deprived them of their vitality. The participants' recovery after HT did not meet their expectations, given that they are young adults in the prime of their lives. The participants were unaware that the way they dress, eat, and sleep was different from their peers and that their appearance and energy were different before the surgery.

Lower expectations from new life

Before surgery, the participants had some physical symptoms such as shortness of breath, inability to run, general fatigue, and so on. The participants believed that an HT would be a turning point that would change their lives forever without those symptoms. However, they were frustrated that their health did not improve as expected in terms of the level of vitality and continued symptoms.

Although they longed for an ordinary life after HT, they encountered new kinds of symptoms owing to HT surgery and immunosuppressants. They could not eat foods they wanted to or sleep comfortably because of the timing of administering immunosuppressants. Their expectations of being able to live as vigorously as normal people were not met.*"I thought there would be a reversal of life, but I was mistaken. At my age, heart transplants are really a challenge. It is hard to accept that you have to worry about your health when you need it most. I miss the daily routine of eating, wearing clothes that I wanted, and playing with others before the surgery."* (Participant 3 –female –25 years –single)

Incompatible with physical and emotional changes from drug side effects

The participants experienced side effects such as lethargy, acne, swelling, and hair loss caused by daily consumption of immunosuppressants, which were necessary to maintain their health after HT. The participants found it difficult to cope with large scars on the chest and changes in their appearance after surgery and found themselves withdrawn.*"I want to study or work more, but when I try, I get tired and I cannot concentrate. Do you know what it is like to feel your mind and body sinking below the surface? My whole being runs out of energy; therefore, it is hard to start a new job or make it persistent."* (Participant 4 –male –34 years –single)*"I also was a* *leader among my friends, but I think my personality changed a lot after surgery. After surgery, my face was getting bigger, and I was getting ugly and had hair loss, body swelling, scar on my chest, and especially acne on my face and back, so I cover my face with a mask when I go outside, or I do not go out."* (Participant 15 –male –30 years –married)

Theme 2: facing unreachable ordinary tasks in life

The participants had a difficult time achieving life tasks smoothly such as relationships, employment, marriage, and childbirth. When they do meet their friends, they cannot drink or smoke, and they cannot eat any food between lunch and dinner so as to maintain an empty stomach for an evening immunosuppressant. In addition, the participants found it difficult to return to work because they felt they were not fully recovered. When they attempted to work, they were not successful. Even for participants with a job, they were unable to maintain economic stability.

Feeling of alienation in social relationships

The participants reported that many of their relationships had changed owing to their lifestyle changes, such as being unable to drink and smoke. After the transplant, friends were divided into two groups: those who understood them and those who did not. They complained that they could not meet with their friends because they had to take immunosuppressants at fixed times every day and had to fast for a period after dosing to maximize the drug's effectiveness.*"When I meet my friends, I have to eat, drink and play like other people, but after HT, I cannot drink alcohol and eat raw food like a sashimi. In addition, based on the time to take immunosuppressant, fasting time is required. Especially when I need to fast in the evening, it is very difficult to make an appointment with friends."* (Participant 6 –male –34 years –single)

High barrier to job switch

The participants reported that the hardest thing after HT was searching for a job. They needed enough recovery time—as little as 6 months to as much as 2 years—after cardiac surgery, which forced them to take a break from their preoperative career. This break in career resulted in a decrease in the participants' peer group. In particular, a male participant who received an HT at a young age had difficulty finding employment because of HT. Even if participants were lucky enough to obtain a job, they often reported unfair treatment or poor working conditions.*"I took a year off from work and it was not easy to get back to work. It is about two years since I got a transplant, so I feel better. It is nice to go back to my old job, but I am worried that my physical condition will change and I will need to change my job. It is hard for me to find a new job because I have to go to the hospital on a regular basis."* (Participant 9 –male –31 years –single)*"I did not go to the army and I got a transplant, so I was often rejected from employment. When I got a job, I began my work with a memorandum that I would not demand any compensation because of my health problems."* (Participant 5 –male –29 years –single

Ambivalence to marriage and childbirth

The female participants reported that they wanted to get married but could not afford it. The Korean culture associates marriage with childbearing, and some reported that their boyfriend's parents opposed to marrying a woman after an HT because of her risk of infertility. Many single female participants said that even if the HT had no significant effect on pregnancy, they were hesitant about marriage and childbirth owing to concerns about passing on the heart disease to their children.*"I have been broken several times so far. [My boyfriend's] parents were opposed to me because of my health condition …I want to get married and have children, but I cannot, so I have to give it up realistically. Even if I am married, I will worry about my child's health. If there is any chance of a genetic factor, I would give up getting married and having a child."* (Participant 10 –female –30 years –single)*"I want to have more children …there are few cases of childbirth in South Korea after transplant, and I think it is impossible to have more children without it threatening my life."* (Participant 13 –female –28 years –married)

At the same time, the male participants were less constrained than female participants in marriage and childbirth, and they experienced no real difficulties creating their own families.*"Luckily, I got a job, got married, and even had a baby. There are many young people around who have had a hard time with the transplant. Fortunately, I was less worried about pregnancy than women because I am a man."* (Participant 14 –male –34 years –married)

Theme 3: lifestyle bordering between burdensome and self-valued

The life participants gained after HT, somewhere between healthy living and being disabled, often confused the participants. Paradoxically, the participants reported that they felt both relief and fear. They felt relief that they were alive due to HT and fear that they might die unexpectedly despite their HT. Officially, disability is categorized into five levels [ranging from 1 (most severe) to 5 (mildest)], and Korea's HT recipients are diagnosed with having Disability Level 5. The participants wished to return to their normal lives after HT, but they struggled with their poor physical and mental condition.

Focusing on negative aspects

The participants pretend that they are enjoying life with their family and friends, but they know they are not like their friends. The participants envy ordinary lives such as getting a job, getting married, and raising children. They often feel worse now than before the transplant, and they have a hard time finding the way to live now. The participants reported that they were sad or depressed because they were unable to live a life similar to others.*“There is no job, no marriage, no hope, no fun in life. I feel like I live in a tunnel where there is no end every day. Others say I have a new life because I got a new heart, but I thought to myself sometimes it was better to die rather than live this difficult life. I think it is a shame now, but I have been taken to the emergency room after taking all the immunosuppressant at home, because I tried to commit suicide.”* (Participant 1 –female –33 years –single)

The participants thought they were healthy after an HT but could not stop thinking about death. They reported trying to avoid thoughts of death, and some even became reluctant to attend funerals or visit hospitals.*“I am heart-transplanted and healthy, but waking up in the morning, I often feel anxious that today is my last day of living. Especially the days that I do not feel good, I am worrisome all day. My depressed feeling is passed on to my family and they feel sad too.”* (Participant 14 –male –34 years –married)

Focusing on my own life

Over time, the participants recognized that they were physically and emotionally different from others and had to cope with reality. Moreover, the participants tried to focus on good things about their life after an HT and live positively.*“I hated being different from other people in my early twenties. I do not know why I was so obsessed with living like others. I feel that because I am making a living these days, I do not have to suffer from the gaze or social perspective of others.”* (Participant 10 –female –30 years –single)*“Having an HT does not mean that I am disabled, so it is important that I lead my life actively with my own identity.”* (Participant 7 –female –32 years –single)

Theme 4: finding the true meaning of a newly given life

The participants explained that the process of adapting back to their daily lives after an HT was complicated and difficult, but they are happy to breathe and live their lives. They reported that they had learned to value the small moments of happiness with their families, which they had overlooked before surgery. They recognized that because of someone else's unfortunate events, a person's heart was transplanted into them, and they wanted to appreciate that benefit. Furthermore, some of the participants wanted to provide a positive example for other patients undergoing the post-transplant adaptation process.

Recognizing the value of the family

The participants said that having a family to support them was significant for a successful recovery. The parents, husbands, wives, and children who had taken the participants for granted were grateful for their existence. Participants who created a new family after transplant reported feeling happiness as an unexpected gift.*“If I had not had a heart transplant, I would still live my life like a jerk, doing whatever I wanted to, drinking and smoking. The best thing about the transplant is that I became mature, got married, and had children, and now I have my family. Living happily with my family is the main reason why I live now.”* (Participant 15 –male –30 years –married)

Being satisfied with the life given

The participants said they were fiercely competitive, such as in terms of money or honors, before the HT, but realized that without health, everything was meaningless. In addition, after an HT, they realized that they were satisfied with their lives.*“I always thought to be happy, you have to make a lot of money and have a better economic status. But now I know that it is best to live happily in the condition given to me instead of wasting my emotions on useless things.”* (Participant 5 –male –29 years –single)

Taking a step further into a worthy life

Some participants said they wanted to be a mentor or role model for young transplant recipients who are struggling after transplantation, by learning how to live confidently despite discrimination and difficulty. *"There are many young people who are still struggling in the adaptation stage who are having difficulty with their identity, health and marriage. I want to be a role model to share my experience and encourage them. I want to live a valuable life and share the life I have been endowed with in some way."* (Participant 12 –male –29 years –single)

Discussion

This study explored the lived experiences of recipients of an HT at a young age and describes in detail how HT affects all aspects of their young adult life. Based on the 15 individual in-depth interviews, four themes have been identified: (1) unwelcome rebirth without vitality, (2) facing unreachable ordinary tasks in life, (3) lifestyle bordering between burdensome and self-valued, and (4) finding the true meaning of a newly given life.

Theme 1, "unwelcome rebirth without vitality," is contrary to the findings of previous studies [9], which also found participants' focusing on the joy of rebirth and expectation of a new life. Life satisfaction was reduced owing to lethargy, fatigue [10,19], and changes in appearance [20], which are typical side effects of continuous use of the immunosuppressant required to maintain new heart function after transplantation. As per a study by Massey et al. [21], young transplant recipients reported a 65% compliance rate for immunosuppressants, suggesting that the reason for lack of compliance may be due to these side effects.

The participants in this study were aware of the importance of immunosuppressants, which critically affected their life after transplant. Although the medication side effects are similar to those seen in previous studies [8–10], these participants, who are in their most energetic stage of life, were not satisfied with such effects, which may be tolerated better by older patients. For young adults, these side effects may be unacceptable and shocking [11,20,21], and thus, it is necessary to provide patients with information on the side effects of immunosuppressants and to observe and consult with them periodically. In particular, the degree of fatigue that interferes with daily life should be assessed, and effective intervention should be applied to help patients manage their fatigue [19]. In addition, multidisciplinary approaches are required in the pretransplantation and post-transplantation treatment process to minimize cosmetic changes such as acne and scars on the chest.

Concerning Theme 2, for young HT recipients in this study, many life tasks were unreachable for them. In fact, young adult recipients' happiness was closely related to timely achievement of their capacity, autonomy, and social and mental development [21–23]. Family members and close friends play important roles in supporting HT recipients. Interpersonal relationships facilitate coping with stress and promote an optimistic outlook [24,25]; in particular, a spouse has positive effects on the overall health of a transplant recipient, including survival advantage, medical compliance, management of comorbidities, and emotional support [26]. Therefore, the health-care provider needs to strengthen social support for young HT recipients to have hope in achieving their life tasks.

Most participants stated that employment was a very important goal, similar to the results of previous studies [11,27]. For health reasons, such as supporting their immune systems after HT, participants with high-stress or high-intensity jobs were forced to switch jobs [28]. The participants in this study learned to be satisfied with obtaining any kind of job, given the difficulties in job search and unfair treatment in the employment process.

In Korea, which has a traditional Confucian ideology [29], it is considered impossible to marry a sick woman who may not be able to give birth. Most female participants reported that marriage became difficult after surgery, given the childbirth issue. However, a previous study [30] on pregnancy and childbirth after a liver transplant showed that it was a life-threatening pregnancy, but through that difficult process, childbirth eventually led to life satisfaction by having a family. Deshpande et al. [31] found that successful pregnancy outcomes are possible among all organ transplant recipients. Nevertheless, potential fetal side effects such as premature birth and low birth weight delivery and recipient side effects such as hypertensive disorders and graft rejection [31,32] are expected; thus, patients should be monitored closely by their health-care providers to ensure a safe pregnancy. HT recipients can have successful pregnancies by maintaining a stable organ function via multidisciplinary care support.

Regarding Theme 3, the participants were found to have adjusted to a "lifestyle bordering between burdensome and self-valued." This was a prominent problem in the early stages after transplantation. This is in contrast to findings that old-aged HT recipients have a positive outlook on life [8,9]. However, it is consistent with a previous study that found young adults were more isolated from their peers than older patients, resulting in less compliance with treatment [8,22].

This seems to be due to the uncertainty of life and their trauma of facing a fatal heart disease at a young age [11]. After a long wait, their HT was a miracle, but they continue to live in fear and under the shadow of the uncertainty of death [33]. Given their conflicting feelings, social support is necessary to help young adult HT recipients deal with negative emotions, and health-care providers should provide periodic counseling to allow them to express such emotions.

In a study by Waldron et al. [11], young adults were described as undergoing a life transition and that they yearned for "normal;" thus, they considered that they would return to normal life only when their social roles were properly achieved. Health identity in young adulthood is the driving force to endure life [11,23], so health-care providers and families should pay attention and help them to have an unshakable identity and positive attitude toward life.

For Theme 4, through trial and error and persevering despite difficulties, the participants accepted their new life, "finding the true meaning of a newly given life." Previous studies [8,34] on the quality of life of post-transplant recipients showed improved quality of life after transplantation, especially in terms of overall health, social functioning, and vitality. The findings of Theme 4 is consistent with a previous study [35] that HT recipients can achieve a satisfactory life by thinking positively, living in a stable family, and friendships, while avoiding strong negative emotions, overwork, and stress [24,35]. Therefore, HT recipients' physical and psychological well-being can be improved by following medical recommendations to protect the new heart and by promoting an optimistic attitude toward life.

Through this study, moving past the symbolic meaning that an HT is a gift of new life [9], young adult recipients have been able to expand their lives through their experience with fatal heart disease, rigorous procedures of transplantation, and medication side effects after surgery. They showed how they struggled through a series of stages to overcome difficulties [14]. However, most of the problems they face now have no fundamental solution, and they are living in a state of uncertainty without proper preparation for their future. Based on the findings of this study, health-care providers should have a deeper understanding of young adult HT recipients to provide tailored care before and after transplantation and effective interventions for adapting to life after transplantation.

Health-care providers need a multifaceted approach to help recipients accept and adapt to changes in life after HT. In particular, pre- and post-HT education needs to be developed to effectively manage the post-HT life. The education should comprise medication administration, information about appearance change, social relationship change, and infection control due to taking immunosuppressive drugs. In addition, health-care providers need to play an important role as information providers and active advisors to prevent young HT recipients from being dismissed as disabled and deprived of opportunities in their social life.

This study has several limitations. First, because this study's participants were enrolled from one tertiary hospital in a city, there should be caution for generalizability. Repetitive study on the given topic from different patient backgrounds is necessary. Second, the purpose of this study was to recruit young adult HT recipients; however, the results found that the post-HT duration varied from 1.6 years to 13.7 years. Further qualitative study is necessary to determine if there are any differences in the experience of HT based on the length of post-HT duration.

Conclusion

This study revealed young adult HT recipients' lived experiences within the Korean context. HT was a major challenge in young adult HT recipients' lives. HTs have hampered the completion of important life tasks, such as employment, marriage, and childbirth, and diminished their confidence in life. However, they gradually tried to embrace their new life rather than viewing themselves within the dichotomous norms of normal and abnormal. Furthermore, they felt gratitude for family and everyday moments and learned how to be satisfied in life. The results of this study will improve the understanding of young adult HT recipients and lay the groundwork for developing practical solutions to address employment and childbirth problems after transplantation.

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Conflict of interest

The authors declared no conflict of interest.

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No.	Gender	Age (years)	Diagnosis	Duration of transplantation (months)	Religion	Marital status	Education	Occupation	Main income
1	F	33	DCMP	132	Yes	Single	University	None	Pension
2	M	34	DCMP	18	Yes	Married	University	None	Parents
3	F	25	DCMP	60	Yes	Single	High school	None	Parents
4	M	34	DCMP	118	Yes	Single	University	None	Parents
5	M	29	Congenital	50	Yes	Single	High school	Insurance planner	Himself/herself
6	M	34	DCMP	164	None	Single	University	None	Parents
7	F	32	DCMP	75	None	Single	University	Service industry	Parents
8	F	34	DCMP	165	Yes	Single	University	None	Parents
9	M	31	DCMP	20	None	Single	University	None	Parents
10	F	30	DCMP	118	Yes	Single	University	None	Parents
11	F	29	DCMP	36	Yes	Single	University	Public officer	Himself/herself

12	M	29	Valve	85	None	Single	High school	Self-employed	Himself/herself
13	F	28	DCMP	30	None	Married	High school	Housewife	Spouse
14	M	34	DCMP	96	None	Married	University	Public officer	Himself/herself
15	M	30	Valve	110	None	Married	High school	Service industry	Himself/herself

Type	Questions
Opening	Please tell me about your lived experience of pre and post HT surgery.
Details	Do you have any changes in daily living or lifestyle?a)If so, what were those changes?b)How do you feel about those changes?Have you ever struggle with any physical or psychological difficulties?a)If so, what were they?b)How was your coping with difficulties?c)Has anyone been providing support resources?Have your relationships with your family, friends or spouse/lover changed after HT?a)If so, how have you coping with those changes?b)What kind of support resources would you want?Do you have happy or sad memorable experiences in your life after HT?a)If so, what were those experiences?b)How do you feel about those experiences?Do you have advantages or disadvantages in your life after HT?a)If so, what are they?b)How do these affect your life?Do you have current fears in your life?a)If so, please specify them.b)What is the ways to overcome the fears?Do you need any help to improve quality of your life?a)If so, what specific help do you need?What does HT mean to the young adult HT recipient?
Ending	Is there anything you would like to add?

Themes	Subthemes	Meaning units
Unwelcome rebirth without vitality	Lower expectations from new life	Frustration with an incomplete physical condition Longing for an ordinary life
Incompatible with physical and emotional changes from drug side effects	Lowered confidence due to appearance changes Feeling powerlessness with loss of vitality	Facing unreachable ordinary tasks in life

Feeling of alienation in social relationships	Burdens of having a limited lifestyle Having troubles in taking immunosuppressants regularly	High barrier to job switch
Disappointed with the unfavorable employment system Unfair employment opportunities due to HT history	Ambivalence to marriage and childbirth	Distress from indelible wound caused by people who oppose marriage Internal anguish on passing heart disease to children
Lifestyle bordering between burdensome and self-valued	Focusing on negative aspects	Obsession about being different from peers Feeling of being stuck in a tunnel of continued symptoms Constant fear of death
Focusing on my own life	Living a self-confident life without being dominated by others' presence Acceptance of life's changes	Finding the true meaning of a newly given life
Recognizing the value of the family	Family as a driving force of life Gratitude for the existence of the family	Being satisfied with the life given
Realizing the importance of health Awakened deeper happiness never felt before	Taking a step further into a worthy life	Wishing to be a role model of hope Getting to know the meaning of sharing

DETAILS

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Level of and Related Factors to Diabetes Awareness among Diabetic Adults by Gender: Based on Data from the Korean National Health and Nutrition Examination Survey

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ABSTRACT (ENGLISH)

Purpose

This study aimed to determine the level of awareness about diabetes mellitus (DM) and identify the associated factors among diabetic adults in Korea by sex, using data from most recent nationwide representative survey.

Methods

Secondary data analysis was conducted using data obtained from the Korean National Health and Nutrition Examination Survey VII (2016–2018). In total, 2,026 participants (1,049 men, 977 women) aged ≥30 years with DM were included. Data were analyzed using a complex sample analysis considering the combined sampling weight for 3 years. Odds ratios and 95% confidence intervals were calculated using stepwise multiple logistic regression analysis to identify the association between DM awareness (DA) and sociodemographic and health-related factors.

Results

Researchers observed that 60.2% of men and 68.4% of women had DA. DA levels in both men and women were higher in those who were older, less educated, had normal weight, had hypertension and/or dyslipidemia, and had a family history of DM than in their counterparts. Having undergone a health screening in the past 2 years was associated with DA levels in men, whereas glycated hemoglobin levels of 5.7–6.4% were associated with higher DA levels in women.

Conclusion

The level of DA is unsatisfactory. Although the DA level is slightly higher in women than in men, it needs to be improved regardless of gender. Most of the factors associated with DA levels are similar in both men and women. Nurses in the community setting should provide health education, conduct campaigns, and promote referral to medical services by targeting the high-risk groups with lower DA identified in this study.

FULL TEXT

Introduction

Diabetes mellitus (DM) is characterized by hyperglycemia owing to the loss or dysfunction of β-cells in the pancreas and causes long-term metabolic disorders and complications if not treated well [1]. According to the Korean National Health and Nutrition Examination Survey (KNHANES), the prevalence of DM in adults aged ≥30 years was 12.4% in 2017, which represents a significant increase from the value of 9.7% in 2007 [2]. The longer an individual has DM and uncontrolled blood sugar levels, the greater is the risk of vascular complications [3]. Therefore, it is important for people to monitor their blood sugar levels and initiate appropriate treatment based on a diagnosis by a physician as early as possible to reduce the risk of DM complications.

DM awareness (DA) is defined as the recognition of DM by being diagnosed with a doctor [2]; it influences DM treatment and control [4]. Unfortunately, there are few studies on DA in Korea, and one study using data from the National Sample Cohort Database of the National Health Insurance Service reported a DA level of 61.8% [5]. However, it is difficult to identify the current DA level, given that the data in the previous study were collected in 2013. The Korea Ministry of Health and Welfare continues to make efforts to increase the DA level as one of the strategies for preventing and managing cardiovascular diseases via public health centers [6], and the National Health Insurance system in Korea supports health screening every 2 years to promote early detection of various diseases including DM [7]; thus, the recent DA level may have changed from that in 2013. Moreover, although the cohort database used in the previous study is known to be representative and accurate, there was a difference in health screening participation rates by socioeconomic status, which may have increased the risk of selection bias [5]. Therefore, studies conducted using more representative data that are less affected by socioeconomic status are needed. In most studies on DA, including previous domestic studies, DM diagnosis was based only on fasting blood sugar levels [5,8–13]. Considering that the glycated hemoglobin (HbA1c) level is widely used for the diagnosis of DM [1], HbA1c and fasting blood sugar levels should be measured for the diagnosis of DM.

With regard to the factors associated with the DA level, socioeconomic factors such as age; gender; educational level; current employment status; household income; health-related factors such as smoking status, physical activity, body mass index (BMI), hypertension, and dyslipidemia; and family history of DM have been investigated [5,8–13]. Some socioeconomic and health-related factors have shown inconsistent results or have been considered in limited studies. For example, some studies reported that the education level was related to the DA level [9,11,12], while some studies did not report this relationship [8,10,13]; some studies reported that the education level was not related to the DA level [5]. Most national and foreign studies have identified factors associated with the DA level regardless of sex [5,9–13], but it may be necessary to identify whether factors affecting the DA level differ by sex because some studies have reported that the DA level differs by sex [5,11,12]. Based on a literature review, we aimed to identify the DA level and factors associated with DA among Korean adults by gender, using data from most recent nationwide representative survey.

Methods Aims

This study aimed to evaluated the level of DA and identify the associated factors among Korean adults with DM, using data from the KNHANES VII (2016–2018), the most recent and Korea representative survey.

Participants

This study analyzed KNHANES VII data, which had been collected by the Korea Centers for Disease Control and Prevention from 2016 to 2018. The KNHANES is a biennial, nationwide cross-sectional survey that assesses the health and nutritional status of the general population in Korea [2]. The sample of KNHANES VII was selected using a two-stage stratified cluster sampling method for enumeration districts and households, and a health survey, health screening, and nutrition survey were conducted to appropriate household members. Among 31,689 members of the target population, total 24,269 participated in the KNHANES VII (2016-2018) survey (average response rate: 76.6%). The inclusion criteria for this study were as follows: no missing data for sampling weight, over the age of 30, those with DM, and no missing data for the variables associated with DA. DM was defined as satisfying at least one of the following three criteria, based on American Diabetes Association [1]: (1) self-reporting of history of diagnosed DM, (2) a fasting plasma glucose of ≥126 mg/dL, and (3) A1C of ≥6.5%. Total 2,026 participants (1,049 men, 977 women) met those inclusion criteria (Figure 1).

Variables and definitions

The variables in this study included the sociodemographic and health-related factors that have been reported to affect the DA level in previous studies [5,8–13], and the DA. Sociodemographic factors included gender, age, educational level, currently working, and household income. Collected data were reclassified based on the objectives of the study. Age was categorized as “30–39 years”, “40–49 years”, “50–59 years”, “60–69 years”, and “70 years or older”. However, due to the small sample size of “30–39 years” group, we incorporated “30–39 years” and “40–49 years” group to “30–49 years”. Educational level categories were “elementary school and below”, “middle school”, “high school”, and “college and above”. Currently working was categorized as “yes” or “no” based on the current employment status. Household income was categorized by quartile as “low” (less than 1 million won per month), “lower-middle” (between 1 million and 2 million won), “upper-middle” (between 2 million and 3 million won), and “high” (more than 3 million won).

Health-related factors included a health screening in the past two years, current drinking, current smoking, physical activity, BMI, comorbidity (hypertension, dyslipidemia), A1C level, and family history of DM. Current risk behaviors were defined in two stages. First, drinking and smoking were categorized as “never”, “former”, and “current” based on response to the survey question on drinking status or smoking status. Second, they were recategorized as “neither”, “drinking only”, “smoking only” and “both” based on whether or not they currently drink or smoke. Physical activity was categorized as “yes” or “no” based on “pa-aerobic” variable built by KNHANES team, which was defined as moderate intensity activity for at least two and half hours or high intensity activity for at least one hour 15 minutes, or combined activity a week [2]. BMI was calculated with the formula body weight (kg)/height^2 (m^2). Based on the classification of the Korean Society for the Study of Obesity [14], BMI was categorized as “underweight (BMI 1]. Family history of DM was defined as any of the parents or siblings' affirmative responded to the survey question on history of diagnosed DM. The DA was defined as the proportion of individuals who showed affirmative response to the survey question on history of diagnosed DM among all individuals with DM [5].

Statistical analysis

The data were analyzed with SPSS 23.0 statistical software (IBM Corp., Armonk, NY, USA) using a complex sample analysis, and the combined sampling weight of two years was calculated by multiplying weight by the ratio of the number of survey units by year according to the KNHANES manual [2]. Statistical significance was set at *p* 15]. Meanwhile, a sensitivity analysis was done to check the robustness of the findings on the DA level and factors associated including those who were excluded because of missing in explanatory variables. That is, we compared the characteristics of between those who were included in this study and excluded because of missing in explanatory variables using χ^2 test, and all characteristics were significantly different each other except A1C among women (Supplementary Tables 1 and 2).

Ethical considerations

This study was conducted after receiving permission for the use of data from the website of the National Health and Nutrition Survey, and approval of exempt review (Approval no. 05-2019-053) from the Institutional Review Board of the Pusan National University Hospital.

Results Sociodemographic and health-related characteristics of the participants

Table 1 presents the sociodemographic and the health-related characteristics of the participants by gender in the KNHANES VII study. Among 1,049 men, mean age was 57.48 years, and most of them were educated above high school level (68.0%), and in the upper-middle and high income group (54.2%), had undergone a health screening within the past two years (73.5%), and 22.8% had history diagnosed hypertension and dyslipidemia. Among 977 women, mean age was 62.66 years, and 45.5% of them were elementary school and below, 40.1% were currently working, and 34.6% had history diagnosed hypertension and dyslipidemia. Men showed significantly different from women in characteristics except BMI, A1C level, and family history of DM.

The level of and factors associated with DA

The overall DA level was 63.7%, and significantly higher in women (68.4%) than in men (60.2%) (Table 1).

According to Table 2, the DA level in men was significantly different by age, educational level, currently working, household income, receiving health screening in the past two years, current drinking and smoking, BMI, comorbidity, and family history of DM. As a result of a multiple logistic regression analysis, the DA level was higher in men aged 50 years or older than in reference group under the age of 49 years, in men with elementary school and less (OR = 1.76), or high school (OR = 1.66) education than men with college and above education, in men with health screening in past two years than men without (OR = 1.89), with BMI of 22.9 or less than men with BMI of 25 or more (OR = 1.77), with either hypertension or dyslipidemia than without both of them, and with family history of DM than men without (OR = 2.23).

According to Table 3, the DA level in women was significantly different by age, educational level, currently working, BMI, comorbidity, A1C level and family history of DM. As a result of a multiple logistic regression analysis, the DA level was higher in women aged 70 years or older than in reference group under the age of 49 years (OR = 2.15), in women with elementary school and less than women with college level and above education (OR = 1.82), with BMI of 22.9 or less than women with BMI of 25 or more (OR = 1.70), with either hypertension or dyslipidemia than without both of them, with family history of DM than women without (OR = 1.91), and showed higher in women with A1C of 5.7-6.4% (OR = 2.63) than under 5.7%.

Sensitivity analyses

According to a sensitivity analysis, the DA level was 61.6% in men and 69.7% in women, and the factors associated with the DA level showed the similar trends to the results when using only those who met the inclusion criteria among both men and women. However, educational level was not significantly related with the DA level among women although those who were elementary school or less showed the highest level of DA (Supplementary Tables 3 and 4).

Discussion

DA is critical for the positive treatment and control of DM [4]. This study determined the DA level and identified factors associated with DA using data from a recent nationwide representative survey. The overall DA level in this study was slightly improved compared to the value of 61.8% in a previous study conducted in Korea [5], but the DA level still needs improvement, especially in men. However, a direct comparison between the two findings should be made carefully considering the differences in data sources, inclusion criteria based on age, and definitions of DM. The DA level was higher in women than in men in this study, which supports the findings of several previous studies performed in Korea [5], the Southern Cone of Latin America [8], and China [11]. Considering that the risk of complications is predicted to be high in men because the high prevalence of DM [5,16], the need to improve the DA level is more urgent in men than in women.

The DA level was associated with age, educational level, BMI, comorbidities such as hypertension and dyslipidemia, and a family history of DM in both men and women. Higher DA levels were seen in those who were older, especially those aged ≥50 years among men and ≥70 years among women; less educated; had normal weight (BMI ≤22.9 kg/m^2); had comorbidities such as hypertension and dyslipidemia; and had a family history of DM, regardless of sex. These findings have several implications. First, the DA level increased with age, as observed in many previous studies [5,8–13]. Elderly people are more concerned about their health conditions, more interested in health-promoting behaviors [17], and more willing to gain awareness of their medical conditions than younger people who are less aware of their health risks [13]. Among people in their 40s and those aged p Supplementary Table 5). As mentioned previously, because of the high DA level among those aged ≥70 years, it seems that the DA level was high in people with an elementary school or lower education level. Therefore, health education programs and campaigns about regular blood glucose tests and doctor consultation should be further emphasized among young adults and adults with a high level of education in Korea. Such health programs could be started in universities as a part of the health-related curriculum [13] or at workplaces as health promotion programs.

People with obesity (BMI ≥25 kg/m^2) are less likely to be aware of their hyperglycemic condition, which supports the findings of a previous study in Korea [5]. However, several studies on the DA level did not show a significant relationship between obesity and the DA level [11,13], and this difference may be related to the BMI criteria considered for classifying obesity. A BMI ≥25 kg/m^2 is considered to indicate obesity in Korea [14], but a BMI ≥28 or ≥30 kg/m^2 was considered to indicate obesity in previous studies in China [11] and Malaysia [13], respectively. Obesity is well known to be associated with DM [18–20]; thus, people with obesity should be aware of their hyperglycemic condition. However, people with obesity with a BMI ≥25 kg/m^2 was even lower than that of people with a BMI ≤22.9 kg/m^2 (normal weight), regardless of sex. Nurses should arrange “know my blood sugar level” time as a part of weight control programs for people with obesity and emphasize the importance of regular blood glucose tests and awareness of their hyperglycemic condition during the program.

People with hypertension or dyslipidemia showed above-average DA levels and were more likely to be aware of their hyperglycemic condition than people without these conditions, as observed in previous studies [9,10]. Considering that hypertension and dyslipidemia are well-known risk factors for DM [21,22] and that people at high risk of DM should be aware of their hyperglycemic condition, this finding is encouraging. However, only approximately 4 in 10 people without both hypertension and dyslipidemia were aware of their DM status, and thus, it is important to educate adults who do not have underlying diseases such as hypertension and dyslipidemia to be mindful of their health conditions and undergo regular health screening.

People with a family history of DM showed significantly higher DA levels regardless of gender, which is consistent with the findings of previous studies [5,11,13]. People with a family history of diseases perceive themselves to be more vulnerable and susceptible to diseases [23] and undergo screening more often than those without a family history of diseases [23], which may lead to an increase in disease awareness. To increase the level of DA among people with no family history of DM, efforts should be made to educate them that DM occurs in conjunction with genetic and environmental risk factors [24].

Having undergone health screening in the past 2 years was associated with the DA level only in men, while the HbA1c level was associated with the DA level only in women. As undergoing health checkups is known to lead to an increase in the DA level [25], the higher participation in health checkups in men than in women may have contributed to findings observed in this study. In 2017, the rate of participation in national health screening was 79.7% among men, which was higher that the value of 77.2% among women [26]. Women with prediabetes (HbA1c levels of 5.7–6.4%) showed the highest DA level. Surprisingly, only two-thirds of women with HbA1c levels above 6.5% were aware of DM, which was not significantly different from that in those with a normal glycemic condition. As HbA1c is an index of long-term glycemic control [27], people with a high level of HbA1c are vulnerable to diabetic complications. Therefore, it is necessary to establish a system at the national level and to inform people through campaigns that dietary management and regular blood sugar tests are needed in the prediabetes stage.

Household income was not related to DA levels in both men and women. Findings on household income levels and DM have been inconsistent across studies: either a proportional relationship [9] or no relationship [10]. Findings from another study indicated that those with very low or very high household income levels showed higher DA levels than the others [13]. As people in Korea have more opportunities for checking their blood glucose levels every 2 years via a free health screening [28] or by visiting clinics or public health centers (levels can be assessed at a low cost under the National Health Insurance Program), they can be aware of their hyperglycemic condition regardless of their economic status. Smoking status, drinking status, and physical activity were not related to DA levels in both men and women. The results for the relationship between smoking status and DA levels were consistent with those of previous studies [8,11,13]. The results of the relationship between drinking status and DA levels were inconsistent in previous studies: no relationship [8] or negative correlation [11]. In addition, the results for the relationship between physical activity and DA levels were inconsistent in previous studies: no relationship [11,13] or the relation of high DA levels with low physical activity levels [8]. Therefore, it is necessary to further investigate the relationship between drinking status and physical activity and DA.

This study has several strengths. First, to the best of our knowledge, this is the first study to identify the level of DA and associated factors according to gender using the most recent nationwide community-based data in Korea and to show sex-specific findings. In particular, the KNHANES involved nationally representative data and was conducted using a standardized questionnaire in accordance with a standardized protocol by trained investigators, which increases the generalizability and validity of our findings. Second, we used both fasting blood glucose test results and HbA1c test results for selecting people with DM. DM in previous studies was defined based only on fasting blood glucose test results [5,8–13], even though HbA1c is widely used by healthcare professionals to diagnose DM [1]. Third, we confirmed the robustness of the findings through a sensitivity analysis including those who were excluded because of missing in explanatory variables. Therefore, the findings of this study may be applied to those aged ≥30 years with DM.

However, caution must be exercised when interpreting our results because of the following limitations: First, we could not use the data of the oral glucose tolerance test (OGTT) to select people with DM because it was not performed during the KNHANES. If OGTT data had been included, the number of patients with DM would most likely have been higher, which could affect the level of DA. Second, in this study, BMI was classified according to guidelines from the World Health Organization (in its publication, the Asia-Pacific Perspective) and the Korean Society for the Study of Obesity; therefore, caution should be exercised when generalizing these results to other populations, even to Westerners. Third, those who had missing values on explanatory variables (sociodemographic and health-related factors) among subjects aged ≥30 years with DM were excluded from this study. Finally, because this was a cross-sectional study, it may be necessary to conduct studies with longitudinal data to avoid reverse causation bias.

Conclusion

Approximately 60.2% of men and 68.4% of women aged ≥30 years with DM are aware of their DM status; these values need to be improved in both men and women. Except for two factors, namely, participation in health screening in the past 2 years and HbA1c levels, all factors associated with DA levels were similar in both men and women. The level of DA was particularly low in those aged ≤49 years, with a higher level of education, with obesity, and without both hypertension and dyslipidemia, regardless of sex. Therefore, nurses in the community setting should identify high-risk populations with lower DA levels based on the present study findings, provide health education and conduct campaigns using mass media and social networks, and promote the use of medical services for people to become aware of their hyperglycemic condition.

Funding source

None.

Conflict of interest

The authors declared no conflict of interest.

Appendix A Supplementary data

The following is/are the Supplementary data to this article:**Multimedia component 1**Multimedia component 1

Appendix A Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.anr.2021.01.003.

Characteristics		Men (N = 1,049)	Women (N = 977)	p
n (%)†	n (%)†	Age (yrs)	30–49	198(25.8)
123(15.4)	<.001	50–59	258(31.6)	202(25.8)
60–69	305(25.0)	278(24.8)	≥70	288(17.6)
374(34.0)	mean ± standard error	57.48 ± 0.44	62.66 ± 0.46	Educational level
Elementary school or less	234(16.9)	479(45.5)	<.001	Middle school
167(15.1)	164(15.9)	High school	353(35.3)	242(28.7)
College or higher	295(32.7)	92(9.9)	Currently working	Yes
699(73.7)	376(40.1)	<.001	Low	273(21.3)
384(35.9)	<.001	Household income (in quartile)	Lower-middle	271(24.5)
253(25.8)	Upper-middle	263(28.1)	190(21.2)	High

242(26.1)	150(17.1)	Ever health screening in past 2 yrs	Yes	770(73.5)
646(65.0)	.001	Current drinking and smoking	Neither	185(15.2)
526(50.9)	<.001	Drinking only	499(48.4)	421(46.1)
Smoking only	66(6.0)	8(1.0)	Both	299(30.4)
22(2.0)	Physical activity	Yes	413(41.8)	292(32.3)
<.001	Body mass index (kg/m^2)	≤22.9 (normal)	265(23.9)	236(23.4)
.360	23–24.9 (overweight)	267(25.0)	226(22.2)	≥25(obesity)
517(51.1)	515(54.4)	Comorbidity	Neither	383(40.4)
226(25.1)	<.001	Hypertension only	293(24.6)	238(22.5)
Dyslipidemia only	127(12.2)	165(17.8)	Both	246(22.8)
348(34.6)	Glycated hemoglobin (%)	<5.7 (normal)	54(4.8)	34(3.5)
.421	5.7–6.4 (prediabetes)	248(24.0)	240(25.2)	≥6.5 (diabetes)
747(71.2)	703(71.3)	Presence of family history of DM	Yes	416(42.9)
440(45.0)	.417	Awareness of DM	Yes	678(60.2)

Characteristics		DA (n = 678) n (%)†	Unadjusted OR (95% CI)	p	Adjusted OR (95% CI)	p
Age (yrs)	30–49	74(34.7)	1		1	
50–59	157(60.9)	2.92(1.94–4.39)	<.001	2.32(1.47–3.64)	<.001	60–69
223(73.0)	5.07(3.29–7.82)	<.001	4.14(2.44–7.02)	<.001	≥70	224(77.9)
6.61(4.24–10.31)	<.001	5.52(3.03–10.05)	<.001	Educational level	Elementary school or less	177(74.3)
3.33(2.22–4.90)	<.001	1.76(1.03–3.02)	.039	Middle school	123(69.5)	2.62(1.62–4.24)
<.001	1.63(0.92–2.90)	.097	High school	227(62.0)	1.87(1.31–2.67)	.001
1.66(1.08–2.54)	.020	College or higher	151(46.5)	1		1
	Currently working	Yes	422(56.7)	1		1
	No	256(70.0)	1.78(1.30–2.44)	<.001	0.96(0.63–1.46)	.861
Household income (in quartile)	Low	201(68.5)	1.59(1.07–2.38)	.023	0.92(0.54–1.57)	.750
Lower-middle	166(55.7)	0.92(0.62–1.36)	.673	0.72(0.44–1.16)	.174	Upper-middle
168(60.0)	1.10(0.73–1.66)	.660	1.14(0.72–1.79)	.575	High	143(57.7)

1		1		Ever health screening in past 2 yrs	Yes	523(64.2)
1.87(1.36–2.55)	<.001	1.89(1.33–2.66)	<.001	No	155(49.0)	1
	1		Current drinking and smoking	Neither	139(70.5)	2.23(1.38–3.60)
.001	1.42(0.79–2.55)	.238	Drinking only	327(61.4)	1.48(1.05–2.09)	.025
1.09(0.74–1.60)	.666	Smoking only	45(65.9)	1.80(0.94–3.45)	.077	0.97(0.45–2.07)
.931	Both	167(51.8)	1		1	
Physical activity	Yes	255(59.4)	0.95(0.71–1.28)	.737		
No	423(60.7)	1				BMI (kg/m^2)
≤22.9 (normal)	187(68.1)	1.88(1.29–2.75)	.001	1.77(1.11–2.80)	.016	23–24.9 (overweight)
183(66.8)	1.78(1.22–2.60)	.003	1.37(0.89–2.11)	.156	≥25(obesity)	308(53.2)
1		1		Comorbidity	Neither	172(39.4)

1		1		Hypertension only	207(65.6)	2.93(2.02–4.26)
<.001	2.42(1.61–3.64)	<.001	Dyslipidemia only	103(81.9)	6.96(3.78–12.82)	<.001
6.57(3.32–13.00)	<.001	Both	196(79.2)	5.85(3.84–8.92)	<.001	5.87(3.74–9.22)
<.001	Glycated hemoglobin (%)	<5.7 (normal)	32(55.6)	1		
	5.7–6.4 (prediabetes)	150(55.9)	1.01(0.49–2.11)	.977		
≥6.5 (diabetes)	496(61.9)	1.30(0.67–2.50)	.436			Presence of family history of DM
Yes	296(64.7)	1.39(1.03–1.89)	.033	2.23(1.57–3.18)	<.001	No

Characteristics		DA (n = 684) n (%)†	Unadjusted OR (95% CI)	p	Adjusted OR (95% CI)	p
Age (yrs)	30–49	53(48.6)	1		1	
50–59	135(64.8)	1.94(1.15–3.27)	.013	1.27(0.69–2.34)	.444	60–69

200(70.3)	2.49(1.53–4.07)	<.001	1.31(0.67–2.56)	.432	≥70	296(78.6)
3.88(2.32–6.47)	<.001	2.15(1.04–4.47)	.040	Educational level	Elementary school or less	367(74.8)
2.56(1.51–4.34)	<.001	1.82(1.00–3.30)	.049	Middle school	119(69.6)	1.98(1.10–3.57)
.023	1.78(0.94–3.37)	.076	High school	151(62.5)	1.44(0.86–3.43)	.165
1.61(0.94–2.77)	.084	College or higher	47(53.6)	1		1
	Currently working	Yes	239(62.0)	1		1
	No	445(72.6)	1.63(1.20–2.22)	.002	1.35(0.94–1.92)	.102
Household income (in quartile)	Low	291(72.6)	1.49(0.93–2.38)	.101		
Lower-middle	179(67.3)	1.16(0.70–1.90)	.572			Upper-middle
124(65.9)	1.09(0.65–1.81)	.754			High	90(64.1)
1				Ever health screening in past 2 yrs	Yes	464(70.9)
1.39(0.99–1.95)	.057			No	220(63.6)	1

			Current drinking and smoking	Neither	392(72.9)	1.39(0.41–4.68)
.598			Drinking only	270(63.0)	0.88(0.26–2.94)	.833
		Smoking only	6(85.2)	2.96(0.36–24.13)	.310	
	Both	16(66.0)	1			
Physical activity	Yes	205(70.2)	1.14(0.80–1.62)	.465		
No	479(67.5)	1				BMI (kg/m^2)
≤22.9 (normal)	177(71.6)	1.37(0.92–2.03)	.124	1.70(1.08–2.66)	.022	23–24.9 (overweight)
169(73.5)	1.51(1.02–2.23)	.039	1.55(0.97–2.48)	.069	≥25(obesity)	338(64.8)
1		1		Comorbidity	Neither	106(45.2)
1		1		Hypertension only	177(74.6)	3.55(2.26–5.57)
<.001	2.98(1.77–5.02)	<.001	Dyslipidemia only	132(80.4)	4.95(2.92–8.38)	<.001

4.94(2.86–8.54)	<.001	Both	269(75.0)	3.62(2.46–5.33)	<.001	3.25(2.05–5.17)
<.001	Glycated hemoglobin(%)	<5.7 (normal)	18(51.1)	1		1
	5.7–6.4 (prediabetes)	184(75.2)	2.90(1.21–6.96)	.017	2.63(1.02–6.82)	.046
≥6.5 (diabetes)	482(66.8)	1.92(0.86–4.30)	.111	2.18(0.93–5.13)	.074	Presence of family history of DM
Yes	332(73.7)	1.58(1.15–2.17)	.005	1.91(1.33–2.74)	<.001	No

DETAILS

Subject:	Comorbidity; Sample size; Diabetes; Womens health; Socioeconomic factors; Family medical history; Regression analysis; Body mass index; Gender; Hypertension; Sociodemographics; Nutrition; Variables; Family income; Medical screening; Fasting; Households; Health insurance
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Document 17 of 29

Development and Validation of the Happiness Scale for Middle-Aged Women Based on Existence, Relation, and Growth Theory

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ABSTRACT (ENGLISH)

Purpose

This study aimed at developing a happiness assessment scale for middle-aged women (HAS-MW) in Korea.

Methods

Preliminary items for the scale were drafted from the results of literature review and personal interviews and open-ended questions with women in the community. The interviews were based on the theory of existence, relatedness, and growth. After validating a preliminary scale, we analyzed the validity and reliability of the new scale items, and model fit. We surveyed 600 women aged 40 years to 64 years for exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Valid data were divided into 352 for EFA and 174 for CFA by multiplies of number 1 to 3.

Results

Using exploratory and confirmatory factor analyses, we extracted four primary factors—self-value, positive thinking, self-care, and family relationship—and with a total of 24 items for HAS-MW. The fit of the final model was evaluated as good showing $\chi 2/df = 2.10$, goodness of fit index = .80, comparative fit index = .85, root mean square error of approximation = .08, standardized root mean residual = .05. The HAS-MW had a significant positive correlation with the Oxford Happiness scale and showed a significant negative correlation with the Hwa-Byeong Scale. Cronbach's α for the new scale was .91, and the Spearman-Brown half coefficient was .93. The new scale used a five-point Likert scale with higher scores indicating greater happiness.

Conclusion

The HAS-MW is a reliable and valid one. It can be used to measure the level of happiness for middle-aged women. In addition, it might be applied to find low women and to evaluate the effect of intervention program related to happiness in woman of middle age.

FULL TEXT

Introduction

Women in middle age (approximately 40–64 years old) may face emotional crises, feeling psychologically low or worthless as menopause lowers estrogen levels [1]. However, it is also the period when they mature by looking back on their lives. Furthermore, middle-aged women's happiness also affects their families [2,3], as many enjoy sharing time with others with the clear perspective of those with accumulated experiences. Thus, middle age can be interpreted as the pinnacle of a new direction, not a downward curve in life. This period of adulthood can be made happy by actively embracing various internal and external changes and maintaining a positive balance in life [2,4].

The Korean Dictionary defines happiness as “a state of pleasure and contentment in life” [5]. The concept of happiness has three common yet diverse characteristics. First, it is subjective; second, it reflects active and positive aspects of life; finally, it involves an overall assessment of life [6]. The Subjective Happiness Scale measures overall subjective happiness based on the respondent's perspective [7]. Individuals' definitions of “happiness” may vary. Some may judge happiness in the moment; others may answer looking back on a year or their whole life. Thus, it is difficult to measure individual happiness with a simple question [8].

In addition, culture influences “happiness” conceptualization [9], as Westerners emphasize intrapersonal or internal experiences, whereas Chinese culture emphasizes the interpersonal or external. Furthermore, it is not certain that subjective well-being constitutes all the dimensions of happiness in Korean culture, such as positive relationships with others, self-acceptance, family identity, personal growth, love, academic concern, life purpose, responsibility for one's own life, sense of purpose, life goals or mission, health, and financial success [6].

The theoretical definition for happiness is “physical comfort and emotional pleasure related to satisfying personal needs in a specific social and cultural environment” [9]. It depends on personal characteristics and cognitive evaluation of the external situation. Furthermore, achievement of life goals means ultimate self-realization and meaningful outcomes in human relationships [10]. Among the happiness-related theories, such as Maslow's hierarchy of needs, self-determination theory, modernization and freedom of choice, and positive psychology, Alderfer condensed 3 dimension of the Existence, Relatedness, Growth (ERG) theory [11] from Maslow's 5 needs [12]. Specifically, existence needs include all material and physiological desires. Relatedness needs encompass social and external esteem; relationships with significant others such as family, friends, coworkers, and employers. Growth needs internal esteem and self-actualization; these impel a person to make creative or productive effects on himself and the environment. This ERG theory supports individual specific objectives depend on the uniqueness of each person ultimately [11]. The Happiness Index for Korean that renamed the Korean Happy Life Inventory [6] did not include the continuous interaction between women and the surrounding environment. A happiness assessment scale for middle-aged women (HAS-MW) in Korea should include internal external needs and the continuous interaction with surrounding environment to understand happiness for middle-aged women.

The next important factor to objectively measure happiness is the criteria for “happiness.” These criteria depend on the economic, political, social, and cultural environments to which individuals belong [13] that lead to their perception of happiness [14]. Happiness has a positive effect on many parts of our lives. In particular, the happiness of middle-aged women is a subjective perception affecting not only their own lives but also their families and communities [3]. The use of abstract happiness as a measurement criterion requires an objectively measurable indicator (or something interpreted as an objective indicator) [15]. A scale for measuring happiness must reflect the subject's characteristics to ensure the subjective measurement method is valid and reliable. However, the only tool for measuring the happiness of middle-aged Korean was developed for all adults, regardless of gender [6,16]; few tools have been developed by identifying the original characteristics and components of happiness based on perspectives of middle-aged women. It is required to develop a happiness assessment scale reflecting characteristics or attributes of happiness in middle-aged women to consider gender and age.

Therefore, the first step in developing a happiness-measurement instrument is understanding the components of happiness for the target population. We identified nine components that comprise happiness for women in middle age [17], reflecting existence, relations, and growth needs of ERG theory [11]. Accordingly, we sought to develop a happiness-measurement tool reflecting middle-aged Korean women's physical, psychological, and sociocultural characteristics—based on nine components of their happiness [17]—to be used as the primary scale for evaluating happiness for women of this age. This HAS-MW will be first scale in Korea based on ERG theory for women in middle age and different from other happiness scales.

The conception of and sources of well-being or happiness may be different in collectivist cultures that emphasize harmony in relationships with others rather than individualism [13]. Thus, subjective well-being consists of three components: life satisfaction, presence of positive affect/absence of negative affect, and psychological well-being, based on the intensive integration of several theoretical domains including life span developmental perspectives, mental health, and clinical psychology [18].

Hence, we aimed to understand happiness for middle-aged women according to ERG theory [11] and to develop a HAS-MW. To verify that the scale would have a sufficiently empirical foundation, a previously published first phase of the instrument's development [17] involved concept analysis of in-depth interviews with middle-aged women. The results of that previous study yielded nine extracted components of happiness [17]. The present article describes phase two of our research: developing and validating the new scale, the HAS-MW, to be used to assess and evaluate happiness of women in middle age in a comprehensive and multidimensional way using physical, psychological, and social traits.

Methods Study design

This methodological study included a cross-sectional survey to develop a HAS-MW. The framework of the conceptual model in this study is Alderfer's ERG theory [11]. Scale development process are shown in Figure 1.

Participants and data collection

Data were collected from February 1 to March 23, 2018, from middle-aged women aged between 40 and 64 years. Participants were assigned based on the population census—Statistics Korea 2015 [19] to Seoul metropolitan and six

Korean provinces. Inclusion criteria were middle-aged (40-64 years) women in community. Women those who admitted in the facilities such as hospital or nursing home were excluded. A total of 600 questionnaires were distributed by mail or personal contact; 567 were collected (response rate = 94.5%). A total of 526 copies (92.8%) were used for final analysis; 41 were excluded owing to insufficient data (7.2%).

Participants provided their informed consent to participate, verifying that they understood the purpose and content of the study. The sample size needed was more than 300, or 5–10 times the number of items for exploratory factor analysis (EFA), and five times the number of items for confirmatory factor analysis (CFA) [20]. According to the previous explanation, sample size was decided to be 600 in total for EFA and CFA. Multiples of 1 and 2 were determined by the EFA group, and multiples of 3 were determined by the CFA group. In addition, data of participants were 352 for EFA and 174 for CFA exclusively by and these data were satisfied minimum requirement of sample size for EFA and CFA.

Ethical consideration

This study was approved by the Institutional Review Board of the Soonchunhyang University (Approval no. 1040875-201706-SB-02-2). Participants were informed of the purpose of the survey and agreed to answer our questionnaire.

Scale development

This scale development was conducted in accordance with reference of scale development [21].

Generate an item pool and format for measurement

Literature reviews were performed after searching PubMed, EMBASE, CINHAL, and KMBASE, KISS, KoreaMed, DBpia, Riss, and the National Assembly Library database. The publication period searched was January 1, 1980 to August 31, 2017, because research on well-being, life satisfaction, and quality of life was published after 1980. The literature review of 133 articles and one-hour interviews with 25 middle-aged women revealed the attributes of middle-aged women, related factors, and components of happiness [17]. Women were asked to talk about main questions such as “How do you think about happy person as a middle-aged woman?”, “When do you feel happy?”, “What are you doing to be happy?”, and so on. Through literature review and analysis of interviewed contents, we extracted a total of 80 initial items, composing 9 components of physical function factor, economical factor, appearance factor, family relations, social relations, self-esteem, mind control, positive thinking, and leisure life based on ERG theory.

Item formats for assessment of happiness is a Likert scale. Because Likert scaling is widely used in instruments measuring opinions, beliefs, and attitudes. Likert scale response options are a 5-point scale (1: Absolutely disagree. 2: Mostly disagree 3: Moderate 4: Mostly agree 5: Absolutely agree).

Item pool reviewed

Extracted items were reviewed by one professor and 25 middle-aged women. Twenty-five participants completed pooled items. It was also considered an average time to response and understandability.

Inclusion of validation items

Inclusion for validation items was performed by six experts. For validation items, based on established guidelines [22]. As a next step, pilot test was conducted using a 5-point Likert scale to 30 participants in 3 provinces.

Scale evaluation Administering items to middle-aged women

Nunnally suggests that 300 people is an adequate number [19]. Tabachnick and Fidell reports that the sample size needed was more than 300, or 5–10 times the number of items for exploratory factor analysis (EFA), and five times the number of items for confirmatory factor analysis (CFA) [21]. To prevent pitfall of small sample size, five times of survey items and about 20.0% drop rate, 600 in total were recruited, 400 for EFA, and 200 for CFA.

Evaluate the items

Descriptive statistics and reliability and validity tests were performed with SPSS Statistics 24.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to determine frequency, range, mean, and standard deviation of the sample's demographic and clinical characteristics. All other tests were two-tailed, and a *p*-value of less than 5.0% was considered statistically significant.

To evaluate the performance of the individual items, analysis was conducted for item means, item variances, skewness and kurtosis, and item-scale correlations. The item performance, absolute values of skewness, and kurtosis were normally distributed: all absolute values satisfied with values less than 3.0 for skewness and less than 7.0 for kurtosis. Furthermore, confirmed item-scale correlations (≥.30) [21,23].

For construct validity, we performed EFA using IBM SPSS 24.0 and CFA using IBM SPSS AMOS 20.0 (IBM Corp., Armonk, NY, USA). Researchers used principal components analysis as the factor extract model to minimize information loss from minimum-factor prediction, and varimax rotation to know structures of independent factors by maximizing the sum of factor-loading variance [23], the Oxford Happiness Questionnaire (OHQ) was evaluated with principal component analysis and varimax rotation [24]. First, to confirm the appropriateness of materials for EFA, Kaiser-Mayer-Olkin (KMO) test, and Bartlett's test of sphericity were evaluated [25]. Bartlett's test of sphericity confirmed patterned relationships among the variables, as seen in the correlation matrix (*p*

For extracting factors through EFA, the number of factors was determined by the following criteria: eigenvalue of 1 or above, factor loading (≥.40) [25], and accumulative variance of 50–60.0% [21,26]. For CFA model verification, the goodness of fit coefficients, Normed χ2 (χ2/df), the goodness of fit index (GFI), standardized root mean residual (SRMR), root mean square error of approximation (RMSEA), Tucker-Lewis index (TLI), and comparative fit index (CFI) were verified. In addition, the HAS-MW criterion validity and discriminant validity were compared.

For criterion validity, the OHQ [24] was used. Because it has been used as golden standard world wide, it was selected. Pearson's correlation coefficient was applied to determine the criterion validity of the HAS-MW's and the OHQ-Korean [27] scale. The twelve negative items among the 29-item OHQ were reverse-scored. The sum of the item scores was the overall measure of happiness, with higher scores indicating greater happiness. Cronbach's α of this study was .87, whereas the original version reported Cronbach's α of .90 [24].

For discriminant validity, Pearson's correlation coefficient was calculated for the HAS-MW and the Hwa-Byung Scale [28]. Hwa-Byung is a culture-related anger syndrome in Korea. And higher in the degree of hwa-byung, higher in depression or anger. Therefore, this scale is thought to be negatively related to happiness [29]. The Hwa-Byung scale comprises 15-items related to emotional and physical symptoms evaluated on a 5-point Likert scale. Cronbach's α at development was .92 [28]; Cronbach's α was .93 in this study.

Results Participants' characteristics

Researchers used data of 352 of 526 participants for EFA. The participants' mean age was 50.6 (±7.17), and most of the women were married (84.4%), 53.7% had education levels of college or above, 74.7% had one or two children, 72.4% held jobs outside the home, 71.9% was religious, 68.5% had no diseases, and 58.2% had not ended their menstrual cycles. On the other hand, participants for the CFA were 174, and their mean age was 49.9 ± 7.51. Of them, 81.6% was married, 60.3% had an education level of college or higher, 33.3% finished high school. Of the participants, 73.0% had one or two children, 33.3% had some form of disease, and 37.9% had ended their menstrual cycles (Table 1).

Scale development Generation of item pool and item selection

Generated 80-item pool was reviewed by one professor and by 25 middle-aged women. In this step, 3 items were excluded owing to redundancy.

Six experts (two psychologists with doctoral degrees, three psychiatrists, and one doctor of women's studies) verified item content for valid item selection to measure a happiness for women in middle age. Ten items (I-CVIs

Item evaluation for adequacy

As a next step, item evaluation for adequacy as a scale was conducted using a 5-point Likert scale to 30 participants in 3 provinces. 30 participants completed 59-item questionnaire in an average of 8 minutes; the mean of understandability was 3.20–3.70 (from four scores), indicating the participants found the questionnaire easy to understand. Item mean (±SD) for 59 items showed 3.57 (±0.35) and internal consistency was Cronbach's α .93. In this step, Bartlett's value was χ^2 = 8191.02 (*p* **Scale evaluation**

In the scale evaluation step, using IBM SPSS 24.0 and AMOS 20.0 (IBM Corp., Armonk, NY, USA), exploratory factor analysis identified categories of similar statements and extracted 4 factors. Also validity was tested with the

Korean version of OHQ [27] for criterion validity, and with Hwa-Byung [28] for discriminant validity. Item mean (±SD) for 59 items showed 3.44 ± 0.38 (minimum 2.29, maximum 4.68) with 352 participants. Through confirmatory factor analysis for model fit, the reliable and valid 24-item HAS-MW was developed.

Exploratory factor analysis Number of factors

The number of factors was determined by the following criteria: eigenvalue of 1 or above, factor loading (≥.40) and accumulative variance of 50–60.0%. Ten items (having item-total correlation coefficients Fig. 2a].

Item reduction

During four times of EFA, 6 items with loading lower than .40 and 8 items with one factor one item were removed (reduced to 35 items). Three redundant items were rejected after comparison with other items in the same factor and 32 items were extracted.

In the fifth EFA, all items' factor loadings were satisfactory (>.40). Through review of items (factor loading > .40), 4-items (Q31, Q49, Q52, Q56) were deleted that not fit any factor or show different meaning from other items. Finally, four factors, 28 items including three dimensions of ERG (existence, relation, and growth) theory were produced. These 28-items explained 53.2% of the variance for happiness in middle-aged women (Table 2, Fig. 2b).

Confirmatory factor analysis Model fit

For CFA model verification of 4-factor, 28 items scale, we used the data not used in the EFA (n = 174). To improve model fit, we performed an analysis requesting modification indices. At first, for the estimates of CFA, identifying four items (Q6, Q10, Q33, Q42 in Table 2) with a critical ratio of 1.96 (p Table 3). Second, the modified model fit resulted in a final scale of 24 items reflecting happiness in middle-aged women. Critical ratio was 4.809–10.040 (p Table 3). Model fit indices for the scale with four factors, 24 items were χ^2 = 517.63 (p 2 is sensitive to sample size, so we performed further examination. GFI was .80, which is thought to indicate a comparatively good model fit. The RMSEA was .08, and the SRMR was .05, indicating satisfactory model fit [25]. The fit of the final model was verified to be good, having χ^2/df = 2.10, GFI = .802, AGFI = .758, NFI = .749, IFI = .850, TLI = .829, CFI = .848, RMSEA = .080, and SRMR = .05 (Table 3). Based on the above CFA, the four-factor 24-item of the HAS-MW was considered as valid (Supplement 1).

Factor naming

Four factors composed of 24 items were extracted after CFA [Fig. 2b]. Factors were named as ‘Self-value’, ‘Positive thought’, ‘Self-management’, and ‘Family relations’ based on their content: Factor 1 included eight items (Q29, Q30, Q32, Q34, Q36, Q37, Q38, and Q40) meant “to be loved and be accepted as valuable by oneself” and was named ‘Self-value’. Factor 2 included eight items (Q39, Q44, Q45, Q46, Q47, Q48, Q54, and Q55) meaning positive thought and joyful feeling and was named ‘Positive thought’. Factor 3 included five items (Q5, Q8, Q57, Q58, and Q59) related to the physical/psychological leeway to do something and was named ‘Self-management’. Factor 4 included three items (Q18, Q19, and Q21) related to interaction among family members and was named ‘Family relations’ (Table 3, Fig 2b).

Criterion validity and discrimination validity

Criterion validity was confirmed with the OHQ-Korean version [27]; the correlation coefficient between HAS-MW and the OHQ was r = .84 (p 28], and the correlation coefficient between HAS-MW and Hwa-Byung was r = −.51 (p

Reliability

The internal consistency of HAS-MW was also evaluated using Cronbach's α and the Spearman-Brown half coefficient. Cronbach's α of the final 24-item scale was .91 for all items and Cronbach's α for component factors (Factor 1, 2, 3, 4) were .88, .81, .80, and .76, respectively. The Spearman-Brown split-half parallel reliability coefficient was .93. Hence, the. HAS-MW was considered reliable for measurement of happiness for middle-aged women.

Finalizing scale

Through confirmatory factor analysis, 24 items were verified as HAS-MW reliable and valid. Mean (±SD) for scale was 86.74 (±10.45) (range: 44~108). Item mean (±SD) was 3.61 ± 0.43. One professor of Korean language education confirmed text of final scale and it was translated [S1].

Discussion

A growing number of social scientists are examining humans' more positive aspects, such as subjective well-being, psychological well-being, life satisfaction, happiness, and quality of life [13,14,30]. Also, researchers have tried to measure the achieved happiness, personality, attitude and value, and life-style domains of happiness as they have come to be defined in the literature. In this study, we tried to understand happiness for middle-aged women based on ERG theory [11] and developed the HAS-MW in Korea. Our findings suggest that the HAS-MW shows good psychometric properties. In this section, we discuss about internal consistency and validity, and components of a scale.

First, in the validity, criterion-related validity of this scale showed high correlation with the OHQ [24], the gold standard happiness measurement. The OHQ focuses on life satisfaction and emotional experience [24]. However, it does not include leisure, family relationships, self-achievement, or self-development, while the HAS-MW includes attributes of happiness in middle-aged women. In addition, people's literacy diminishes as they grow older [31], so we aimed to use the fewest items possible and make them easy to answer [27]. The HAS-MW composed of positive wording questions. Pooled item of HAS-MW included negative questions, but those kind of items were excluded naturally. The study excluded negative wording items of the OHQ and raised convenience [32] and positive wording might prevent potential response errors [33]. Furthermore, the HAS-MW has discriminant validity, showing a negative correlation with the Hwa-Byung Scale [28]. When compared with the results of the more severe Hwa-Byung, which includes items that negatively affect quality of life [34], the HAS-MW we developed has confirmed discriminative validity.

Second, the reliability of the HAS-MW in this study was established: Cronbach's α was 91, and the Spearman-Brown split-half reliability was .93. It has a reliable scale based on the standpoint that Cronbach's α is .60 or higher indicates good reliability of newly developed psychological and social scales [35]. Furthermore, the HAS-MW fits uses a five-point Likert scale, the most reliable scale for a subject-centered approach [36].

Third, the “happiness” components we included support the ERG theory [11]. The HAS-MW comprises four factors, among which “family relationship” corresponds to the relatedness needs in ERG theory; the others, “self-value,” “positive thinking,” and “self-management,” correspond to the growth needs in ERG theory, which represent the desire for growth and achievement [11]. This feature of middle age expresses as a process of re-recognizing the value of oneself and discovering the value and life's meaning through internal reflection [4], suggesting the importance of growth to the happiness of middle-aged Korean women. Some attributes of the HAS-MW differ from the Koreans' Happiness Scale of Life [6], although it is also based on the ERG theory and the Maternal Happiness Scale [37]; they share common traits but the factors that are most important vary depending on participants' characteristics. The factors of HAS-MW (See Supplement 1, [S1]) include self-value (self-worth), with eight items (Q1–Q8) that are important determinants of happiness. Prior researchers have identified these values which relate to being recognized by oneself and others [38]. Such recognition increases subjective happiness because self-esteem rises when one feels validated as an important and indispensable individual [39]. The Korean version of the Mental Health Continuum-Short Form [40] also recognizes self-value for happiness. Inclusion of the self-value factor items may signify a cultural shift from traditional values of collectivism to a modern values of individualism, reflecting the attitudes of middle-aged women who are actively moving toward becoming the center of their own lives, as individuals, and away from being submissive and passive wives or mothers in a male-centered society. This result also supports the thinking that individualistic and collectivistic cultures rely on different sorts of information in making life satisfaction judgments [41].

The second factor, positive thinking, comprises eight items (Q9–Q16) that strongly relate to happiness based on appreciation. Positive thinking relates positively to psychological well-being, life satisfaction, and the use of positivity to maintain psychological stability in everyday life [41]. The positive thinking factor also reflects how meaning in women's lives depends on their degree of acceptance of menopause [42]. That is, happiness in middle-aged women can be evaluated and experienced differently by different generations or individuals [13,14,43].

The third factor, self-management, expressed in five questions (S1: Q17–Q21), included factors related to leisure activities in life. The importance of leisure has been the focus of several studies of happiness in people of middle age [44]. The pleasant experience associated with a life of leisure reduced depressive symptoms, making it an important source of life in middle-aged and older adults [43]. In this factor of self-management, there are items that are different from the OHQ in Korean [27]. That is, items such as “I have a healthy and well-balanced diet” and “I have my own way of relieving stress” are expressed in specifically positive language for self-management in the HAS-MW. On the other hand, the OHQ is composed of pleasurable life, meaningful life and engaging life, does not include self-management.

Finally, the fourth factor, family relationship, comprises three items (S1: Q22–Q24). This factor was included in the Happiness index for Koreans [6] but not the Korean Youth Happiness Index [45]. This concept refers to how happiness depends on individuals and how they prioritize it in their lives in terms of their family relationships, which are seen as particularly important for middle-aged women. A stable and strong bond or meaningful relationship can invoke positive feelings and make women feel happy [9,43,46]. In particular, this study revealed the importance of family relations to the happiness of Korean middle-aged women, as evidenced by the items “We have a good family relationship (including parents, siblings)”, “We care about each other (including parents, siblings),”and “We make important decisions through discussions (including parents, siblings)”. This attribute is consistent with research that emphasizes emotional stability as a major dimension of happiness in women's happiness [43,47]. Hence, we suggest that the family relations factor should be considered for development programs to support women emotionally in the future.

The HAS-MW developed in this study is the first scale in Korea with its reliability and validity expressed in empirical language that reflects the attributes and properties of happiness in middle-aged women. It is meaningful to develop a scale that directly explores and checks the components of happiness in middle-aged women. The 4 factors are related to each other, yet are independent and reflect individual and collectivist cultural characteristics [13,41].

A few limitations should be considered when interpreting the HAS-MW. This study did not provide a cut-off score for happiness. In general, to show a cut-off point, the golden standard must be used as the appropriate reference point. However, we used the OHQ [24] as the golden standard but it does not provide a cutoff point. Furthermore, happiness is relative based on individual differences [13,48]. Thus, it is difficult to conclude that a person with a low HAS-MW score is absolutely unhappy. Furthermore, since the factors that make contribute to great happiness vary by individual; the scores depend on the person rather than the tool used. The objective cut-off point should be decided through a careful and complex process which should be determined by a common consensus of experts. Also, model fit indices of CFI and TLI (>.80) are permitted, but it is not great (>.95). Further validation study is necessary to be reanalyzed and improve model fit.

In addition, the study only involved women in Korea; therefore, its validity in other cultures is unknown. Future research may use this scale as a basis for versions to fit various cultures globally. Despite limitations, it is expected that the HAS-MW would be useful for individuals and counselors to evaluate happiness-related factors of middle-aged women and to contribute to the creation of a bright and healthy society by improving their positive well-being. The newly developed HAS-MW may also be useful in clinical assessment, where the happiness score might reflect recovery from psychological conditions such as anxiety, stress and depression. Also it could be used for women with low scores of HAS-MW to get counseling or treatment. It is required to explore the gender effects in happiness in middle-aged men and women and cultural impacts for multicultural background. Finally, under conditions of COVID-19, happiness needs to be reevaluated to see the change in middle-aged women who worked more for their families than before COVID-19.

Conclusions

This study developed the HAS-MW, considering their pursuit of happiness, and it measures happiness based on the fulfillment of ERG needs. It is a significant development in illuminating and measuring positive aspects of happiness, particularly for Korean women in middle age.

The HAS-MW is a reliable and valid scale to measure happiness in middle-aged women and is composed of four factors, “self-value,” “positive thinking,” “self-management,” and “family relationship,” comprising 24 items.

Happiness is measured using 5-point Likert scores, and higher scores indicate happier women. This scale may also be useful in clinical assessment for psychological conditions such as anxiety, stress, and depression. It is required to show the similarity and difference from the attributes for happiness in middle-aged men. We suggest future studies not only women with diseases and those with multicultural backgrounds but also middle-aged men.

Conflict of interest

All authors declare no potential conflicts of interests.

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Appendix A Supplementary data

The following is the Supplementary data to this article:**Multimedia component 1**Multimedia component 1

Appendix A Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.anr.2020.12.002.

Characteristics	Categories	Total (n = 526)	EFA (n = 352)	CFA (n = 174)
M ± SD or n (%)	M ± SD or n (%)	M ± SD or n (%)	Age (yrs)	
50.3 ± 7.17	50.6 ± 7.17	49.9 ± 7.51	Marital status	Single
33 (6.3)	18 (5.1)	15 (8.6)	Married	438 (83.3)
297 (84.4)	142 (81.6)	Divorced	24 (4.6)	16 (4.6)
8 (4.6)	Bereaved	19 (3.6)	13 (3.7)	6 (3.5)
Remarried	9 (1.7)	8 (2.3)	1 (0.6)	Others
3 (0.6)	0 (0.0)	3 (0.6)	Education	Elementary school
11 (2.1)	9 (2.6)	2 (1.2)	Middle school	30 (5.7)
21 (5.9)	9 (5.2)	High school	191 (36.3)	133 (37.8)
58 (33.3)	Over college	294 (55.9)	189 (53.7)	105 (60.3)
Number of children	0	25 (4.8)	9 (2.6)	16 (9.2)
1–2	390 (74.1)	263 (74.7)	127 (73.0)	≥3
78 (14.8)	62 (17.6)	16 (9.2)	Job	No
145 (27.6)	97 (27.6)	48 (27.6)	Yes	381 (72.4)

255 (72.4)	126 (72.4)	Religion	No	158 (30.0)
99 (28.1)	59 (33.9)	Yes	368 (70.0)	253 (71.9)
115 (66.1)	Disease	No	357 (67.9)	241 (68.5)
116 (66.7)	Yes	169 (32.1)	111 (31.5)	58 (33.3)
Menopause	No	313 (59.5)	205 (58.2)	108 (62.1)

Item No. (Total items = 28)	Communality	Factors			
F1	F2	F3	F4	Q33^{+}	.80
.73	.64	.26	−.02	Q32	.74
.66	.29	.14	.07	Q34	.66
.66	.12	.28	−.04	Q38	.69
.65	.39	.05	.17	Q36	.68
.64	.38	.04	.32	Q30	.65
.62	.28	.08	.35	Q29	.67
.55	.40	.17	.17	Q37	.70
.55	.46	−.03	.31	Q40	.60
.53	.41	.27	.15	Q46	.67
.13	.80	−.05	−.01	Q47	.55
.21	.70	−.03	.03	Q45	.56
.33	.58	.13	.18	Q44	.58
.00	.57	.09	.08	Q48	.53
.21	.57	.18	.16	Q39	.53

.40	.56	.04	.10	Q55	.71
.26	.51	.15	.21	Q42^{+}	.59
.16	.47	.16	.04	Q54	.69
.33	.44	.21	.14	Q10^{+}	.63
−.05	.13	.72	.02	Q58	.76
.36	−.04	.70	−.03	Q6^{+}	.66
.41	.05	.68	−.12	Q59	.72
−.11	.23	.67	.19	Q57	.72
.31	.04	.65	.16	Q5	.56
.17	.02	.61	.22	Q8	.62
.14	.38	.54	.14	Q18	.72
.11	.06	.10	.79	Q19	.72
.15	.22	.14	.76	Q21	.63
.10	.13	.12	.74	Eigen value	
9.16	2.58	1.72	1.45	Explained variance (%)	
16.39	15.74	12.38	8.71	Cumulative explained variance (%)	

Factors	No	Items	Unstandardized regression weight	SE	CR	Standardized regression weight
Self-value	Q32	I think life is a constantly changing and growing process for me.	1.00			.70

Q36	I am a worthy person.	.94	.10	9.80	.82	Q29
I have a lot of strong points.	.93	.10	9.07	.73	Q38	I think positively about myself.
.91	.09	9.92	.82	Q30	I value myself.	.90
.10	9.31	.76	Q40	I am satisfied with myself.	.83	.11
7.98	.65	Q37	I'm the one that others need.	.82	.10	8.45
.69	Q34	I spare no cost about learning.	.73	.11	6.52	.52

Positive thought	Q47	I try to see others as they are.	1.00			.66
Q55	As I experience difficulties I think it is an opportunity to learn.	.99	.14	7.25	.62	Q44
I focus on what I can do well.	.96	.14	7.03	.63	Q45	I am satisfied with the result I effort
.93	.13	6.94	.63	Q39	I have a good personality.	.92

.14	6.83	.57	Q48	When I talk to other person, I focus on them.	.81	.13
6.94	.63	Q46	I am thoughtful others around me.	.78	.12	6.52
.60	Q54	I think experience of menopause leads to a deeper understanding of life's meaning.	.73	.15	4.91	.41
Self-management	Q59	I do a hobby that I want.	1.00			.87
Q58	I travel whenever I want.	.88	.09	10.04	.76	Q57

I have enough spare time to enjoy my own time.	.60	.08	7.16	.58	Q8	I have my own way of relieving stress.
.48	.09	5.61	.45	Q5	I eat a healthy and well-balanced diet.	.39

.08	4.81	.39	Family relations	Q19	We care about each other (including parents, siblings).	1.00

		.87	Q18	We have a good family relationship (including parents, siblings).	.86	.10

9.02	.74	Q21	We have decided important things with discussions (including parents, siblings).	.79	.09	8.51

DETAILS

Subject:	Womens health; Likert scale; Happiness; Culture; Literature reviews; Middle age
Identifier / keyword:	factor analysis, statistical; female; happiness; middle aged; validation study
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Document 18 of 29

Development and Validation of the Humanistic Practice Ability of Nursing Scale

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ABSTRACT (ENGLISH)

Purpose

The purpose of this study was to develop a Humanistic Practice Ability of Nursing (HPAN) scale adapted to China and validate its psychometric properties.

Methods

The original HPAN scale was revised through a literature review. Sixteen experts who met the inclusion criteria were consulted 2 rounds by the Delphi method. According to their suggestions and opinions, the structure, content, and semantics of each item of HPAN were modified, and a HPAN scale was preliminarily developed. The HPAN scale was validated through item analysis, exploratory factor analysis, convergent validity, and reliability. The data came from 406 first-class hospital nurses.

Results

A 5-dimension, 29-item HPAN scale demonstrated satisfactory fit with significant factor loadings. The split-half reliability coefficient of the scale was .98, the split-half reliability coefficient of each dimension was .86–.99, Cronbach's α coefficient was .96, and the Cronbach's α coefficient of each dimension was .87–.98. The model fit of the scale was good, and the items of the scale showed convergent and discriminant validity.

Conclusion

The HPAN scale indicated that the reliability and validity were good. It is easy to imply factors of HPAN. This scale can be used to assess the HPAN.

FULL TEXT

DETAILS

Subject:	Patients; Behavior; Nursing education; Colleges &universities; Ethics; Legal medicine; Communication; Nursing theory; Nurses; Nursing care; Adjustment; Clinical nursing
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Document 19 of 29

Comparison of Bleeding, Hematoma, Pain, and Discomfort After Bone Marrow Examination With or Without Sandbag Compression

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ABSTRACT (ENGLISH)

SummaryPurpose

A safe and effective hemostatic care is necessary after bone marrow examination to minimize bleeding, pain, and discomfort. However, a standardized hemostatic care protocol following bone marrow examination has not been established. The purpose of this study was to investigate the differences in bleeding, hematoma, pain, and discomfort by the hemostatic method used following bone marrow examination.

Methods

This study was carried out with a pre-test/post-test nonequivalent control group design. Sixty-four patients undergoing bone marrow examination at the hemato-oncology ward in a tertiary hospital in South Korea were assigned to an intervention ($n = 30$) and comparison group ($n = 34$). The intervention group was treated using a compression dressing alone, while the comparison group received a compression dressing followed by sandbag compression. Both groups received two hours of bedrest. Bleeding, hematoma, pain, and discomfort were measured at one and two hours after the biopsy.

Results

No significant differences in the occurrence of bleeding between the groups at one and two hours after bone marrow examination were observed, and no participant developed hematoma. The intervention group had significantly lower pain than the comparison group two hours after the bone marrow examination as well as lower discomfort one hour and two hours after the bone marrow examination ($p < .05$).

Conclusion

Applying only compression dressing after a bone marrow examination is effective in reducing pain and discomfort without measurable differences in bleeding and hematoma, suggesting that compression dressings alone could be effective in lowering pain and discomfort following bone marrow examination.

FULL TEXT

Introduction

Patients with hematologic disorders often undergo bone marrow aspiration or bone marrow aspiration and biopsy to obtain an accurate diagnosis and to identify the etiology of the disease [1–3]. Owing to population aging, changes in dietary patterns, and environmental changes, blood disorders have increased in recent years [4], and bone marrow biopsy is becoming increasingly common in South Korea. From 2010 to 2017, there was a 21.0% increase from 17,349 to 21,003 biopsies [5], suggesting that better management of patients undergoing bone marrow biopsy may be required.

Bone marrow examination is an invasive procedure in which bone marrow samples are typically obtained from the iliac crest, anterior iliac crest, or sternum using a needle. Hence, bleeding prevention at the puncture site is important [1]. Because the incidence of bleeding two hours following a bone marrow examination is 16.0% and four hours after the bone marrow examination is 5.3% [6], appropriate hemostasis is crucial. Discomfort around the puncture site has been reported to have an average rating of 3.12 (out of 10) two hours after the bone marrow examination and 5.90 four hours after the bone marrow examination, suggesting that patient discomfort rose with increased periods of bedrest [6]. Fifty-nine percent of patients during the procedure of bone marrow examination reported experiencing moderate discomfort [7]. Furthermore, 17.0% of the patients after 10 minutes and 64.0% after 1 day following bone marrow examination reported experiencing moderate pain [7]. The pain level after bone marrow examination was 1.98 on a 0–5 scale [8], which also showed moderate pain after bone marrow examination. Given these findings, safe and effective hemostatic care is needed after bone marrow examination both to minimize bleeding and to promote the patient's comfort.

However, the lack of a standardized hemostatic care protocol following bone marrow examination, such as the lack of recommendations of a hemostatic method (whether sandbag is applied or not) and absolute bedrest time, has led hospitals in South Korea and abroad develop and implement their own protocols [9–22]. Existing hemostasis protocols of other countries after bone marrow examination have recommended applying pressure for two minutes until bleeding stops, compressing with gauze and Elastoplast [12], applying pressure to the biopsy site with the patient lying on their back for 10–60 minutes until the bleeding stops, and then adhering a bandage [10,13–18]. Bedrest should be taken within an hour after compression on the biopsy site following a bone marrow examination in the USA, Japan, Vietnam, Singapore, and Canada. While it is the current practice not to use sandbags in other countries, some Korean nurses still practice applying sandbags after the bone marrow examination for 1 to 6 hours.

In South Korea, the guidelines for hemostatic care following a bone marrow examination, such as duration of absolute bedrest and the use of a sandbag, have shown variations by academic society, nursing associations, and hospitals. South Korean hospitals and the Korean Nurses Association guidelines currently instruct patients to place a sterile gauze and sandbag on the biopsy site while the patient lies in the supine position for 1–2 hours [19] or 4–6 hours [20,21]; applying manual pressure to the biopsy site for 5–10 minutes, applying a dressing, and having the patient lie on his or her back for 90 minutes [11]; applying pressure with a sterile bandage over it and having the patient lie down quietly until their vital signs are normalized [22]. One notable difference between the South Korean and international guidelines is that existing South Korean guidelines suggest bedrest with a sandbag lasting from several minutes to several hours.

Particularly, patients who have received a hemostatic method involving a sandbag after a bone marrow examination have reported that pain and physical discomfort from the bedrest in a fixed position for a prescribed length of time are greater than the discomfort from the biopsy [6]. If there is no increase of bleeding complication without a sandbag and the bedrest time is shortened, patients' pain, discomfort, complaint, and toileting self-care deficit from the sandbag and immobility will be reduced [6]. Needs for nursing care for those patients’ problems will be reduced furthermore. With consensus from evidence-based nursing practice, educating a revised protocol and applying it to nursing practice are necessary to increase the satisfaction of patients and the nursing efficiency. Exploring nursing interventions that effectively prevent bleeding while minimizing pain and discomfort in patients who undergo a bone marrow examination is needed to improve patient care. Therefore, we explored if the bedrest time can be reduced to 1 or 2 hours, even without sandbag application.

Objectives

The purpose of this study was to compare the effects of hemostatic methods with and without a sandbag on the incidence of bleeding and hematoma, pain, and discomfort following a bone marrow examination. First, we hypothesized that there would be no difference in the occurrence of bleeding between the intervention group that used a compression dressing alone and the comparison group that used both a compression dressing and sandbag (Hypothesis 1). Second, we hypothesized that there would be no difference in the incidence of hematoma between the intervention group that used a compression dressing alone and the comparison group that used both a compression dressing and sandbag (Hypothesis 2). Third, we hypothesized that the intervention group that used a compression dressing alone would report less pain than the comparison group that used both a compression dressing and sandbag (Hypothesis 3). Fourth, the intervention group that used a compression dressing alone would have less discomfort than the comparison group that used both a compression dressing and sandbag (Hypothesis 4).

Methods Study Design

The study used a pre-test/post-test nonequivalent control group design to examine the effects of hemostatic methods using a sandbag on bone marrow examination complications.

Participants and Setting

Patients who were admitted to a single tertiary hospital in Cheongju, South Korea for a bone marrow examination were identified for potential enrollment in this study. We recruited participants of the outpatient department who were scheduled to undergo bone marrow examination. We explained the study to the patients prior to their consent. To be eligible for participation, the inclusion criteria included the following: being aged 19 or older; having a diagnosed blood disease; being hospitalized for a bone marrow examination; no current spinal disease with low back pain; a platelet count $\geq 10 \times 10^3/\mu L$; intact cognition; alert consciousness; ability to communicate; ability to understand and respond to the survey; and being willing to sign an informed consent to participate in the study. The exclusion criteria were those who were unable to stop antithrombotic and anticoagulant agents, were cognitively impaired, or had a mental illness that would hinder study participation [[23]].

The sample size was computed using the G*Power program (Heinrich Heine University Dusseldorf, German). For an independent *t*-test with a power of .80, a significance of .05, and an effect size of .80 [[24]], the minimum sample size per group was found to be 26. Anticipating a 30.0% attrition rate, we attempted to recruit 34 participants for each group. Four patients in the intervention group were dropped because of their refusal to complete the questionnaire; the final analysis included data from 34 patients in the comparison group and 30 patients from the intervention group.

Instruments Demographic and Clinical Characteristics

The survey included the demographic characteristics of participants' gender, age, education level, religion, marital status, and occupation. Diagnosis, history of bone marrow examination, underlying disease, bleeding in the past month, and blood test results (platelet count and prothrombin time) were collected as clinical characteristics.

Bleeding and Hematoma

The amount of bleeding was measured based on the area (length × width) of blood on one 10 × 10 cm gauze after one hour and two hours of biopsy. Bleeding after two hours was measured by including the area of bleeding measured at one hour without replacing the compression dressing [[25]]. Hematoma refers to a collection of blood, and its presence was determined based on visual inspection and palpation [[26]]. Hematoma was categorized dichotomously as "present" or "absent" [[27]].

Pain

Pain is defined by the International Association for the Study of Pain [[28]] as an unpleasant sensory and emotional experience related to tissue damage. Pain associated with bone marrow examination was assessed with a numerical rating scale (NRS) [[29]]. We assessed pain using the one-item NRS for pain presented by Korea's National Cancer Information Center [[3]]. The ratings ranged from 0–10 with a higher score indicating more severe pain. The scores were categorized as *mild pain* for 0–3, *moderate pain* for 4–6, and *severe pain* for 7–10.

Discomfort

Ashkenazy and DeKeyser Ganz defined discomfort as an unpleasant feeling resulting in a natural avoidance or reduction of the source of the feeling [30]. Discomfort related to applying a sandbag after the procedure was measured with a self-reported questionnaire developed by Park et al. [25,31]. We assessed discomfort using the discomfort scale developed by Lee [32] and modified and adapted by Park et al. [33] The scale consists of 16 items rating psychological (3 items), environmental (1 item), and physical discomfort (12 items). For this study, we selected seven relevant items from the 12 items assessing physical discomfort, and the content validity was verified by three hemato-oncology nurses, one oncology nurse specialist, and one hematologist-oncologist. All seven items had a CVI of .80 or higher, so all were selected. The discomfort scale was rated on a four-point Likert scale (1 = *No*; 2 = *Mild*, 3 = *Moderate*, and 4 = *Severe*). The total score ranged from 7–28, where a higher score indicated a higher level of discomfort. The Cronbach's α of physical discomfort was reported to be .71 by Park et al. [33] and .84 in this study.

Study Intervention

In this study, for hemostasis, a sandbag was applied following the use of a compression dressing for the comparison group, while a compression dressing alone was applied for the intervention group. To prevent the diffusion effect, participants were initially assigned to the comparison group first, and then participants were assigned to the intervention group.

The bone marrow examination took about 30 minutes. An analgesic (meperidine 25 mg) was intravenously injected 5 minutes prior to the biopsy for both groups. There was no adverse effect from the medication. A bone marrow examination needle of 11 gauge (TrokaBone, PAJUNK GmbH Medizintechnologie; thickness 3 mm, length 100 mm) was used. After removing the biopsy needle, the compression dressing and sandbag were applied for the comparison group and the compression dressing alone was applied for the intervention group for hemostasis. Hemostasis following a bone marrow examination was performed as follows with the reference to the hemostasis protocols after a bone marrow examination used in hospitals [10,13–19]. Countries except Korea apply less than 1-hour bedrest [10,13–18], and at least two hospitals including the one in this research were applying the 2-hour bedrest method [19].

First, for the compression dressing, manual compression was performed for 2–3 minutes until bleeding from the puncture site stopped, with an additional 2–3 minutes of compression if the bleeding did not stop. Next, a 10 × 10 cm gauze was folded into one-fourth size and placed over the puncture site with some pressure, and the patient was instructed to lie on a bed for two hours. For sandbag compression, a 1.8 kg sandbag (25 cm × 16 cm × 2.5 cm) was fixed over the iliac crest (puncture site) such that it did not drop to one side following the compression dressing, after which the patient was prescribed bedrest for two hours. For both groups, another hour of bedrest was ordered after two hours of bedrest when the blood on the gauze did not turn brown and pinkish blood was still observed. Two patients in the intervention group had another hour of bedrest after two hours of bedrest.

Data Collection

Data were collected from April 20, 2017 to December 20, 2017, for the comparison group, and from December 22, 2017 to September 2, 2018, for the intervention group. Two oncology nurse specialists participated in data collection: one for the questionnaire survey and medical record collection and the other for measuring bleeding, pain, and discomfort at the patient's bedside. All the measurements were done by one specialist, inter-measurer variability was not a concern. Baseline data were collected by an oncology nurse specialist in the education and counseling room in the hemato-oncology ward. The oncology nurse specialist distributed a structured questionnaire to the patients prior to the bone marrow examination, and patients completed the questionnaire containing items about their demographic and clinical characteristics. The questionnaire took about 2–3 minutes. Information about prothrombin time and platelet count, which may affect bleeding, was collected by an oncology specialist nurse from the patients' medical records after they completed the survey. Another oncology specialist nurse measured post-procedural bleeding, hematoma, pain, and discomfort at the patient's bedside one hour and two hours after the bone marrow examination. Hematoma was examined during an additional outpatient follow-up visit one week after the bone marrow examination.

Data Analysis

The collected data were analyzed using the SPSS 24.0 software (IBM Corp., Armonk, NY, USA). Demographic and clinical characteristics were analyzed with the frequency and percentage or mean and standard deviation, and the baseline differences between the two groups were examined using an independent *t*-test, Chi-square test, and Fisher's exact test. The effects after treatment in both groups were analyzed with independent *t*-tests and Chi-square tests.

Ethical Consideration

This study was approved by the institutional review board at the study hospital (Approval No. 2017-03-018-002), and written consent was obtained from the participants after informing them of the purpose and procedure of the study.

Results Homogeneity Among Participants Demographic Characteristics

There were no significant differences between the two groups with regards to gender, age, education, religion, marital status, and occupation (Table 1). Of the 64 participants (30 in the intervention group and 34 in the comparison group), 40 (62.5%) were men and 24 (37.5%) were women. The mean age of participants was 57.63 years (*SD =* 14.58) in the intervention group and 61.27 years (*SD* = 17.02) in the comparison group.

Clinical Characteristics

The most common diagnosis was acute leukemia, with 12 in the intervention group (40.0%) and 13 in the comparison group (38.2%) having this diagnosis. There were no significant differences in past bone marrow exam history, underlying disease, bleeding history, and blood test results (platelet count and prothrombin time; Table 2).

Group Comparisons Amount of Bleeding

There were no significant differences in the occurrence of bleeding between the intervention group and the comparison group one hour (t = 0.84, p = .403) and two hours (t = 0.69, p = .491) after the bone marrow examination, supporting Hypothesis 1 regarding the lack of differences in the occurrence of bleeding between the two groups. The mean values of bleeding at one hour and two hours after a bone marrow examination were 0.86 cm^2 (*SD* = 1.12) and 1.41 cm^2 (*SD* = 1.65), respectively, in the intervention group and 1.14 cm^2 (*SD* = 1.53) and 1.75 cm^2 (*SD* = 2.22), respectively, in the comparison group (Table 3).

Incidence of Hematoma

None of the participants in both groups developed a hematoma one hour, two hours, and one week after the bone marrow examination, supporting Hypothesis 2 regarding the lack of difference between the two groups in the incidence of hematoma (Table 3).

Level of Pain

There was no significant difference in pain one hour (t = 1.58, p = .120) after a bone marrow examination, but there was a statistically significant difference in pain two hours (t = 2.90, p = .006) after a bone marrow examination between the two groups. Hypothesis 3 regarding decreased pain in the intervention group compared to the comparison group was partially supported. The mean pain scores at one hour in the intervention and comparison groups were 0.33 (*SD* = 0.76) and 0.79 (*SD* = 1.49), respectively, and those at two hours were 0.33 (*SD* = 0.66) and 1.32 (*SD* = 1.87), respectively, showing lower pain scores in the intervention group (Table 3).

Level of Discomfort

There were significant differences in discomfort between the two groups at one hour (t = 2.00, p = .049) and two hours (t = 3.09, p = .003) after a bone marrow examination, which supported Hypothesis 4 which predicted that the intervention group would have lower levels of discomfort compared to the comparison group. The discomfort scores at one hour in the intervention and comparison groups were 1.32 (*SD* = 0.36) and 1.51 (*SD* = 0.41), respectively, and those at two hours were 1.43 (*SD* = 0.41) and 1.79 (*SD* = 0.49), respectively, showing lower discomfort scores in the intervention group (Table 3).

Discussion

Although bedrest and restricted movement following a bone marrow examination is viewed as being essential for the prevention of bleeding complications, the exact extent of allowable movement has not been clearly defined, and discomfort and pain, owing to remaining in a fixed, supine position for a prolonged period, pose a challenge for patients [31,34]. This study examined differences in the incidence of bleeding and hematoma as well as pain and discomfort levels by a hemostatic method following a bone marrow examination.

One of the major adverse events following a bone marrow examination is hemorrhage resulting from injuries to surrounding organs from the insertion of a biopsy needle [35]. Our results showed that there were no differences in the incidence of bleeding and hematoma between the comparison group that used a sandbag and compression dressing and the intervention group that used compression dressing only. This finding is consistent with a previous study that showed the lack of significant differences in the incidence of complications following cardiac catheterization between the group that used a sandbag and the group that did not [36]. Furthermore, these findings are consistent with results demonstrating that patients who did not use a sandbag after coronary angiography showed no increased incidence of hemorrhagic complications [37]. Accordingly, it appears that compression dressing alone without the use of a sandbag for hemostasis is effective.

In our study, the comparison group that used a sandbag showed significantly higher pain scores two hours after a bone marrow examination compared to the intervention group that only received a compression dressing. While the pain score one hour after a bone marrow examination was not different between the two groups, the intervention group showed a little change in pain scores over time, unlike the comparison group that showed a higher pain score at two hours compared to one hour. Similar results were found in previous research where the patients' pain scores increased with more weight of the sandbag or over time in patients who underwent transcatheter arterial chemoembolization [38]. Overall, these results indicate that prolonged bedrest with a sandbag increases pain.

As patients need to lie down in a fixed posture with their knees straight for a prolonged time following a bone marrow examination [39], 70.0% of patients who underwent a bone marrow examination experienced moderate to severe (VAS ≥ 30 mm) pain due to immobilization and bedrest [7]. To mitigate such pain, analgesics and sedatives can be administered [40]. In our study, an opioid analgesic was administered immediately prior to the biopsy, and the participants showed low levels of pain (0.33 in the intervention group and 0.79–1.32 in the comparison group). In a previous study, applying acupressure after a bone marrow examination reduced the pain score from 7.9 out of 10 to 4.9 out of 10 [41], while applying massage therapy reduced the pain scores from 5.75 out of 10 to 4.00 out of 10 [42]. Furthermore, the intervention group that was treated using a classical Turkish Music intervention showed a significantly lower pain score (1.55 out of 10) compared to the control group (3.36 out of 10) [43]. In our study, administering an opioid analgesic and abstaining from the use of a sandbag led to the lowest pain score among patients.

In our study, the comparison group that used a sandbag showed significantly higher discomfort scores one hour and two hours after a bone marrow examination compared to the intervention group that was only treated with a compression dressing. Although we cannot compare our results directly with previous findings due to a lack of studies examining discomfort after a bone marrow examination, our results are consistent with previous findings that suggest that patients who used a sandbag had greater discomfort six hours after a cardiac catheterization than patients who did not use a sandbag [36]. Furthermore, whereas the discomfort score increased by 0.11 over time in the intervention group, it increased by 0.28 in the comparison group. This is like previous results that reported decreased discomfort in patients whose duration of bedrest with a sandbag was shortened from 4 to 2 hours following cerebral angiography [44].

Applying sandbag for the hemostatic method following a bone marrow examination is not used in other countries. However, some Korean nurses have used a sandbag for 1–6 hours to prevent bleeding from bone marrow examination. This appears to be just a convention passed on from generation to generation. In this study, there was no bleeding complication in the intervention group with less bedrest time and without a sandbag alongside a reduction of patients' pain and discomfort. The satisfaction and safety of patients will be increased if nurses do not apply sandbag compression with shorter bedrest. Without sandbag application and with the reduction of immobility, nursing care for the discomfort, toileting, and transferring patients to the examination room will be reduced. No additional staff will be necessary for another medical examination during the bedrest [6]. In addition, nursing activity, such as changing the sterile drape of sandbags to prevent infection, will be no more necessary. Revision of the nursing protocol based on the evidence will increase productivity and satisfaction of nursing. Therefore, empirical evidence suggests that omitting the use of a sandbag and minimizing bedrest after a bone marrow examination could effectively improve the quality of nursing care on bone marrow examination.

Limitations

This study was a single-center study that could not completely control exogenous variables owing to the nonrandomized assignment to prevent the diffusion of intervention. Measurement on bleeding and hematoma was done by a nurse. It will be better if bleeding and hematoma were measured by two nurses independently and their measurements were averaged. Moreover, we could not control the potential impact of the clinician on the outcomes of the procedure. Hence, we recommend that future research includes a randomized controlled experimental design to adjust confounding factors. In order to find out whether the bedrest time can be reduced, the study on the comparison of bleeding and discomfort according to 30, 60, 90, and 120 minutes is necessary.

Conclusions

Bone marrow examination is an invasive procedure needed to diagnose a blood disease and determine a patient's prognosis. We found no differences in bleeding and the presence of hematomas between the group that used both compression dressing and sandbag and the group that had compression dressing alone for hemostasis after a bone marrow examination. The intervention group showed significantly lower pain and discomfort compared to the comparison group. In conclusion, applying compression dressing with a two-hour bedrest could be an appropriate hemostatic intervention following a bone marrow examination.

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None.

Conflict of interest

The authors declare no conflict of interest to disclose.

Acknowledgments

None.

Variables	Categories	Intervention Group (n = 30)	Control Group (n = 34)	χ^2 or t (p)
n (%) or M (SD)	n (%) or M (SD)	Gender	Men	21 (70.0)
19 (55.9)	1.16 (.249)	Women	9 (30.0)	15 (44.1)
Age (years)		57.63 (14.58)	61.27 (17.02)	0.91 (.366)
Level of Education	≤ Middle School	12 (40.0)	15 (44.1)	−0.04 (.968)
High School	11 (36.7)	9 (26.5)	≥ College	7 (23.3)
10 (29.4)	Religion	No	15 (50.0)	18 (52.9)
−0.23 (.818)	Yes	15 (50.0)	16 (47.1)	Marital Status
Married	26 (86.7)	31 (91.2)	1.54 (.553)[a]	Single

4 (13.3)	3 (8.8)		Occupation	No
15 (50.0)	18 (52.9)	−0.23 (.818)	Yes	15 (50.0)

Variables	Category	Intervention Group (n = 30)	Control Group (n = 34)	χ^2 (p)
n (%)	n (%)	Diagnosis	Acute leukemia	12 (40.0)
13 (38.2)	11.23 (.245)[a]	Chronic leukemia	4 (13.3)	1 (2.9)
Lymphoma	5 (16.7)	3 (8.8)	Multiple myeloma	1 (3.3)
3 (8.8)	MDS	1 (3.3)	4 (11.8)	MPN
5 (16.7)	3 (8.8)	AA	0 (0.0)	2 (5.9)
ITP	0 (0.0)	1 (2.9)	PRCA	1 (3.3)
0 (0.0)	Unknown Origin Cytopenia	1 (3.3)	4 (11.8)	History of Bone Marrow Biopsy
No	21 (70.0)	29 (85.3)	−1.46 (.151)	Yes
9 (30.0)	5 (14.7)	History of Bleeding	No	25 (83.3)
30 (88.2)	0.32 (.723)[a]	Yes	5 (16.7)	4 (11.8)
		M (SD)	M (SD)	t (p)
PLT (×10^3/μL)		334.33 (397.64)	181.25 (243.57)	−1.83 (.074)
PT (INR)		1.12 (0.14)	1.43 (1.63)	1.05 (.296)
Count of Comorbidity		1.20 (.48)	1.26 (.51)	0.52 (.606)

Variables	Categories		Intervention Group (n = 30)	Control Group (n = 34)	t (p)
M (SD)	M (SD)	Bleeding	One hour later		0.86 (1.12)
1.14 (1.53)	0.84 (.403)	Two hours later		1.41 (1.65)	1.75 (2.22)
0.69 (.491)	Pain	One hour later		0.33 (0.76)	0.79 (1.49)
1.58 (.120)	Two hours later		0.33 (0.66)	1.32 (1.87)	2.89 (.006)
Discomfort	One hour later		1.32 (0.36)	1.51 (0.41)	2.00 (.049)
Two hours later		1.43 (0.41)	1.79 (0.49)	3.09 (.003)	
		n (%)	n (%)	χ^2 (p)	Hematoma
One hour later	Present	0 (0%)	0 (0%)	0.00(1.000)	Absent
30 (100%)	34 (100%)	Two hours later	Present	0 (0%)	0 (0%)
0.00 (1.000)	Absent	30 (100%)	34 (100%)	One week later	Present
0 (0%)	0 (0%)	0.00 (1.000)			Absent

DETAILS

Subject:	Patients; Pain; Bone marrow; Hematoma; Hypotheses; Intervention; Nursing care; Questionnaires; Biopsy
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Identifier / keyword:	bone marrow examination; hematoma; hemorrhage; pain; patient comfort
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Document 20 of 29

Symptom Experience and Related Predictors in Liver Transplantation Recipients

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ProQuest document link

ABSTRACT (ENGLISH)

SummaryPurpose

Symptom experience after liver transplantation (LT) provides healthcare professionals with important information about the benefits and limitations of LT from patients' perspective. This study aims to explore the multidimensional symptom experience and analyze related predictive factors in LT recipients.

Methods

This cross-sectional study evaluated the occurrence, frequency, intensity, and level of distress of 40 symptoms in 265 LT recipients. Stepwise multiple regression analysis was performed to analyze the influencing factors of symptom experience.

Results

The analysis of patient-reported data indicated that the ten most common symptoms were fatigue (42.3%), frequent sleep interruptions (38.9%), difficulty falling asleep (35.9%), decreased memory (34.0%), dreaminess (29.8%), itch (28.7%), muscular weakness (26.4%), shortness of breath (25.3%), anxiety (24.5%), and hand tremor (21.9%). Patients were classified into four groups according to survival time (1-month, 2–6-month, 7–12-month, and >1-year groups) after LT, and the most common symptom was fatigue in the one-month and 2–6-month groups, difficulty falling asleep in the 7–12-month group, and decreased memory in the >1-year group. Type of the primary caregiver, complications, concerns about the decreased ability to perform household and outdoor activities, and concerns about being a burden to the family were predictors of symptoms burden.

Conclusion

LT recipients experienced complicated symptoms. In clinical practice, it is critical to integrate physicians, nurses, and social workers as a medical team to help LT recipients develop suitable coping strategies that can potentially address patients' concerns, increase the sense of confidence, and improve symptom outcomes.

FULL TEXT

DETAILS

Subject:	Liver transplants; Patients; Quality of life; Data collection; Validity; Regression analysis; Blood &organ donations; Surgery; Disease; Activities of daily living; Questionnaires
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Evaluation of Nurse Practitioners' Professional Competence and Comparison of Assessments Using Multiple Methods: Self-Assessment, Peer Assessment, and Supervisor Assessment

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ProQuest document link

ABSTRACT (ENGLISH)

SUMMARYPurpose

Nurse practitioners (NPs) are increasingly important in healthcare as they play a key role in leading advanced nursing practices. Assessing their professional competence is essential. The aim of this study was to evaluate NPs' professional competencies based on at a collaborative model around NP self and compare different methods of assessment.

Methods

This is a cross-sectional study, and a purposive sample of 211 participants in the teaching hospital was used. Methods used were self-assessment (nurse practitioners), peer assessment (physicians and nurses) and supervisor assessment (head nurses).

Results

The competence of nurse practitioners was rated as moderate (mean score = 3.45 of a possible 5; SD = 0.59). However, each method resulted in differences in competence for total scores and dimensions. The highest competence was in direct patient care (mean = 3.55, SD = 0.53), and the lowest score was in monitoring the quality of patient care (mean = 3.30, SD = 0.82). *post hoc* analysis shown that supervisor assessment rated professional competence significantly lower than the method of self-assessment and peer assessment ($F = 10.07$, $p < .001$).

Conclusion

NPs require an increased effort to continuous learning for enhancing professional competencies. Moreover, using multiple methods for assessment to obtain a more comprehensive and accurate evaluation of NPs’ professional competence.

FULL TEXT

Introduction

Nurse practitioners (NPs) are expert nurse clinicians leading advanced nursing professional practices [1,2]. In the USA, NPs provided care that was similar to those of a physician's [3]. According to American Association of Nurse Practitioners (AANP) described that NPs focus on health promotion, disease prevention, diagnosis and prescribe treatment and health education [4]. They also play roles as healthcare researchers, interdisciplinary consultants, and patient advocates [4]. In Taiwan, NPs are a result of the shortage of residents in the healthcare system [5]. Therefore, the role of the NP is considered as a new professional role. According to the *Nursing Personnel Act*, Taiwan, one of the scope of practice of NPs is assisting in medical intervention [6]; however, NPs are not allowed to take responsibilities in diagnosing and prescribing treatment. Hence, in Taiwan, NPs' roles focus on health promotion, disease prevention, and health education.

The roles and professional competencies of NPs have becoming more and more important [1]. Regarding “competence” is defined as the specific knowledge and set of skills of an individual [7]. Competence is also defined as the functional adequacy and capacity to integrate knowledge and skills in specific contexts [8]. “Professional competence” is associated with job performance and requirements based on professional expectations [9]. NPs are expected to have expert knowledge, skills, and professional competence to ensure high-quality care in clinical practice [10]. According to the AANP, NPs are licensed, autonomous clinicians focused on managing people's health conditions and preventing disease [11]. NPs are expected to be leaders and able to practice for comprehensive assessment and direct/indirect patient care and improve patients care [5]. Satisfactory professional competence for NPs has positive effects in clinical practice, such as increasing patient satisfaction, shortening length of stay, and reducing re-admission rates [3,12]. Therefore, ongoing assessment of the professional competence of NPs is very important [13].

The ideal method for competence assessment is controversial because of concerns regarding its objectivity and comprehensiveness with respect to evaluations of competence in clinical practice [14,15]. Evaluation of NPs' professional competence generally uses a self-assessment format. Studies have demonstrated that competencies vary in different nursing environments, which emphasizes the need for different assessments to enhance the accuracy of the measurement [16]. Different methods for competence assessment have been recommended: self-assessment, peer assessment, and supervisor's assessment [17–20]. Self-assessment is the most common and traditional method used in the evaluation of competence. Cowan et al. [21] used self-assessment to determine nurse competence in five European countries and showed that competence varied across countries. However, Meretoja and Leino-Kilpi [22] suggested that when performance is determined by self-assessment subjectivity is limited. Parker and Hill [1] reviewed evaluation of NP's performance in the United States and stated that peer assessment is gaining interest as the evaluation method, Kenny et al. [23] also stated that peer assessment is the most effective method for evaluating professionalism of NPs and is important for providing feedback and fostering professional growth [17]. John-Mazza [24] used peer assessment to evaluate the clinical practice of NPs and suggested that peer assessment could reflect actual clinical competence.

Regarding supervisor's assessment, Bahreini et al. [16] and Meretoja and Leino-Kilpi [22] indicated that supervisors play a key role in evaluating nurse's competence. To maintain high standards of care, supervisor's assessment of nurse competence should be performed annually. Supervisor's assessment is considered a valuable assessment method [8,16]. Numminen et al. [25] compared the supervisor's assessment and self-assessment of nursing staff competence. The result reported that the supervisor's assessment of nurses' competence was higher than the self-assessment of competence.

Empirical studies regarding the comparison of different assessment methods of NPs' competence are lacking. However, studies have been conducted for nurses. For instance, Meretoja and Leino-Kilpi [22] compared the self-assessment of nurses with managers' assessments of nurse competencies in a university hospital and found the overall score of competence of managers was significantly higher than that determined by nurses' self-assessment. In contrast, when Bahreini et al. [16] compared self-assessment by nurses with supervisor's assessment by head nurses to evaluate nurse competencies, the level of competencies from self-assessment was higher than the supervisor's assessment.

Our literature review suggested that using only two evaluation methods for comparison resulted in inconsistent assessments. Thus, little about NP professional competencies can be gleaned from these different methods of evaluation. We need different methods to more accurately and objectively evaluate NPs' professional competencies. To address this issue, our study used a multi-assessment approach for evaluating NPs professional competence to identify educational needs. In Taiwan, NPs' assessment and management belong to both nursing and medical departments in hospital [26]. However, head nurses are responsible for evaluating NPs' performance [26]. According to the multidisciplinary collaborative model proposed by Chan et al. [27] collaborative pathways connecting interdisciplinary members of health team contribute view and recommendation according to their particular expertise. Based on the multidisciplinary collaborative model, NPs' location could be as a central part in a triangle model. In this triangle collaborative mode, NPs must collaborate with physicians, nurses, and head nurses (Figure 1). For more comprehensive assessment for NPs' professional competencies. Besides NP self, physicians, nurses, and head nurses who really collaborated with NPs should be invited to assess NPs' competencies. Therefore, we adopted three methods to assess NP professional competencies in this study: peer assessment by physicians and nurses, supervisor assessment by head nurses, and self-assessment by the NPs with comparing different evaluation methods examining the differences and similarities of these methods. Our findings could serve as a guide for continuing education courses, a reference for improving competence evaluation methods in general and as a means of gaining a more comprehensive, evaluation for assessing the professional competence for NPs worldwide.

Methods Aims

The aim of this study was to evaluate NPs' professional competencies in Taiwan. Because of the importance of health team work, we used a triangle collaborative model around NPs to assess NPs' professional competencies. Besides NP's self-assessment, three point assessments from supervisor's assessment (by the head nurse) and two peer assessments (by nurses and physicians) were also examined and then their differences and similarities among these methods were compared.

Study design

A cross-sectional comparative study was adopted in this study.

Participant recruitment and sample size

In health team work, NPs must collaborate and interact with physicians, nurses, and supervise by head nurses [26]. We used a triangle point around NPs to assess NPs' professional competence. Four kind groups (i.e. NPs, physicians, nurses, and hand nurses) participated in this study who were classified three types of assessments including self-assessment, physicians, and nurse colleagues as peer-assessment groups, and supervisor's assessment. All participants were selected from a 400-bed teaching hospital. The sample size was calculated by using G*power analysis with the following parameters: α level = .05, power = .9, and effect size = .3. The minimum estimated sample size was 180 participants. We used a purposive sampling method to select participants. Firstly, we invited all 23 NPs in this hospital to participat in this study. Then we invited nurses, physicians, and head nurses who really collaborated and worked together with NPs. The total number was 282. Thirdly, based on a previous study indicating the response rate ranging from 66.0% to 83.0% [28], we distributed 240 questionnaires. Finally, a total of 211 participants (23 NPs, 31 physicians, 143 nurses, and 14 head nurses) completed the questionnaires; the response rate was 88.0%.

Data collection and instrument development

A questionnaire was developed for data collection. The questionnaire was self-administered and consisted of two parts: demographic characteristics and professional competence. After acquiring the list of participants, each participant independently filled out the questionnaire and returned it in an envelope.

Demographic characteristics

Participant characteristics included gender, age, the educational level, the work unit, the number of years, and position on the clinical ladder.

NPs' professional competence

Since 2011, for enhancing NPs' quality of healthcare, the Taiwan Association of Nurses Practitioners has established and continuously revised guideline for NPs’ competence [29] However, the guideline is not concrete and measurable enough. Therefore, we developed a measureable questionnaire with 45-item questionnaire for data collection titled “Nurse Practitioner Professional Competence Questionnaire” (NPPCQ). The NPPCQ was developed based on the Taiwan Association of Nurses Practitioners Guideline for NP's Competence [29], which was reviewed by a panel of experts. The questionnaire incorporated five factors: NP role identity (three items), direct patient care (26 items), nursing and health teaching (six items), communication and collaboration (seven items) and monitoring the quality of patient care (three items). Items were evaluated for level of importance with a five-point Likert scale (1 = very low to 5 = very high). The range of the total score was 45–225, with higher scores indicating that NPs had better competence. The score for each of the five competency dimensions was determined by calculating the mean of the items in each dimension. A value of 3.0 indicated a moderate level of competency.

Validity and reliability

A panel of experts and a convenience sample of 23 NPs participated in testing the validity and reliability. The level of validity and reliability were determined by validity and reliability.

Validity

A panel of three experts established the content validity of the NPPCQ. The experts were certified as NP instructors and included one gastroenterologist, one general surgeon, and one senior NP. The experts were asked to rate the relevance and clarity of each item of the NPPCQ using a four-point Likert scale. Items were to be excluded if the score was less than 3; however, no items received this score. The content validity index was .91.

The construct validity of the NPPCQ was examined by exploratory factor analysis using maximum-likelihood extraction and varimax rotation. This method identified five factors with eigen values greater than 1, accounting for 74.6% of the total variance. The factor loading of each corresponding item ranged from .49 to .95.

Reliability

Internal consistency reliability was examined using a Cronbach's α coefficient. Five dimensions of NPPCQ were as follows: NP role identity was .72, direct patient care was .94, nursing and health teaching was .90, communication and collaboration was .93, and monitoring the quality of patient care was .95. The total of NPPCQ was .93 indicating a good internal consistency.

Ethical considerations

This study was approved by the Institutional Review Board of the National Yang-Ming University Hospital (Approval no. 2013A012). The information packet received by participants included the purpose of the study, the questionnaire, informed consent (including guarantee of anonymity), and a demographic survey. Participants completed the questionnaire and demographic survey anonymously and voluntarily and were free to stop participating at any time.

Data analysis

All data were analyzed using SPSS 15.0 statistical software (IBM Corp., Armonk, NY, USA). Demographic characteristics and professional competencies were analyzed by descriptive statistics including frequency, percentage, mean, and standard deviation. One-way analysis of variance and Scheffe's *post hoc* analysis were used to compare professional competencies assessed by the three different methods for the four types of participants.

Results Participant characteristics

As shown in Table 1, the disciplines of the 211 participants included 23 NPs (10.9%), 31 physicians (14.7%), 143 nurses (67.8%), and 14 head nurses (6.6%). The participants had a mean age of 31.5 ± 6.9. The NPs, nurses, and head nurses were predominantly women (91.3%, 97.1% and 100%, respectively), and physicians were predominantly men (90.3%). The mean age of NPs was 32.1 years; the mean number of years in the current job was 5.4 years, and a majority (91.3%) of the NPs had college degrees. The mean age of physicians was 38.7 years; the mean number of years in the current job was 5.7 years; most of physicians (71.0%) had bachelor's degree, and 29.0% had a master's degree; a majority (93.5%) of the physicians worked in the medical and surgical ward. The mean age of nurses was 28.83 years, and the mean number of years in the current job was 4.3 years. More than two-thirds (67.1%) of the nurses had college degrees, and 73.4% of the nurses worked in the medical and surgical unit. The mean age of head nurses was 36.7 years, the mean number of years in the current job was 8.0 years, and all of head nurses had bachelor's degrees.

Participants' evaluation of NPs' competencies

As shown in Table 2, the overall score for competency was 3.45 (SD = 0.59). Competencies in the five dimensions were also ranked as moderate, with mean scores ranging from 3.30 to 3.55. Direct patient care scored the highest, and monitoring of quality of patient care was the lowest.

Competency scores and evaluation methods Comparison of NP competency among groups

The overall competency varied with each of the four groups. The peer assessment by physicians rated the overall competence of NPs the highest (3.83 ± 0.49), followed by NP self-assessment (3.51 ± 0.49), peer assessment by nurse colleagues (3.38 ± 0.55), and the lowest score (2.64 ± 0.93) was from the supervisor's assessment by head nurses. Scheffe's *post hoc* analysis showed that NPs', physicians' and nurses' rankings of overall competency were significantly higher than head nurses.

Comparison of NP self-assessment and peer assessment

Physician and nurse colleagues performed what we defined as peer assessment. The overall of competency of NPs as assessed by physicians was higher than the NPs' self-assessment; however, the differences in scores were not statistically significant. When the five individual dimensions of professional competency were evaluated, only the NP role identity dimension was significantly different, with a higher rating from physicians (3.73 ± 0.53) than NPs (3.13 ± 0.57). The overall score for competency, evaluated by nurse colleague's peer assessment, was not significantly different from NPs self-assessment. In addition, similar to the evaluations by physicians, competency in the dimension of NP role identity was rated higher by peer nurses (3.31 ± 0.60) than by the self-assessment of NPs (3.13 ± 0.57). In contrast, NP self-assessment scores in the four other dimensions of competency were all higher than scores given by peer nurses, although these scores were not significantly different.

Comparison of NP self-assessment and supervisor's assessment

Head nurses performed the supervisor assessment of the NPs. The overall competence rating from head nurses (2.64 ± 0.93) was significantly lower than NP's self-assessment score (3.51 ± 0.49). The head nurses scored all five dimensions of professional competency lower than NPs' self-assessment. Two of these dimensions, nursing and health teaching and monitoring quality of patient care, were significantly lower than the NPs' self-assessment rating scores.

Comparison of peer assessment and supervisor assessment

The scores for peer assessment by physicians and supervisor assessment by head nurses were significantly different ([Table 2]). Mean scores from physicians' evaluation were the highest overall, and professional competencies were significantly higher than scores obtained from the head nurses' evaluation. For all five dimensions of competency, the findings revealed significantly higher scores from physicians than head nurses.

With respect to the comparison between peer assessment by nurses and supervisor assessment, regarding the analysis of overall competencies, we found that nurse-evaluated NP professional competencies were significantly different from evaluations by head nurse. However, competency ratings in the five dimensions were not significantly different.

Discussion NPs' professional competence

The assessment by the medical professional group showed that the NPs in our study had a moderate level of professional competency. This finding is similar to that of Chang et al. [19] but lower than that of Cajulis and Fitzpatrick [30]. The reasons may be related to higher education and more work experience parameters found in the study by Cajulis and Fitzpatrick [30]; all NPs had a master's degree. Several reports have indicated that education positively correlates with personal professional competency [19,22]. In Taiwan, based on the NP national certification requirement, NPs should have at least an associate degree, with three or more years of clinical working experience, and completed the NP training program [31,32]. Indeed, according to the AANP, NPs should be educated at the graduate level [11]. With education as the best way of closing the gap between actual and expected competency, policy maker and nurse educators should consider to improve NPs' education level to master's degree to fulfill the certification requirement and then to improve quality of patient care. In addition, work experience also differed in these studies. NPs in our study had fewer years of practical work experience (4.83 ± 4.60 years) than the the NPs evaluated by Cajulis and Fitzpatrick [30] (5.98 ± 5.41 years). Less working experience may result in NPs demonstrating lower degrees of professional competence.

Five dimensions of competencies were also revealed a moderate degree. The mean scores were similar (3.30-3.55), and direct patient care rated the highest scores (3.55); next to it was communication and collaboration. The lowest score was in monitoring quality of patient care (3.30). This finding is similar to the study by Chang et al. [19], Copnell et al. [33], Kleinpell [34], and Yao et al. [35]. For instance, Kleinpell [34] found that NPs spend over 80% of their time on direct patient care. The findings of Copnell et al. [33] also supported that NP played a key role in bridging communication and fostering cooperative relationships between patients, healthcare providers, and physicians. Therefore, we concluded NPs are more likely to be the healthcare providers responsible for interacting directly with patients and health team members, relaying important information to patients and acting as a liaison between patients and other team members. As to monitoring the quality of patient care was the dimension with the lowest score for NPs. This result is consistent with those of the studies by Fang and Tung [36] and Kleinpell [34]. The reasons may be because clinical practices are major roles for NPs. NPs have less time for monitoring patient care and quality assurance. Fang and Tung [36] examined daily activities and job competencies of NPs and found that NPs are less frequently involved in practice guidance and quality improvement activities. In a longitudinal study, Kleinpell [34] examined the responsibility of NPs over a five-year period and found that only 17.0–22.0% of NPs reported monitoring patient care for quality assurance in clinical practice. This may account for this dimension having the lowest score. One way to address these shortcomings in professional competence is to encourage NPs to participate in continuing education programs. All the five dimensions of professional competence need to be improved, particularly in monitoring quality of patient care.

Differences among assessment groups

Evaluations of professional competency of NPs differed significantly when the four groups were compared. Physicians rated NPs highest in overall competency and for the five dimensions, followed by NPs, and nurse colleagues; head nurses gave the NPs the lowest scores. The differences between groups within the context of the assessment method are discussed in the following passages.

Differences in self-assessment and peer-assessment methods

Comparison of the self-assessment scores by NPs and peer assessment by physicians and nurses were not significantly different for overall scores of professional competencies. However, the two peer-assessment groups, physicians and nurses, differed in their evaluations of NPs. Physicians rated NPs higher and nurses scored NPs lower, although these scores were not significantly different. One explanation for the higher evaluation by physicians may be that they often work closely with NPs and thus have more opportunities to directly observe NPs' skills. More work experience of NPs, who were formerly registered nurses, and nurses may result in similar expectations of professional competencies. Therefore, nurses apply their own expectations of professional competencies to NPs, and this may also explain the similar ratings between the NPs self-assessment and the nurses peer assessment.

There were also differences between physicians and nurse colleague peer assessment. Physicians rated all five dimensions of competency higher than nurses and three of these dimensions (NP role identity, direct patient care, and communication and collaboration) were significantly different. As stated earlier, NPs in Taiwan have frequent interactions with physicians, and therefore physicians can observe patient care, and communication, and collaboration in the clinical setting, thus leading to the higher rating. However, the lower ratings by nurses may be because nurses do not consider these competencies to be NP roles, and therefore their expectations of NPs may be different. This interpretation is supported by an Australian study [33], which found that NPs had a higher degree of collaboration with physicians than with nurses.

Peer assessment rated all five dimensions of competency higher than the self-assessment of NPs. However, only the dimension of NP role identity was significantly different, and that was from peer assessment by physicians. It is interesting that physicians rated the NPs even higher than the NPs themselves. One explanation may be related to different job descriptions and expectations among the different groups. In most countries, including Taiwan, limitations on the physician's workload and available manpower require a NP to be able to partially perform the role of physician’s assistant and share some of the duties of the physician [36]. This may explain why physicians tended to positively agree with overall of NPs' competencies, which is reflected in the mean of total score of 3.83. The higher score given for the dimension of NP role identity by physicians may be partly explained by the working environment of NPs. In Taiwan, and elsewhere, NPs often work under the instruction of physicians in a collaborative relationship and with a certain degree of autonomy, which may result physicians valuing the role of NPs. This is supported by Hurlock-Chorostecki et al. [37] and Maylone et al. [38] who reported that NPs receive high levels of collaborative relationship and are given a considerable amount of autonomy by physician colleagues.

Differences in self-assessment and supervisor-assessment methods

The most significant differences in the evaluations were seen between the NPs self-assessment and the supervisor assessments. Head nurses rated NPs significantly lower than NPs for overall competency and for two dimensions (nursing and health teaching, monitoring quality of patient care). The overall score of competency (2.64 ± .93) from supervisor assessments was a rating that reflected lower than moderate competency, and this less-than-moderate level was consistent for all five dimensions. These findings are in agreement with studies by Bahreini et al. [16] and O'Connor et al. [14] who also reported that supervisor's assessments of NPs were lower than self-assessment competency ratings. Head nurses, the primary directors of the nursing system, may expect NPs to act as advanced nurses, resulting in a higher standard for the evaluation of NPs' professional competence [13,39]. Head nurses expect NPs to carry out more independent functions such as monitoring quality of patient care, and teaching health, something that NPs do not do on a regular basis. A study by Cheng et al. [26] also confirms these findings and adds an additional explanation. Their study showed that nurse supervisors in Taiwan do not have a clear understanding of how their responsibilities differ from NPs. This confusion could further explain the lower NP competency ratings from nurse supervisors.

Differences in peer-assessment and supervisor-assessment methods

Both nurse and physician peer assessments differed from the supervisor assessments. Although only the overall score was significantly different between peer assessment of nurses and supervisor assessment of head nurses, the nurses evaluated all five of the NP competencies as much higher than did the head nurses. One explanation is that nurse colleagues have a greater recognition of the responsibilities of NPs and provide more support. Several studies [40,41] indicate that nurses are supportive of the role of NPs, recognize the importance of NPs and, in the process of NPs transitioning to advanced practice roles, offer more support to NPs than head nurses.

The high scores of physician peer assessments and significantly low ratings of head nurse supervisor assessments may be explained by Cheng and Chen [42]. Their study, which evaluated “satisfaction with the NP”, found that physicians gave significantly higher ratings for satisfaction with NPs' overall clinical performance than head nurses. This would also explain the high ratings given to NPs by physicians for all five competencies.

To our knowledge, this is the first study to evaluate NPs professional competencies based on a triangle collaborative model around NP self, compare the differences and similarities among NPs, physician, nurses, and head nurse assessment. In Taiwan NPs are a result of the shortage of residents; however, because of regulations placing limits on prescription, medication prescription, this role did not include in this study. For NPs' roles may be verified in different countries. Thus, more studies are expected in different countries in future. In addition, based on our finding, we recommend that policy makers and nurse educators should improve NPs' education level to master’s degree to fulfil certification requirement and then to improve connected international standards to achieve global levels.

The authors acknowledge the present study had some limitations. Additional data will be required to determine if these differences are consistent in different hospital settings and with a larger sample size. The research setting was a teaching hospital, and the sample size of each group was small. These factors limit generalizations of our results to other hospitals. Besides, a larger sample in each group and drawing from different health care facilities are recommended for future research, because it will provide data from a more diverse population and setting. Although the NNPCQ instrument developed for this study had satisfactory validity and reliability, it still need to be modified for use in other countries. Perform confirmatory factor analysis because larger sample sizes are needed. This format of evaluating performance with multiple assessment groups could be applied worldwide by using assessment instruments that are already in place.

Conclusions

Competency evaluation is important for ensuring a high quality of patient care. This study was to evaluate NPs professional competencies and using four different groups and to compare the differences among three assessment methods. However, our study found that NPs revealed a moderate degree of overall professional competencies and even five dimensions. Among five dimensions, the highest score was noted for “direct patient” and the lowest was “monitoring quality of patient care”. Therefore, NPs certain competencies require further development and requires an increased effort to continuous learning for enhancing NPs' professional competencies. In addition, we also found in total dimensions of competency, physician assessment rated the highest score, and then were NP self-assessment and nurse colleague assessment; supervisor assessment rated significantly lower than other three groups. Our findings supported that different assessment methods provide different views of assessing NPs' professional competencies. Therefore, comprehensive assessment through different assessment methods is valuable to improve NPs' competencies, and using multiple methods for evaluating NPs professional competency adds an additional layer that may result in a more accurate assessment of NP's competencies. The 360-degree evaluation method could be used in assessing NPs' competence; therefore, evaluation by patients could be considered as an additional method, adding another perspective to the assessment of professional competencies. More accurate evaluation of NPs can provide information about gaps in education that can be used to develop continuing education programs for monitoring professional competencies to increase the quality of patient care.

Authorship statement confirming

The listed authors meet the criteria for authorship and agree with the content of the manuscript.

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None.

Conflict of interest

The authors declare no conflict of interest.

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SY and HYL were responsible for the study design, developed the instrument. SY, HYL, FIT, and TFW were responsible for the drafting of manuscript and final submission. SY, FIT, and TFW provided statistical expertise and supervision of study.

Variable	NP (n = 23)		Physician (n = 31)		Nurse (n = 143)		Head nurse (n = 14)		Total (N = 211)	
n	%	n	%	n	%	n	%	n	%	Gender
Men	2	8.7%	28	90.3%	4	2.9%	0	0%	34	16.1%
Women	21	91.3%	3	9.7%	139	97.1%	14	100%	177	83.9%
Age (mean ± SD = 31.5 ± 6.9, range 20–60)										
20–25	0	0%	0	0%	25	17.5%	0	0%	25	11.8%
26–30	8	34.8%	7	22.6%	54	37.8%	0	0%	69	32.7%
31–35	12	52.2%	5	16.1%	43	30.0%	4	28.6%	64	30.3%
36–40	3	13.0%	8	25.8%	15	10.5%	10	71.4%	36	17.1%

41–45	0	0%	5	16.1%	4	2.8%	0	0%	9	4.3%
46–50	0	0%	2	6.5%	1	0.7%	0	0%	3	1.4%
≥51	0	0%	4	12.9%	1	0.7%	0	0%	5	2.4%
Education										
College	21	91.3%	0	0%	96	67.1%	0	0%	117	55.5%
Bachelor	2	8.7%	22	71.0%	47	32.9%	14	100%	85	40.3%
Master	0	0%	9	29.0%	0	0%	0	0%	9	4.2%
Work unit										
Medical	10	43.5%	17	54.8%	77	53.8%	8	57.1%	112	53.1%
Surgical	8	34.8%	12	38.7%	28	19.6%	4	28.6%	52	24.6%
GYN &Ped	3	13.0%	2	6.5%	24	16.8%	2	14.3%	31	14.7%
ER	2	8.7%	0	0%	14	9.8%	0	0%	16	7.6%
Current job work experience (mean ± SD = 4.8 ± 4.6, range 0–30)										

≤1 years	2	8.7%	8	25.8%	31	21.7%	0	0%	41	20.8%
2–5 years	13	56.5%	12	38.7%	65	45.4%	4	28.6%	90	45.7%
6–10 years	6	26.1%	7	22.6%	39	27.3%	9	64.3%	51	25.9%
11–15 years	2	8.7%	0	0%	3	2.1%	1	7.1%	6	3.0%
≥16 years	0	0%	4	12.9%	5	3.5%	0	0%	9	4.6%
Clinical ladder										
N1	7	30.4%	N/A	N/A	67	46.9%	0	0%	74	41.1%
N2	9	39.2%	N/A	N/A	67	46.9%	0	0%	76	42.2%
N3	7	30.4%	N/A	N/A	8	5.5%	9	64.3%	24	13.4%
N4	0	0%	N/A	N/A	1	0.7%	5	35.7%	6	3.3%

Competence/evaluations	Total M ±SD	1. NP self-assessment M ±SD	2. Physician peer assessment M ±SD	3. Nurse peer assessment M ±SD	4. Head nurse supervisor's assessment M ±SD	F	P	Scheffe's post hoc

NP Role identity	3.34 ± 0.63	3.13 ± 0.57	3.73 ± 0.53	3.31 ± 0.60	2.66 ± 0.86	8.31	<.001***	2 > 1, 3, 4
Direct patient care	3.55 ± 0.53	3.65 ± 0.44	3.86 ± 0.52	3.48 ± 0.48	2.92 ± 0.75	9.43	<.001***	2 > 3, 4
Communication and collaboration	3.54 ± 0.77	3.73 ± 0.54	4.12 ± 0.60	3.37 ± 0.73	2.69 ± 1.09	13.13	<.001***	2 > 3, 4
Nursing and health teaching	3.42 ± 0.69	3.49 ± 0.58	3.73 ± 0.64	3.35 ± 0.67	2.64 ± 1.12	5.71	.001**	1, 2 > 4
Monitoring quality of patient care	3.30 ± 0.82	3.51 ± 0.67	3.59 ± 0.72	3.24 ± 0.72	2.38 ± 1.32	5.33	.002*	1, 2 > 4
Overall score	3.45 ± 0.59	3.51 ± 0.49	3.83 ± 0.49	3.38 ± 0.55	2.64 ± 0.93	10.07	<.001***	1, 2, 3 > 4

DETAILS

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Development and Validation of a Management of Workplace Violence Competence Scale for Nursing Practicum Students

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ABSTRACT (ENGLISH)

SummaryPurpose

The aim of this study was to develop a scale to measure nursing students' competence in managing violence from patients and relatives in the hospital where nursing students perform clinical practicum.

Methods

Literature review and Delphi expert consultation were utilized to develop the content of the management of workplace violence competence scale (MWVCS). A convenience sample of 797 nursing students responded to the questionnaire. Exploratory factor analysis of the scale was performed. Internal consistency and test–retest reliability were examined.

Results

The MWVCS consisted of 40 items with a five-point scale. Seven factors explained 63.2% of the total explained variance. The content validity index for the scale was .99. Cronbach's α of the scale was .96, and test–retest correlations were found to be ≥ .76.

Conclusion

The MWVCS is a reliable and valid scale for nursing educators to assess the level of students' competence in violence management and to evaluate the effectiveness of education to enhance their ability to manage workplace violence.

FULL TEXT

Introduction

Workplace violence (WPV) in the health sector is a significant global public health problem. In particular, recent studies have shown that more than half of nursing students experienced WPV during their clinical placement [1–3]. The extent of WPV toward nursing students includes both physical and psychological violence, such as kicking, pushing, pinching, verbal abuse, and threats, which have negatively impacted on students' attitudes toward nursing profession [4]. In the UK, the most perpetrators in the incidents experienced by nursing students were nurses (19.6%), and a small proportion of perpetrators was patients (4.9%) [4]. On the contrary, a survey in China showed that most perpetrators of WPV toward nursing students were patients or relatives (77.1%) [5]. In another study conducted in Korea, patients or patients' family members were the most frequent offenders of violence (84.8%) followed by nurses (78.6%) or physicians (57.9%) [6]. Although the incidence and perpetrator of workplace violence across China, the UK, and Korea are different because of social and cultural divergence, among all the healthcare professionals, nursing students are the most vulnerable and at-risk group for WPV because of their inexperience in clinical practice, frequent ward rotation, and the challenges of building relationship quickly with patients and nurses [7]. In addition to physical harm, WPV could cause negative impacts on nursing students psychologically. A survey in China showed that 59.1% of nursing students (n = 543) worried about WPV [8], and the majority of students who experienced WPV had the feeling of anxiety and depression [2], which could decrease students' job satisfaction and intensify the deterioration of relationship with nurses in workplace, ultimately affecting the standards of patient care [4]. It was shown that one in five nursing students (n = 657) considered career change, which will affect the nursing team building and workforce in the future [4].

Because violence prevention is evident to be crucial for nursing students, relevant guidelines and trainings for WPV have been gradually developed [9]. Framework guidelines for addressing workplace violence in the health sector is a well-established joint program of International Labour Office (ILO), International Council of Nurse (ICN), World Health Organization (WHO), and Public Service International (PSI), which clearly illustrates each step of violence management [10]. Apart from the guidelines, some educational programs associated with WPV were designed to be specifically for nursing students. For example, a one-day Management of Aggression Training program, which covered definition, types, legislation, and consequences of WPV as well as the assault cycle and related breakaway skills, was delivered to nursing students in Australia [11]. In addition, there were also some training courses in Germany, Ireland, and America [12–14]. Although the nursing students who participated in these programs have reported a high level of satisfaction with the programs, the level of confidence and improvement of attitude, knowledge, and skills are not comprehensive, and the measurement tools used are not valid. A comprehensive assessment for nursing students' competence in WPV management is required.

Recently, there are some instruments developed to evaluate the skills of violence management. For example, the De-escalating Aggressive Behaviour Scale is a German instrument that assesses nursing students' de-escalation skill of performance in training programs [12]. Although this seven-item, one-dimensional scale has proved to be a practical measure of de-escalation skill with good reliability and validity and has already been modified in English [15], other skills such as breakaway and restraints skills in violence management could not be measured with this tool. There are also other instruments that evaluate healthcare workers' attitudes or confidence associated with WPV. The Management of Aggression and Violence Attitude Scale, which has been mostly used in mental health settings, principally measures nurses' perception of the causes of violence and the approaches to violence management [16]. Although the Management of Aggression and Violence Attitude Scale has been found reliable and valid, it focuses on registered nurses and other registered healthcare professionals. Another one-dimension instrument, the Confidence in Coping with Patient Aggression Instrument, was designed to measure self-confidence of staff in Germany [17]. Although confidence is crucial for performance, it is also underpinned by competence [18]. These existing instruments were developed to measure one single aspect associated with violence management. There is still a lack of instruments directly and specially reflecting nursing students' competence related to WPV management.

The 4R crisis management theory proposed by Heath (1998) has been widely applied into studies in the health field, including violence management [19–21]. In this theory, the four stages of crisis management include reduction, readiness, response, and recovery. The goal of crisis management is to reduce the impact and harmfulness of sudden and uncertain events, which is consistent with WPV management.

The current study aimed to develop and test the MWVCS for nursing students, which is underpinned by the 4R crisis management theory and focused on WPV of the patients or his/her relatives toward students in healthcare facilities. According to the framework guidelines by ILO, ICN, WHO, and PSI, the operational definition of “workplace violence against nursing students” in this study was adapted: incidents where nursing students are abused, threatened, or assaulted by patients and relatives during clinical practicum, involving an explicit or implicit challenge to their safety, well-being, or health.

Methods

The study employed a Delphi method to develop MWVCS among nursing students and psychometric testing of the scale. It consisted of three phases: phase 1, items development; phase 2, Delphi expert consultation; and phase 3, psychometric testing [22].

Phase 1: Items Development

Because 4R crisis management theory was considered as the conceptual foundation [23], the management of WPV was divided into four components: reduction of violence, readiness for violence, response to violence, and recovery from violence. Items were generated from three sources: 1) referring to guidelines, 2) review of literature, and 3) review of items from existing instruments. The framework guidelines of ILO, ICN, WHO, and PSI [10], illustrating the key elements in violence management including violence recognition, workplace risk assessment, intervention to deal with violence, and after-the-event intervention, provided important references for the study. Four domains and 56 items were created to form the initial scale. It consisted of domain 1 (reduction of violence, 18 items), domain 2 (readiness for violence, 16 items), domain 3 (response to violence, 11 items), and domain 4 (recovery from violence, 11 items). A five-point scale was designed for students to rate their level of agreement with each of the items. Each item of MWVCS was rated from 1 (strongly disagree) to 5 (strongly agree). The higher score indicates the better competence in management of WPV.

Phase 2: Delphi Expert Consultation

The Delphi technique was used to establish content validity of the MWVCS in two rounds [24]. The experts were selected based on their professional experience. In total, 18 experts with at least 10 years of professional experience were invited to the Delphi expert consultation (Table 1). Among them, nine experts were nurses in charge of nursing management in hospitals, one expert was a doctor in charge of hospital management, and eight experts were teachers in nursing schools. A four-point scale (1 = irrelevant; 2 = irrelevant unless with major revision; 3 = relevant but minor revision required; 4 = relevant) was used to assess content validity by content validity index (CVI). All items were set up with an open expert comment column to collect expert suggestions. The consultation scales were sent to the experts for completion in 3 weeks. After the collection of the consultation scales in the first round, the research team analyzed the data and discussed revisions. Item-level CVI (I-CVI) was defined as the proportion of experts who gave a score of either 3 or 4. The criterion for inclusion of the item was that the I-CVI was no less than .80 [24]. In the first round, the I-CVI ranged from .83 to 1.00 and the scale-level CVI (S-CVI) was .98. After the first round, eight of the initial 56 items were removed because of overlap with other items (e.g., "I am aware of high-risk areas of hospital violence"), inapplicability in nursing students (e.g., "I will respect others and encourage the team to reach their full potential"), or inappropriate in competence measuring (e.g., "I believe I will benefit from hospital violence related training"). Five additional items were added (e.g., "I will seek support from classmates, teachers and family after the violence") based on the experts' suggestions. Thirteen items were revised based on the advice such as avoid asking more than two questions in one item, reduce the use of vocabulary indicating the level (e.g., "very"), add explanations of some words (e.g., "disengagement techniques"), add "with the help of teachers" in some items, etc. The revised scale and a detailed list of revisions were sent to the experts in the second round.

In the second round, the I-CVI ranged from .83 to 1.00 and the S-CVI was .99. After the second round, one item was removed because of inconformity with most current hospital conditions: "I understand the staff safe house in the hospital". Three items were revised to make the meaning more appropriate (e.g., "I will verify the vague information with patients or relatives" instead of "I will use clarification techniques to verify the patient's vague information"). A 52-item scale was generated after two rounds of expert consultation.

Phase 3: Psychometric Testing

After the Delphi expert consultation, a pilot test was conducted on 20 final-year nursing students in clinical placement using a convenient sampling method. The pilot test was performed to assess the understandability of the items. The pilot test showed that the participants (n = 20) reported no difficulty in reading and understanding all items. Most participants were women (n = 17), with ages ranging between 19 to 22 years. All of them have attended clinical placement for over 6 months. Through interview, it was found that the items were understood by participants as the research team intended. Further analysis of the MWVCS was conducted then. The methods of analysis included item analysis for item appropriation, exploratory factor analysis (EFA), convergent validity, and discriminant validity for construct validity, Cronbach's α coefficients for internal consistency reliability, and test–retest correlations for indicating stability reliability [25].

Participants

A convenience sampling method was used to recruit nursing students from nine universities/colleges in China. Most nursing students in China take clinical practicum in their final year, at which time they have close contact with patients. The final-year nursing students in clinical placement were eligible for the participation. The sample size should be 5–10 times of the number of items in factor analysis [26]. The sample size was calculated to be 260–520. Considering a dropout rate, the questionnaire was distributed to a total of 1,007 nursing students. For test–retest analysis, a group of 20 to 30 participants is recommended [25]. A convenience sampling of 25 final-year nursing students in local hospital was selected to evaluate test–retest reliability by filling in the MWVCS twice in a two-week interval.

Data Collection

Nursing students were approached by the researchers and investigators when they attended courses or meetings in the school. The aim and procedures of the study were explained to the students the survey. Participants were asked to complete and return the questionnaire at the end of the session.

Data Analysis

Data analysis was conducted with the SPSS 24.0 software package (IBM Corp., Armonk, NY, USA). Descriptive analysis was utilized to summarize sample characteristics. An alpha level of .05 was used for all statistical tests. Item analysis was performed by three approaches, including the critical ratio obtained from *t*-test results, item-total correlation coefficient, and Cronbach's α coefficient after item deletion. Items meeting one of the following elimination criteria were removed: (1) the *t*-value of the 27 percentile high-score and low-score groups was insignificant or less than 3.00; (2) the item-total correlation coefficient was insignificant or less than .40; (3) Cronbach's α coefficient after each item deletion was more than that of the entire scale [26]. EFA was performed with principal component analysis and promax rotation. Factors with eigen values greater than 1.00 were extracted. The items with factor loading less than .40 were considered to be eliminated from the scale, and each factor was expected to contain at least three items [22].

Ethical Consideration

The present study was approved by the Ethics Committee of Huzhou University (Approval no. 20190910). The survey was anonymous, and the data collected will be kept confidential. They were assured of the confidentiality and anonymity, as well as that data collected were strictly for study purpose only. The participants were made aware of their right to decline or withdraw their participation at any time without any disadvantage. All respondents participated voluntarily.

Results Sample Characteristics

In total, 1,007 nursing students were invited to participate in the study, and 797 students completed the survey with 79.1% response rate ($^{\text{Table 2}}$). The majority of students were female (89.6%), with an average age of 21.77 years (standard deviation = 1.10). The majority of the students (99.0%) have attended clinical placement for over 6 months when participating in the study.

Item Analysis

Two extreme groups analysis showed that all 52 items had values of critical ratio at a significant level, ranging from 6.80 to 20.51, indicating that the items had a good discrimination between high and low groups. Apart from the item Q8, item-total correlation coefficients were observed between .41 and .68. After each item deletion, the calculated Cronbach's α coefficient was lower than .96, except for the item Q10. Therefore, these two items were deleted by item analysis.

Validity of the MWVCC

According to the Kaiser-Meyer-Olkin (KMO) and Bartlett's test, the KMO value was .96 and χ^2 was 23557.13, respectively ($p < .001$), which indicated the suitability for factor analysis. The item Q9 and Q14 were firstly removed because its factor loading was lower than .40. Then, because some items cannot be explained by corresponding factors, eight items including Q24, Q28, Q29, Q30, Q13, Q6, Q7, and Q11 were progressively deleted.

Finally, seven factors were extracted from the 40 items, with all item loadings above .40 ($^{\text{Table 3}}$). The names of the factors were determined in accordance with the content of the items contained and by referring to the framework guidelines for addressing workplace violence in the health sector mentioned in $^{\text{Introduction}}$ and $^{\text{Methods}}$. The factor 1–7 was named as after-the-event recovery, nurse–patient interaction, response to violence, violence cognition, utilization of protective facilities, knowledge renewal, and risk assessment, respectively. These factors contributed 63.2% of the total variance, indicating good construct validity [22].

The convergent validity of the MWVCS was assessed by examining correlations between the factors and the MWVCS. The convergent correlations ranged from .68 to .88 (*p* Table 4). The discriminant validity was assessed by testing the correlations among the seven factors. The correlations ranged from .39 to .60, which were lower than convergent validity, except one correlation between response to violence and after-the-event recovery being .75.

The correlations among the MWVCS factors provide evidence for both convergent and discriminant validity (Table 4). The I-CVI of the final 40 items ranged from .83 to 1.00, and the S-CVI was .99, which indicated good content validity [24].

Reliability of the MWVCC

The Cronbach's α coefficient of the total scale was .96 and that of the seven factors ranged from .80 to .92. The test–retest correlation coefficient of .90 showed that the MWVCC had excellent category of scale stability [27]. Test–retest reliabilities of the MWVCC by subdomains were .76 for violence cognition, .79 for utilization of protective facilities, .81 for risk assessment, .76 for knowledge renewal, .77 for response to violence**,** .83 for after-the-event recovery, and .85 for nurse–patient interaction.

Discussion

It is evident that an exposure to WPV has a long-term negative impact on physical and psychological health of nursing students [28]. Nursing students are a group of inexperienced health workers who are in the transition from students to professionals and challenged by academic and clinical stress [29]. They have been shown to lack social experience, interpersonal skills, coping strategies, and psychological adjustment ability [30,31]. Given the focus of the existing WPV programs on nurses in specific settings and the limited scope of outcome measures in evaluation of programs, nursing students who are in a vulnerable position require special attention. The study attempted to develop an instrument to assist assessing and evaluating competence in WPV management among nursing students, which is one of the main aspects in WPV prevention education.

The MWVCS comprised 40 items with seven factors, which is consistent with conceptual attributes of 4R crisis management theory. In 4R crisis management theory, the first stage, reduction, refers to the reduction of risk, thus reducing the possibility and harm of the crisis. Two factors, violence cognition and nurse–patient interaction, corresponded to “reduction” in the theory. Violence cognition refers to nursing students' understanding of basic theoretical knowledge of workplace violence, including items on causes, current situation, psychological knowledge, and effects of workplace violence. Nurse–patient interaction consists of items on the communication and interaction between nursing students and patients in the process of providing nursing services.

The second stage of the theory, readiness, refers to the preparation made before the occurrence of a crisis, the purpose of which is to enhance the ability to deal with a crisis. Three factors, utilization of protective facilities, risk assessment, and knowledge renewal, corresponded to “readiness”. Utilization of protective facilities includes items on nursing students' understanding and use of violence prevention equipment and safety measures provided by the hospital. Risk assessment consists of items on nursing students' assessment of the risk and the identification of early signs before workplace violence occurs. Knowledge renewal consists of items about actively participating in education and training related to workplace violence and learning related knowledge to enhance their ability to manage violence.

The third stage, response, refers to the response to a crisis situation, that is, what methods or strategies should be adopted to deal with a crisis. One factor, response to violence, was consistent with it. Response to violence consists of items related to reasonably using de-escalation skill to ease the progress of violence and protecting themselves and getting out of dangerous situations as soon as possible.

The fourth stage, recovery, refers to the arrangements for recovery work and the summary and analysis of related experience after the crisis is under control. One factor, after-the-event recovery, including items on performing post-incident treatment, psychological adjustment, and experience reflection after workplace violence, was consistent with the fourth stage.

The MWVCS developed has its strengths in that it was underpinned by 4R crisis management theory [23] and that the framework guidelines had great reference value to the items development [10]. Another strength of the study is that, through the Delphi method, it was possible to identify and reflect international and national, and collective and individual requirements in managing WPV among nursing students into a set of competence for use in China and potentially many other countries across the world. In the phase of Delphi Expert Consultation, several items were revised and added. For example, verification of vague information was suggested by experts, which was considered as an important interaction skill for violence prevention. In particular, experts noted that seeking assistance from the social support system was a considerable way of psychological adjustment after confronting with WPV. Therefore, the final MWVCS includes Q17 and Q47 to address this suggestion.

Relevant instruments have been globally developed, among which the existing instruments aimed at the attitudes [16], self-confidence [17], or a skill [12]. In the current study, the MWVCS placed emphasis on the management competence throughout the violence occurrence and development, covering reduction, readiness, response, and recovery. It should take 15–20 minutes for students to complete the MWVCS. This instrument could be helpful for nursing educators to obtain a comprehensive understanding of students' violence management competence.

This study has some limitations. First, because no suitable measurement tool was found as a criterion, criterion validity was not performed. Second, two items associated with attitudes were eliminated during item analysis, and the remaining attitude related items were subsequently removed because of the factor containing less than three items. Attitudes toward violence have an effect on the management of WPV [32]. Thus, it is recommended that the MWVCS collocate with a violence-related attitude scale to obtain an overall understanding of students' competence in violence management and their attitudes.

The instrument has important implications for nursing education in the future. Nursing educators in clinical settings have the great responsibility to cultivate students' coping capacity. The competence level of nursing students in the reduction of violence, readiness for violence, response to violence, and recovery from violence should be observed and assessed by educators. Although a number of training programs have been developed, few of them were specially tailored to student requirements [9]. The instrument can be used for nursing students with the experience of clinical observation or practicum. In addition, it can be used as a pretest or post-test tool in related training. Education courses or training programs could be developed based on the understanding of nursing students' strengths and weaknesses in violence management. The effectiveness of the education intervention could also be evaluated using the instrument. All nurses are expected to have the intention to provide violence prevention education [33]. The instruments could provide guidance for nurses in clinical settings, such as providing alarm device introduction, violence risk patient informing, and psychological care. Therefore, nursing students' awareness of violence prevention could be enhanced, and violence incidents and harmfulness could be reduced. Currently, there is a gap between the student requirements and training in the literature. This instrument would allow nursing academics to analyze the influential factors of students' competence in violence management and design scientific targeted training programs.

Conclusion

The MWVCS in the current study has been demonstrated to have good reliability and validity in a large sample of nursing students. It consists of 40 items in seven factors and could be used to measure competence in WPV management. It is a valuable instrument for nursing educators to understand students' competence, identify their educational needs, develop, and evaluate the effectiveness of educational programs. Further studies are needed to test the scale in different contexts and cultures.

Conflict of interest

The authors declare no conflict of interest.

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Characteristics	N	%
Age (years)		

30–39	4	22.2
40–49	8	44.5
50–59	6	33.3
Education level		
Bachelor	3	16.7
Master	9	50.0
PhD	6	33.3
Professional title		
Intermediate	2	11.1
Senior vice	6	33.3
Senior	10	55.6
Working experience (years)		
10–19	7	38.9
20–29	10	55.6
30–39	1	5.5

Characteristics	N	%
Gender		
Men	83	10.4
Women	714	89.6
Age (years)		
18–20	66	8.3

21–23	673	84.4
≥24	58	7.3
Education program		
Junior college study (3 years)	593	74.4
Bachelor's degree study (4 years)	204	25.6
Clinical placement		
< 4 months	5	0.6
4–6 months	3	0.4
> 6 months	789	99.0

Items	M±SD	Factors						
1	2	3	4	5	6	7	After-the-event recovery	42.61 ± 6.65

							Q51. I can reflect on the inadequacies in the process of addressing the violence after the incident.	3.89 ± 0.74

.83	.13	.13	.01	.05	.13	.12	Q43. I can report violence correctly and effectively with the help of teachers after the incident.	3.91 ± 0 .83
.78	.10	.07	.01	.14	.06	.27	Q50. I can make an analysis of the causes of the incident after the violence.	3.81 ± 0 .81

.78	−.15	.10	.05	.03	.16	.19	Q44. I can choose an effective legal approach for personal rights protection with the help of teachers after the violence.	3.89 ± 0 .78

.78	.01	.02	.03	.03	.17	.10	Q45. I can objectively assess my psychological state after experiencing the violence.	3.78 ± 0.83

.77	.19	.07	.07	.13	.13	.24	Q52. I will share my experience of hospital violence with other students to avoid the recurrence of such incidents.	3.99 ± 0 .79

.72	−.03	.05	.01	.11	.22	.09	Q49. I can give psychological comfort to my colleagues after they suffered hospital violence.	3.96 ± 0.76
.68	−.03	.07	.06	.10	.26	.04	Q48. I know how to ask for professional psychological help after the violence.	3.70 ± 0.86

.65	−.11	.07	.05	.02	.00	.30	Q42. I can choose appropriate ways (such as photos, monitoring, witnesses, etc.) to collect evidence with the help of teachers after the violence.	3.84 ± 0.83

.63	.14	.24	.09	.14	.07	.22	Q46. I can use appropriate psychological adjustment methods to adjust the psychological state (such as moderate relaxation, reasonable catharsis, self-suggestion, etc.) after the violenc	3.82 ± 0.82

							e.	
.61	.06	.14	.04	.09	.06	.07	Q47. I will seek support from classmates, teachers and family after the violence.	4.01 ± 0 .79
.54	.15	.03	.01	.12	.23	.03	Nurse–patient interaction	23.79 ± 3.64

							Q19. I don't use derogatory or threatening language with patients.	4.04 ± 0.85
.09	.79	.02	.00	.10	.05	.01	Q18. I respond to patients in appropriate ways (nodding, smiling, encouraging, affirming, etc.).	4.07 ± 0.76

.05	.77	.01	.01	.04	.06	.05	Q16. I give attention to the verbal and non-verbal behaviors (such as words, tone, expressions, actions, etc.) of the patients or relatives.	3.89 ± 0.76

.03	.73	.00	.09	.08	.06	.19	Q17. I will verify the vague information with patients or relatives.	3.88 ± 0.81
.02	.68	.03	.02	.03	.11	.29	Q12. I respect the rights of patients and avoid unintentional infringement or injury.	4.09 ± 0.82

.03	.63	.05	.11	.03	.18	.14	Q15. I will adjust the way of communication according to the cognition of patients or relatives.	3.82 ± 0.76
.02	.63	.02	.09	.02	-.07	.20	Response to violence	29.90 ± 4.80

							Q35. When the patients or relatives raise the voice or become emotional, I can use appropriate communication skills to ease the tension.	3.79 ± 0.76

.05	.07	.82	.04	.07	.02	.10	Q38. When communicating with patients or relatives who have signs of violence, I will try to move to an monitoring area.	3.84 ± 0.82

.07	.13	.70	.10	.07	.21	.04	Q34. I can manage my emotions well when facing complaints and misunderstandings from patients or relatives.	3.78 ± 0 .77

.03	.16	.70	.11	.05	.06	.09	Q37. When facing emotional patients or relatives, I will keep an appropriate distance.	3.98 ± 0 .76

.06	.06	.69	.04	.18	.30	.02	Q36. I know the ways to control the violence tendencies of special patients (e.g., psychopath, alcoholics, drug user).	3.48 ± 0 .90

.05	.18	.66	.06	.03	.15	.25	Q39. When encountering hospital violence, I can appropriately turn to teachers for help.	3.98 ± 0.77

.13	.07	.62	.01	.14	.24	.16	Q41. If controlled by patients or relatives, I can use disengagement techniques (e.g., protect vital parts, communicate to distract attention, utilize disengagement techniques, and call for help time	3.60 ± 0.88

							ly).	
.22	.02	.54	.04	.05	.25	.17	Q40. When encountering hospital violence, I can activate the one-button alarm device.	3.45 ± 0.95
.18	.23	.45	.11	.35	.11	.02	Violence cognition	17.65 ± 3.46

							Q2. I know the causes of the violence in the health sector.	3.60 ± 0.81
.01	.05	.01	.83	.02	.06	.08	Q4. I know the current situation of hospital violence in our country.	3.45 ± 0.89

.03	.04	.05	.78	.02	.05	.09	Q1. I know the workplace violence includes physical and psychological violence.	3.57 ± 0 .89
.02	.07	.01	.78	.02	.10	.09	Q3. I know the psychological knowledge of violence in the health sector.	3.29 ± 0 .88

.02	.04	.01	.77	.05	.16	.16	Q5. I know the impact of hospital violence.	3.75 ± 0 .84
.03	.14	.08	.77	.01	.00	.19	Utilization of protective facilities	13.86 ± 3.12
							Q21. I know the location of the one-button alarm device in the hospital.	3.35 ± 0 .99

.06	.04	.05	.02	.92	.09	.03	Q20. I am familiar with the position of the surveillance camera in my work area.	3.47 ± 0.96
.02	.15	.14	.06	.79	.09	.03	Q23. I know the violence contingency plan of the hospital.	3.28 ± 1.00

.02	.12	.05	.13	.65	.02	.14	Q22. I know the staff passage in the hospital.	3.75 ± 0 .95
.06	.18	.01	.08	.61	.31	.05	Knowledge renewal	11.94 ± 2.17
							Q32. I will participate actively in training related to violence organized by the hospital.	4.00 ± 0 .84

.06	.01	.04	.00	.14	.75	.03	Q33. I will improve my violence management competency by self-directed learning via various approaches.	3.88 ± 0 .84

.02	.15	.07	.07	.15	.72	.18	Q31. I think the occupational protection education in the health sector should contain violence content.	4.06 ± 0.83
.10	.12	.04	.10	.04	.67	.11	Risk assessment	10.89 ± 2.11

							Q26. I can identify the patients or relatives with high risk of violence based on their characteristics (such as personality, expectation of medical treatment, social background, economic conditio	3.60 ± 0.83

							ns, etc.)	
.03	.13	.12	.11	.06	.07	.73	Q25. I can assess the signs of violence using STAMP (Staring and eye contact, Tone and volume of voice, Anxiety, Mumbling and Pacing).	3.64 ± 0 .84

.08	.08	.07	.04	.05	.19	.66	Q27. I can identify high-risk situations where violence occurs (e.g., working alone, unmet demands of the patients or relatives, misunderstanding, unsatisfying treatment effect, etc.)	3.64 ± 0.82

.13	.16	.03	.04	.01	.07	.65	Total score	150.64 ± 20.40
							Eigen value	
15.14	2.61	2.30	1.67	1.24	1.18	1.15	Explained variance (%)	
37.8	6.5	5.8	4.2	3.1	3.0	2.9	Cumulative variance (%)	

Variable	Violence cognition	Nurse–patient interaction	Utilization of protective facilities	Risk assessment	Knowledge renewal	Response to violence	After-the-event recovery	MWVCS
Violence cognition	1							
Nurse–patient interaction	.50**	1						
Utilization of protective facilities	.46**	.40**	1					
Risk assessment	.48**	.49**	.53**	1				

Knowledge renewal	.39**	.60**	.44**	.50**	1			
Response to violence	.52**	.53**	.53**	.58**	.54**	1		
After-the-event recovery	.49**	.59**	.46**	.57**	.60**	.75**	1	
MWVCS	.70**	.75**	.68**	.73**	.72**	.86**	.88**	1

DETAILS

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The Experience to Implement Palliative Care in Long-term Care Facilities: A Grounded Theory Study of Caregivers

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ABSTRACT (ENGLISH)

Purpose

The purpose of this study was to explore the experiences of caregivers in long-term care facilities as they implement palliative care. Although palliative care has been available in Taiwan for more than 30 years, it is often provided in hospitals, few models in the long-term care facilities.

Methods

Semi-structured interviews using grounded theory methodology and purposive sampling. Two small long-term care facilities that had performed well in palliative care were selected from eastern Taiwan. A total of 12 caregivers participated in in-depth semi-structured face-to-face interviews.

Results

Four major stages in the implementation of palliative care were identified: (1) feeling insecure, (2) clarifying challenges, (3) adapting to and overcoming the challenges, and (4) comprehending the meaning of palliative care. The core category of these caregivers as "the guardians at the end of life" reflects the spirit of palliative care.

Conclusion

This study demonstrates that successful palliative care implementation would benefit from three conditions. First, the institution requires a manager who is enthusiastic about nursing care and who sincerely promotes a palliative care model. Second, the institution should own caregivers who possess personality traits reflective of enthusiasm for excellence, unusual ambition, and a true sense of mission. Third, early in the implementation phase of the hospice program, the institution must have the consistent support of a high-quality hospice team.

FULL TEXT

Introduction

In 1980, a rapidly developing economy in Taiwan, a related increase in the number of women entering the workforce, and a lower birth rate combined have contributed to an increase in long-term residential care for older Taiwanese [1–3]. The 1980s saw the rise of many illegal long-term care institutions to address the rising need for long-term residential care. This resulted in a lowering quality of care and an increase in public safety accidents [4]. In 1998, the Taiwanese government responded by increasing the number of beds in long-term care facilities and actively counseled the legalization of smaller institutions with the proviso that they should not exceed 49 beds per facility [4,5]. By 2013, these smaller institutions accounted for 86% of all long-term care facilities in Taiwan [5].

The delivery of good-quality palliative care is dependent on the willingness of institutional managers to give it proper attention and the necessary resources [4,6]. Traditionally, where managers do not fully understand the concept of palliative care, have insufficient staffing, and lack hospice team support, there has been a reluctance to offer palliative care [6–8]. In addition, when it has been delivered, it has suffered from a lack of comprehensive service because of overall deficiencies in skills, education, and training related to the care of near-death patients [9,10]. For example, caregivers at general institutions have tended to send residents to hospitals for emergency treatment when they develop acute problems (such as shortness of breath or hypotension) [6,11]. This has resulted in the overuse of both aggressive medical intervention (such as defibrillators and vasopressors) and life-sustaining treatment (such as mechanical ventilation, intubation, and extracorporeal membrane oxygenation). Such treatments are not only often medically futile (leading to wastes of resources and money), but have also meant that patients experience lower well-being quotients near the end of life [2,11]. If palliative care were to be implemented within long-term care facilities rather than outsourced to emergency units, many of the problems so far addressed could be lessened and decreased.

At present, palliative care in Taiwan can be divided into two main types: “the hospital care model” and “the community care model” [12]. The “hospital care model” includes medical teams caring for patients in hospice wards or hospice teams assisting a general medical team to jointly care for patients in general wards. In contrast, the “community care model” can include a hospice team or clinics delivering care to long-term care facilities or residents' homes [12].

A hospice team is typically composed of doctors, nurses, social workers, and psychologists, and requires certification of completion, issued by an agency authorized by the government, to conduct palliative care training [12, 13]. Depending on the patient's situation or needs (e.g., religious affiliation), a hospice team can also invite other professionals to fulfill an auxiliary role in delivering palliative care (e.g., religious leader) [12,13].

In Taiwan, 85% of palliative care patients receive services from the “hospital care model”,” whereas the remaining 15% involve the “community care model” [12,13]. In contrast, palliative care in both the United Kingdom and the United States is mainly based on the “community care model” [14]. Palliative care is increasingly being offered at a local level, where care homes are embedded in communities and which can provide palliative care independently, without the need for hospital or larger institutional intervention [14–17]. In recent years, the Taiwanese government has become more intent on reducing the concentration of palliative care delivery in hospitals, seeking to shift the delivery of end of life services and hospice care nearer to communities [1,12]. In doing so, the government has actively promoted the “community care model” of palliative care, so that patients can receive comprehensive care within the comforts of their communities, in either care homes or long-term care facilities [6]. The benefit of this model lies principally with the patient. Palliative care patients can, through community level care, receive a level of service and support, which enhances the dignity and comfort they experience toward the end of life [18,19].

The purpose of this study was to explore the experiences of caregivers in long-term care facilities as they implement palliative care. The goals have been to clearly define the palliative care response process and provide suggestions for long-term care institutions when introducing palliative care. This research may also serve as a reference for governmental policy development in their efforts to improve cooperation between long-term care institutions and hospice teams within hospitals.

Methods Design and setting

This study made use of grounded theory, which is well-suited for use in complex, interacted, and unexplored fields [20] like the interaction process between caregivers and others in palliative care implementation investigated in this article. Initially, the researchers did not have a preconceived theory in mind, but they started from the field of research and allowed the theory to emerge from the data. Through the use of systematic induction, deduction, and analysis, a theory rooted in the real-world context was developed [20]. Based on the information received from the certification of the hospice team, two small long-term care facilities that had 4 years of experience and performed well in the implementation of palliative care were selected from five (**Recruitment and participants**

After meeting with the managers of two long-term facilities, consent was obtained from the institutional managers granting the researcher permission to enter the facility for research and to recruit caregivers. Thereafter, the investigator explained to caregivers about the purpose of this study, interview procedures, risks, benefits, and right of withdrawal. Purposive sampling was used to select qualified caregivers, the inclusion criteria of the study participants were as follows: (1) full-time caregivers (nurses and nursing aides), (2) with experience in caring for residents of palliative care, and (3) ability to communicate in a Chinese or Taiwanese. The exclusion criteria of the study participants were as follows: (1) caregivers with less than 3 months (probation period) of experience, and (2) withdraw the study. A total of 12 caregivers agreed to participate in the study and granted informed written consent, who were numbered (S1–S12) in order of their recruitment. Participant demographics consisted of nine women and three men, aged 20 to 59 years, with a minimum of 3 months' experience in hospice palliative care. All of whom remained involved until the end. All relative recruitment was conducted by author S.W.C. The study was approved on June 4, 2015, by the Research Ethics Committee of Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Taiwan (Approval no. IRB104-29-B).

Data collection

Data collection was carried out simultaneously at the two institutions according to the following data collection methods: (1) field observations, (2) semi-structured in-depth interviews, and (3) the basic information sheet. The first data collection period was from August 1, 2015, to July 31, 2016. The second data collection period was from August 01, 2017, to November 30, 2017. The research tools included interview participation consent form, basic information sheet, observation note, reflection diary, voice recorder, and qualitative analysis software NVivo-8. Interviews were face-to-face and held in a quiet and independent room by the author S.W.C. (qualified for qualitative research) in the long-term care facility. Participants were interviewed one or two times (each lasted 45 to 90 minutes). If a relevant concept in the paper needs further explication, or the conclusions are inconsistent and do not follow from observations and interviews, then researchers will need to re-interview and recollect data until whatever conceptual gaps present are addressed. The open-ended question interviews were documented with audio recordings, and after reviewing the articles, interview guidelines were developed by all authors. Over the course of the data collection period, the second author (who volunteered in long-term care facilities) performed observation work, keeping a record of his findings. He would then present these observation records to the first author. The data collected via observation was used to generate questions to be asked during the interview process and to verify what the participants meant when being interviewed. For example, it was found that during the dying phase of the residents, health care providers visit more frequently and receive more medical orders, so health care provider was asked: “What do you do when the residents exhibit symptoms at the end of life?” and “What do you feel or think at that time?"

Data analysis and rigor

The grounded theory of Corbin and Strauss (2015) was used to analyze and compare the data [20]. The researcher initially transcribed the voice-recorded files into verbatim transcripts and also filled in the reflection log. The transcripts were then verified for consistency by listening to the recordings once again while simultaneously scrutinizing the written narrative. The analysis procedures were as follows: **Open coding:** Important sentences were first noted by underlining and separating meaningful phrases for coding. For example, S2 said that "When long-time residents died, my mood was affected and I felt sad since I had been caring for them for a long time. When they died, I felt terrible." As the researchers regarded this as "meaningful," it was underlined and coded as "increased emotional burden." A second example is taken from comments by S7 who mentioned that "We needed to more frequently assess vital signs in residents who were close to death" and this increased their workload. This comment was underlined and coded as "personal burden increased." Since "increased emotional burden" and "personal burden increased" are a result of the implementation of palliative care, the researchers condensed these two into the concept of "increased personal workload." **Axial coding:** The researchers then advanced to axial coding, a strategy for aggregating similar concepts. For example, "increased personal workload" and "low acceptance among the families" are both difficulties encountered in the palliative care setting, so these are classified as "clarifying challenges." **Selective coding:** From the aggregation of similar concepts completed during the axial coding process, we identified four distinct categories into which the majority of caregiver issues could be classified. The analysis procedures can be accessed in [Tables 1 and 2]. As part of their work, the researcher was tasked with verifying and ensuring the rigor of the observation records while they analyzed the interview data. Where the interview data and the observation records were inconsistent, the interview had to be conducted again and the observation data needed to be re-analyzed. Data analysis was conducted by the author S.W.C. To enhance the rigor and coherence of the research process, the second author was responsible for explaining the content of the observation records to the first author for clear and cogent data interpretation. The third author was responsible for monitoring the research process and offering advice and consultation.

Results

Four major stages of implementing palliative care were identified in the interviews with the caregivers: (1) feeling insecure, (2) clarifying challenges, (3) adapting to and overcoming the challenges, and (4) comprehending the meaning of palliative care. The core category shared by the participants may be summed up as "the guardians at the end of life". It reflects the spirit of the successful implementation of palliative care by caregivers in long-term care institutions (see [Figure 1]).

Feeling insecure

Caregivers expressed insecurity about their role before the implementation of the palliative care program. Specific doubts included their self-perception that they are incapable of performing well in the role because of inexperience. Likewise, they voiced the fear of facing the death of residents. The caregivers were worried about not being capable enough to take care of the residents; those worries caused some stresses and psychological discomfort to caregivers: "*I was more worried about how to deal with their symptoms when they were dying*" ***[S10]***. Caregivers were also worried about having insufficient communication skills to explain the strategies for supporting ongoing care:*"I worried that the family members wouldn't accept or understand what I had told them about the way I took care of residents"****[S06]***. Caregivers did mention that they were afraid of facing the death of residents: *"I had never encountered death before. It felt eerie and I was scared"* ***[S03]***.

Clarifying challenges

During the implementation stage of the palliative care program, caregivers initially faced multiple challenges, including low acceptance by residents' families, an increased work burden, and hesitancy about how to build a cooperative relationship with the hospice team. During this stage, the caregivers faced challenges with low acceptance among the families. Reasons given included the desire to avoid hearing "bad news," which might bring bad luck: *"When I tried to bring up palliative care, the family asked, 'How can I give up? How can you talk about such unlucky things? Do you want to curse my dad to die?' And then they refused to listen to me further"* ***[S5]***. Meanwhile, the palliative care concept was too complicated to understand: "*I wasn't sure that the concept was explained clearly.*

It seems like they didn't understand" **[S11]**. There was pressure from other relatives who felt that the palliative care approach represented a failure to carry out their filial duties. "*When I mentioned hospice, they would say: 'Mom and Dad or other relatives will blame us and ask why we were not so filial"* **[S12]**.

In the past, when residents developed acute problems, they would be sent to the hospital for emergency treatment, so few residents would expire in the institution. However, after the implementation of palliative care, caregivers were faced with the deaths of residents and dealt with symptoms at the end of their lives:*"They struggled to breathe and lost control of bodily functions (urination, defecation). I needed to help them, but it was toilsome," "The doctor's orders and medications would change frequently, so we needed to closely monitor the physiological state when they were dying"* **[S09, S06, S07]**.These made them feel that their personal burden increased. However, after an extended time, caregivers had developed emotional bonds with residents. Therefore, when residents passed away, caregivers would sometimes feel despondent, an additional emotional burden: "*I felt like my relative was gone; I cried and felt so sad"* **[S08]**.

Early in the "roll out" of this new program and the development of collaboration between the hospice team and the caregivers, there were numerous adjustment problems. The caregivers thought that the assistance provided by the hospice team A was inadequate, and that there were insufficient training courses about caring for family and infrequent supervisory visits to the institution: "*there were no courses about how to comfort them (families)," "When the hospice team didn't come often, we found ourselves in a panic"* **[S5, S12]**. Another hospice team B had poor communication with the staff of the institution: "*Hospital B was not so friendly. We simply listened to them, and it was impossible for us to discuss the various approaches with them"* **[S1]**.

Adapting to and overcoming the challenges

There is the perception that, principally, the leadership role played by management facilitated the team's adaptation to this new model of care and assisted caregivers in overcoming early challenges. The hospice team provided essential support and avenues of communication among the various professionals developed efficiently. The caregivers believe that a large part of the success is attributable to the influence of leadership in management. The caregivers gained actual support from the manager and learned from her profound work experience: *"She was a nursing aid and later became a nurse and then our manager. She had seen many patients neglected as they were dying. And also she understands our hard work and treats us kindly like her own children"* **[S4]**. The caregivers also learned the spirit and attitude from the manager's story: "*Our manager's grandma used to live in the institution and was taken care of well. So she told us to take care of the residents well as our own family members"* **[S9]**.

Caregivers have learned the new concepts and techniques from the manager and felt the sincere dedication and warm care from the process of managers taking care of the residents: "*We often heard how our manager attended conferences on palliative care from which she brought back the ideas. When we had difficulties with certain situations, she was able to use this new wisdom to teach us how to care for the residents"* **[S8]**. Interviewees could feel the sincere dedication and warm care from the process of managers taking care of the residents: *"Every time I observed our director caring for the residents, the expression on her face and in her eyes was truly a caring expression. It would not be deceiving. We were very touched and wanted to learn from her"* **[S8]**.

These actual actions and beliefs were transformed into organizational culture, and interviewees were inspired by the managers and willing to follow them: *"Our job is hard work, and the staff still working here must understand the working culture and appreciate the philosophy taught by the manager. We all want to learn from her"* **[S6]**.

Caregivers commonly learned the positive thinking from managers and knew they were doing something meaningful: "*The manager told us that we are doing the right and meaningful things, so don't be afraid of the death of the residents. We are helping them. She assured us that all the staff would support one another in this job"* **[S3]**.

In addition, consultant psychologists and religious-spiritual advisors were invited to help the staff discuss their feelings and share their stories and experiences about caring for the dying residents and to give spiritual support to one another: *"During the daily shifts, we shared what had happened that day and how we felt, supporting one another"* **[S3]**. Meanwhile, caregivers took spiritual courses that the managers arranged to help them facing death and to relieve the negative emotions caused by taking care of hospice residents. One innovative activity found to be therapeutic for the staff and to help them with their own grief was to involve them in caring for plants: *" We observed the germination of seeds and then understood that death is not the end, it's the beginning of another life" **[S7]**.*

Initially, the support of the hospice team was very important to the institution as caregiver's implemented palliative care. The hospice team was invited to provide courses about knowledge and skills to improve care and communication. After caregivers gained new knowledge and skills, they worried less about lack of ability: "*After those classes, we had a better knowledge of what residents would be experiencing close to the end of life, how to care for them and how to communicate with their families" **[S10]**.*Therefore, work efficiency was improved and caregivers gradually adapted to new workloads: *"After repeated practice and caring for residents in the program for a long time, we became more efficient at our work" **[S4]**.*

In addition to educational training and spiritual courses, the hospice team also used technology software to provide instant consultation: "*We would use the LINE application to communicate with and request advice from the team when residents developed problems. The availability of this technology helped reduce our fear and manage problems quickly" **[S11]**.* The hospice team also increased the number of visits to the institution until the staff had fully developed the required skill-sets, allowing them to feel secure and to get through the roll-out period as efficiently as possible: *"Once residents enrolled in palliative care, it was rarely necessary to send them to hospital. The hospice nurse would visit and provide necessary medicines. This really relieved the caregivers" **[S8]**.* In the end, the institution realized that there had been inadequate communication and cooperation with one of the two hospice teams, so caregivers terminated their relationship with that team and continued to work with the one team with which there had consistently been better cooperation: *"We had cooperated with two hospitals, but one of them often couldn't solve the problem immediately, and we needed to send the patient back to the emergency, so we transferred to a more efficient and effective hospice team that addressed issues on a more timely basis" **[S12]**.*

Initially, acceptance of the palliative care concept was low among the residents' families. The caregivers had a desire improve communication efficiency, and they found that communication became more effective as trust developed: "*Family members were less friendly when they first came in. I preferred to wait for a while, then I slowly brought up the issue (palliative care), and then it would be easier to communicate when we were familiar, one with the other" **[S1]**.* And caregivers shared ideas with colleagues: "*During our daily shifts, I would often ask colleagues to share with me tips for improving my communication skills"**[S9]**.* If caregivers felt that communication remained ineffective, they would require the assistance of hospice team to help them communicate: "*Some families would be unclear about palliative care even after we had discussed it and fully explained. In those cases, we would invite the entire hospice team to sit with the family for a discussion" **[S12].***

Comprehending the meaning of palliative care

When the last stage, family members achieved a deep understanding of the role of palliative care as their relationships with caregivers solidified. Without regret, families expressed appreciation for how the institution valued life and guarded the dignity of their loved ones during end-of-life care. Meanwhile, caregivers also truly understood the meaning and value of life. When staff determined that the death of a resident was imminent, caregivers would invite the family to be at the bedside to accompany their loved one through the transition. This provided comfort for the resident in their final moments while it also allowed the family to express their love and thoughts. Staff have reported that family members expressed relief to see their loved one take the last breath without pain or struggle and expressed gratitude to the institution for providing this care environment for which they had no regrets. These experiences validated for the staff that their mission had been meaningful and successful: "*Family members would return to the institution after the funeral to thank us, so grateful that they had been able to accompany their loved one who had died peacefully in our care. There was no regret" **[S3]**.*

The outcome for the resident and family is likely to vary greatly based on whether or not they had elected the hospice benefit. For example, interviewees described that: *"I have encountered some families who had elected not to choose hospice and their loved one suddenly died in the hospital. The family had no time to prepare, had made no prior arrangements with a funeral home and were, at times, confronted with uncertainty as to where the body would be kept while they made necessary arrangements for burial. Those families who had elected hospice had* *been able to accompany their loved one in those final moments and were more psychologically prepared"* ***[S10]***. Meanwhile, because of avoiding emergency intervention, the resident could die peacefully: *"I think that hospice can allow for the dying patient to transition with dignity. We observe peaceful facial expressions with little change in appearance. It is like they simply fall asleep"****[S9]***. Therefore, the caregivers expressed that they truly understood that their role is to assist the family to understand what to expect while guarding the dignity of the resident.

One of the more profound effects that hospice work has had on the caregivers is how it has reinforced their perception of the value of nursing and has, very importantly, provided recognition for the staff: "*I feel that others need my care. This is my mission. I am a useful person in this world. I feel I belong here when working in this place"* ***[S2]***. Although the work is full of challenges, it is a unique professional role that has broadened their regard for the meaning and value of life: "*In the process of caring for others, I have come to realize the meaning of life. When people are dying, it is useless to have money. Even the person who can call the wind and summon the rain cannot escape death. So treasure our time, doing meaningful things, saying what we wanted to say, having no regrets. So, pursue your dreams now"* ***[S6]***.

The caregivers reflected on their own personal and professional growth and how the shared experiences with residents and families had been mutually beneficial. Although the palliative care model, under the compassionate support of the staff, ensured that the residents' physical and emotional needs had been skillfully addressed, that dignity had been preserved in the dying process, the caregivers reported their own developing sense of accomplishment, which affirmed the importance of their role. Recognizing the gratitude of family as they witnessed the true healing effects of palliative care further enhanced the self-confidence of caregivers who affirmed that the process had been personally and professionally transforming.

Discussion

This study indicated that the hospice residents have higher complexity diseases, which create increased workload and pressure for caregivers; furthermore, staff faced the death of residents and sadness because of the loss [21–23]. Education and training in the form of seminars and workshops followed by ongoing mentoring of inexperienced caregivers by more senior staff will promote self-confidence among nursing personnel and likely increase their knowledge base and efficiency [24–26]. Emotional support of hospice staff, who almost daily face the loss of life, is absolutely essential to the success of palliative care programs [27]. Pre-service workshops on grieving should be integrated with palliative care training, and specially trained psychological support personnel should be integral to the hospice team [28]. Ongoing training [29], memorial services for those residents who have died [30], and spiritual care courses can increase working efficiency by addressing the personal grief and loss experienced by caregivers.

This study found that in the initial stage of cooperation between facility and hospital hospice team, there was a gap in expectation between the two parties regarding the content and frequency of hospice team services, and the timeliness of providing consultation and services. The literature mentioned that the hospice team must fully inform and explain in detail the method of care, reasons, impact, and the consistency of communication with the caregivers [22,31,32]. Communication technology can also be used to shorten communication and service timeliness [22,23,32]. Our research found that, in the early stages of the program, facilities would replace the hospice team when communication seemed inadequate. However, one of the hospice team was perfectly willing to maximize frequency of service until the caregivers had enough capacity. Available technology communication tools provided instant communication and support, increasing cooperation [32,33].

In addition, we found that acceptance by family members was low during the initial implementation phase of the program, so delaying sensitive communication until trust has been established may be more effective. Rosemond et al pointed out that it is important to build a family's trust in the caregivers [34]. As long as there is a sense of trust between them, the family will be more willing to listen to the explanation and suggestions of the caregivers [35]. When certain caregivers are less skillful at communicating the principles of the palliative care model, they could benefit from additional training and the opportunity to "shadow" and observe more skillful colleagues as they interact with residents and families [36]. The hospice team has extensive experience and could mentor those care providers who are lacking in the same. If necessary, please ask the members of the hospice team to help communicate [37–39].

Apropos of our concern for family members, the care team timely communicates imminent death to the family to facilitate their participation in the final moments of life leading up to the passing [40]. Likewise, relative to our concern for the dying patient, the providers strictly adhere to the expectations of the resident and family that their wishes for a dignified end-of-life will be honored and that their choice for no last-minute emergency interventions will be respected [40,41]. These two guiding principles are inherent in the hospice concept and have transformed the way people die [42]. The results of this study show that the caregivers do indeed follow this protocol and have consistently involved family in a timely fashion. Allowing for a dignified death with serenity has been integral to the practice, and the caregivers gain self-worth through the care process [43]. Their work becomes a continuing experience of self-growth and the development of their professional expertise, which become direct benefits for future palliative care clients in their care.

Professional knowledge can be enhanced through learning and continuous practice, but the key to success or failure is about “people” The long-term care institution can successfully implement palliative care. In addition to the professional support provided by the hospice team at the outset, the most important over-riding factor is the principled focus and determination of the manager whose enthusiasm and mission inspire and influence the caregivers resulting in an organizational culture imbued with professionalism. The result is high-quality palliative care. In addition, when recruiting employees, the program selects candidates with enthusiasm for service. Then, once candidates are hired, managers can work to foster an environment conducive to enduring enthusiasm through the use of making adjustments, incentivizing learning, and encouraging pride and dynamism in service delivery. In these ways, enthusiasm can be transformed into high-quality palliative care. Some of the employees in the institution are young nurses, and this is their first working experience of palliative care. They are all enthusiastic and having dreams of changing the world, and working here makes them feel proud [17]. In addition, several of the senior employees, who had been helped by others before, were grateful and hoped to give back to society. In short, the characteristics of these employees are either natural or trained, and they are all full of ambition, sense of mission, enthusiasm, and responsibility.

Strengths/limitations

In this study, the subjects are small long-term care facilities in eastern Taiwan, so the results may not be extrapolated to other regions or long-term care facilities of different sizes. In addition, we suggest to include the hospice teams and managers of the long-term care institution as participants in the future study to make the research more comprehensive.

Conclusion

This study shows that a long-term care facility should minimally have three conditions for successful palliative care implementation. First, the institution requires a manager who is enthusiastic about nursing care and sincerely wants to promote palliative care, can stimulate the enthusiasm and sense of mission of the caregivers, and also can provide solid and consistent support for the caregivers. Second, the institution should own a group of employees with full of enthusiasm, ambition, and a sense of mission. Third, early in the implementation phase of the palliative care program, the institution should have the consistent support of a high-quality hospice team to provide requisite training and immediate consultation for staff, while instilling the principles and standards of best practice palliative care in the developing program.

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Conflict of interest

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Open coding	Axial coding	
Code	Concept	Category
Worried about inexperience	Worried about not being capable enough	Feeling insecure
Worried about insufficient communication skills	Never encountered death	Afraid of facing the death of residents
Afraid of ghosts	Increased emotional burden	Personal burden increased
Clarifying challenges	Increased workload burden	Desire to avoid hearing “bad news”
Low acceptance among the families	Pressure from other relatives	Inadequate assistance
Cooperated with the hospice team	Insufficient training courses	Infrequent supervisory visits
Spiritual courses to relieve negative emotions	Leadership of the managers	Adapting to and overcoming the challenges
Learned positive thinking from managers	Learned new concepts and techniques from managers	Actions and beliefs were transformed into organizational culture
Trust was developed	Improve communication efficiency with the families	Caregivers shared ideas with colleagues
Instant consultation by technology software	Support of the hospice team	Courses about knowledge and skills to improve care and communication
Increased the number of visits	Family to be at the bedside to accompany	Making the families have no regrets
Comprehending the meaning of palliative care	To see their loved one without pain or struggle	Outcome is vary greatly based on whether elected the hospice benefit or not
Guarding the dignity of the resident	Avoiding emergency intervention	Truly understood their role

Selective coding	
Category	Core category
Feeling insecure	The guardians at the end of life
Clarifying challenges	Adapting to and overcoming the challenges

DETAILS

Subject:	Patients; Long term health care; Teams; Nursing care; Medical research; Hospitals; Palliative care; Data collection; Caregivers; Interviews; Nurses; Grounded theory; Consent; Qualitative research
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Factors Influencing Supportive Care Needs of Colorectal Cancer Survivors

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ProQuest document link

ABSTRACT (ENGLISH)

SummaryPurpose

There is an increasing number of colorectal cancer survivors in South Korea. However, no research has identified supportive care needs of survivors of colorectal cancer in South Korea. Thus, the purpose of this study was to determine the level of supportive care needs and effects of emotional state and quality of life (QoL) on supportive care needs of colorectal cancer survivors.

Methods

This cross-sectional study was conducted among 115 survivors of colorectal cancer in South Korean who had primary treatment of surgery for colorectal cancer. Data were collected from April to September 2016. Participants responded to self-reported questionnaires assessing supportive care needs, emotional state (Hospital Anxiety and Depression Scale), and QoL (Functional Assessment of Cancer Therapy-Colorectal scale).

Results

The overall score of supportive care needs for colorectal cancer survivors was 1.22 ± 0.61 (full score: 3 points), with health care staff and social support needs garnering highest scores. Approximately, 20.0% and 21.7% of patients had anxiety and depression, respectively. The mean QoL score was 2.90 ± 0.53, with social and family status having the lowest QoL score. Multiple regression analysis showed that both the period after treatment and anxiety significantly influenced supportive care needs.

Conclusion

Appropriate interventions should be used immediately after completion of treatment to help reduce anxiety and meet supportive care needs of colorectal cancer survivors.

FULL TEXT

Introduction

Colorectal cancer is the second most common cancer in South Korea with a 5-year survival rate of 75.0%, higher than the overall cancer survival rate of 70.4% in South Korea. Early detection of cases and advancement of cancer treatment technology have led to a rise in the number of survivors [1].

Depending on the stage of colorectal cancer, various treatment modalities may be used. However, these treatments can cause irreversible physical changes and result in several consequent problems [2]. The primary treatment for colorectal cancer is surgery. Chemotherapy and radiation therapy can be added depending on the location and stage. Colorectal cancer surgery can lead to long-term sequela such as intestinal adhesions, bowel disorders, and sexual dysfunction. In fact, 71.3% of patients who underwent rectal cancer surgery experienced excessive bowel movement 6–24 months after surgery [3]. Chemotherapy has general side effects such as nausea, vomiting, and alopecia. These side effects eventually disappear on termination of treatment. However, patients who experience peripheral neuropathy after they receive oxaliplatin as standard colorectal cancer chemotherapy after surgery have reduced quality of life (QoL) [4]. Furthermore, patients who undergo radiation therapy show adverse events such as fecal incontinence and sexual dysfunction [5].

As shown in a previous study [6], colorectal cancer survivors experience diverse problems including decreased QoL, limited social lives, negative emotions such as depression and anxiety, and financial difficulties. Compared with their healthy counterparts, colorectal cancer survivors undergo more challenges related to changes in roles at home and societal and financial problems [7]. Furthermore, survivors continue to worry about recurrence [6]. Thus, there is a great need for emotional support for their fear of recurrence [8]. As the number of colorectal cancer survivors increases, demands to address late complications, prevent secondary cancer, and address psychosocial problems after the termination of treatment have increased [3]. Interests in the QoL of survivors have also increased [6]. Nevertheless, most health care staff focus on meeting physical needs such as peripheral neuropathy and changes in patient's bowel movement during the treatment period [3].

Supportive care refers to the provision of necessary services for those who are living with cancer or affected by cancer to meet their informational, emotional, spiritual, social, and physical needs [9]. Information needs of cancer survivors are related to treatment, prognosis, rehabilitation, surveillance, body image, and sexuality [10]. Cancer survivors are relieved when treatment is over. However, they remain uncertain of what comes next. Thus, cancer survivors have at least one unmet emotional, spiritual, or social needs [11]. Cancer survivors who have unmet physical needs due to treatment side effects such as fatigue, tingling sensation, and alopecia often experience decreased QoL [12]. To systematically support potential health issues that cancer survivors may experience throughout their lives, both concerns and needs of patients must be accurately identified. Factors influencing supportive care needs must be identified to ensure adequate care for survivors. Good understanding of supportive care needs of a survivor will help us develop an effective supportive care service [9].

Supportive care needs of cancer survivors are influenced by emotional conditions such as anxiety and depression [13]. Actually, colorectal cancer survivors experience clinical meaningful levels of anxiety and depression [14]. Unmet supportive care needs of colorectal cancer survivors have a significant correlation with QoL [15]. Survivor's QoL also changes over time after cancer treatment [6]. Therefore, supportive care needs of colorectal cancer survivors must be studied according to different emotional state and QoL.

Several studies have investigated supportive care needs of colorectal cancer survivors [2,8,15,16]. Continued efforts have been made to manage survivors by developing and implementing multiple programs [17]. However, there is little research on factors influencing supportive care needs of colorectal cancer survivors. In South Korea, management of cancer survivors is one of the national cancer policies [18]. Several studies have been performed by cancer-related societies. However, most of these studies on cancer survivors have focused only on breast cancer survivors [19,20].

Only a few studies have evaluated colorectal cancer survivors [21,22].

Therefore, the purpose of this study was to identify the level of supportive care needs and effects of emotional state and QoL on supportive care needs of colorectal cancer survivors in South Korea. Findings from this study will help us develop programs that address the management of colorectal cancer survivors in South Korea.

Methods Design

A descriptive survey was conducted to identify supportive care needs of colorectal cancer survivors and determine factors that could influence supportive care needs of colorectal cancer survivors. This cross-sectional survey was performed among 115 Korean colorectal cancer survivors who had primary colorectal cancer treatment.

Sample

Adult patients aged 19 years or older who were followed-up after completing adjuvant therapy (chemotherapy and radiation therapy) after colorectal cancer surgery at S Hospital in C University were analyzed. Of total patients, 116 patients who had either Stage I, II, or III colorectal cancer without recurrence or metastasis were enrolled. Stage IV patients were excluded as many of them continued to receive treatment. Patients who had been diagnosed with another type of cancer, who had previous mental problems, and those who were taking psychiatric medications were also excluded from this study. There was no limitation of patients' survival periods so that the influence of survival period after treatment on supportive care needs could be determined. A total of 116 patients participated in this study. One of them was excluded from the analysis because of incomplete responses.

Sample size

Sample size was computed using the G*power 3.1 software [23]. With a statistical significance of 0.05, a power of 0.8, a medium effect size of 0.15, and seven predictors in multiple regression, the minimum sample size was found to be 103. Considering potential loss to follow-up, 116 patients were enrolled for this study.

Instruments General and disease-related characteristics

General characteristics included gender, age, education, religion, occupation, and disease-related characteristics including period since treatment, current tumor stage, and treatment status with radiation and chemotherapy.

Supportive care needs

After adapting it for use with colorectal cancer survivors, a 59-item comprehensive assessment tool for needs of cancer patients [24] was used to measure supportive care needs. Content validity was tested by 10 experts (2 colorectal cancer specialists, 4 nurses with more than 10 years of experience managing colorectal cancer patients, and 4 nurses with PhDs). Nine items related to hospice and hospital facilities and four items related to chemotherapy with a content validity index of **Factors influencing supportive care needs Emotional state**

Emotional state was measured using the Hospital Anxiety Depression Scale (HADS) originally developed by Zigmond and Snaith [25] and standardized in Korean by Oh et al. [26]. The HADS was purchased from Granada Learning Education Group (www.gl-assessment.co.uk). In this 14-item scale, odd-number items measure anxiety, whereas even-number items measure depression. Each item was rated on a four-point scale from 0 (none) to 3 (severe), with a higher score indicating a higher degree of anxiety and depression. A score of 0–7 indicates a state without depression or anxiety. A score of 8–10 indicates mild depression or anxiety and a score of 11–21 indicates moderate or severe depression and anxiety [25]. Cronbach's α values for anxiety and depression were .89 and .86, respectively, in a study of Oh et al. [26]. In the present study, they were .87 and .71, respectively.

QoL

QoL was measured using the Korean version (FACT-C_KOR) of the Functional Assessment of Cancer Therapy-Colorectal (FACT-C) originally developed by Ward et al.[27] after obtaining approval from the original developer FACIT (www.facit.org). The FACT-C contains colorectal cancer-specific items in addition to the FACT-general scale. It was developed to assess cancer survivors. It was translated into Korean by Kim et al.[28]. This 36-item tool measures physical state (7 items), social/family state (7 items), emotional state (6 items), functional state (7 items), other states, and colorectal-specific items (9 items). Each item was rated on a five-point scale from 0 (not at all) to 4 (strongly true), with a higher score indicating a higher QoL. The Cronbach's α of the FACT-C_KOR was .87. It was .91 for the present study.

Data collection

Data were collected from April to September 2016 after obtaining approval from the institution. Disease-related characteristics were obtained from medical records. We reviewed and approached all patients who had completed treatment for colorectal cancer coming to the outpatient clinic for a surveillance visit during the study period. The purpose of this study was explained to patients who met the inclusion criteria. The questionnaire was distributed to patients if they were willing to participate in this study. Participants responded to self-report questionnaires measuring supportive care needs, emotional state, and QoL.

Ethical considerations

This study was approved by the institutional review board (Approval no. KC16QISI0257) at ST. Mary's Hospital in Catholic University. Questionnaires were completed by those patients who provided informed consent. It took about 15 minutes to complete the survey.

Data analysis

Collected data were analyzed using SPSS software 24.0 (IBM Corp., Armonk, NY, USA). Participants' characteristics, supportive care needs, emotional states, and QoL were presented as frequencies and percentages and as means and standard deviations. Differences in supportive care needs, emotional states, and QoL were analyzed with t-test, analysis of variance, and Scheffé test. Relationships among supportive care needs, emotional state, and QoL were examined with Pearson's correlation coefficients. Factors affecting supportive care needs were identified with multiple regression analysis.

Results Participants' characteristics

Approximately, of the total participants with a mean age of 57.32 years, 57.4% of participants were men. About 55.7% either completed high school or had a lower educational level and 63.5% had a religion. About 71.3% were employed. The mean period after treatment termination was 24.95 months. About 37.4% had Stage III cancer. Approximately, 21.7% of patients underwent radiation therapy, whereas 62.6% received chemotherapy as adjuvant therapy ($^{\text{Table 1}}$).

Supportive care needs

$^{\text{Table 1}}$ presents scores of supportive care needs for the sample population. The mean score was 1.22 of 3. Among subcategories, health care staff and social support needs had the highest score (1.56), followed by information and education needs, family, interpersonal relationships, religious and spiritual needs, psychological needs, and physical needs. Women had a higher score (1.36) of supportive care needs than men (1.11) (*p* = .032). Women also had higher scores for psychological needs than men (*p* = .012). Patients under the age of 50 years had the highest score for information and education needs (*p* = .045). Those who had a religion had a higher score (1.31) (*p* = .024) for the following items: physical needs (*p* = .028); family, interpersonal relationships, religious, and spiritual needs (*p* = .001). For patients with p = .002), the following needs had the highest scores: information and education needs (*p* = .001), physical symptoms (*p* = .007), and health care staff and social support needs (*p* = .032). Supportive care needs, information and education needs, and physical symptoms were higher for those under 6 months of treatment than those with 6 to 12 months of treatment and those with 25 months or more treatment. Stage II patients had the highest scores for psychological needs (*p* = .024). Patients who received chemotherapy had higher scores for supportive care needs (*p* = .044) and psychological needs (*p* = .030) ($^{\text{Table 1}}$).

Emotional state and QoL

The mean anxiety score was 0.67 of 3. About 13.9% of participants had mild anxiety and 6.1% had moderate anxiety. The mean depression score was 0.73 of 3. Approximately, 15.6% of participants had mild depression and 6.1% had moderate depression ($^{\text{Table 2}}$). The mean QoL score for all patients was 2.90 of 4. Among QoL subcategories, social/family state (2.29) had the lowest score, followed by functional state, other state, emotional state, and physical state ($^{\text{Table 2}}$).

Factors influencing supportive care needs

Supportive care needs were positively correlated with anxiety (r = .64, *p* = .001) and depression (r = .50, *p* = .001) but negatively correlated with QoL (r = −.32, *p* = .001) ($^{\text{Table 3}}$). A multivariate regression analysis including seven independent variables (anxiety, depression, QoL, gender, religion, period after treatment, and chemotherapy) was performed. Gender, religion, period after treatment, and chemotherapy were selected as covariates because overall supportive care needs differed significantly when stratified by these groups. As a result of checking autocorrelation with Durbin–Watson, the assumption of residual independence was fulfilled as it was close to 2 (2.080). As a result of the test of multicollinearity using the tolerance limit and the variation inflation factor (VIF) value, it was found that all variables did not have a multicollinearity problem because the tolerance limit was 0.1 or higher or the VIF value was not more than 10 (tolerance limit: .37~.96; VIF: 1.04~2.73). Results of multivariate regression analysis showed that only the period after treatment (*p* = .013) and anxiety (*p* = .001) were main factors affecting supportive care needs. Regression analysis revealed that the explanatory power of this regression model was approximately 48.0% (F = 14.26, *p* Table 4).

Discussion

An important step in the development of an intervention plan for colorectal cancer survivors is the process of recognizing supportive care needs of colon cancer survivors whose number is growing globally. Supportive care needs may vary based on cultural and social differences. Thus, this study was conducted to examine supportive care needs and influence factors of colorectal cancer survivors in South Korea.

In this study, health care staff and social support needs had the highest score for supportive care needs, followed by needs for information and education. This was similar to results of Kotronoulas et al. (2017) [8] on patients undergoing treatment for colorectal cancer. Either during treatment or after treatment, information should be obtained by contacting medical staff [29].

In the present study, findings revealed that colorectal cancer survivors had the greatest supportive care needs for health care staff and social support, particularly within 6 months after treatment completion. A potential explanation for this is that patients suddenly have limited opportunities to meet with health care staff after completing their treatment course. Russell et al. (2015) [2] have found that colorectal cancer survivors still desire to have opportunities to frequently consult medical staff regarding their difficulties even after completing their treatment. Thus, it is important for medical staff to discuss follow-up care with patients immediately after treatment completion and monitor patients' needs.

Colorectal cancer survivors also showed a high need for information and education. This need was particularly high among patients aged 30]. Showing needs particularly high for those with age 2]. Currently in South Korea, education for patients undergoing surgery or receiving chemotherapy is covered under insurance. Thus, it is offered frequently. This same education is not offered to cancer survivors, although cancer survivors also desire to receive education [2]. Hence, it would be important to identify such needs, implement relevant education, and ultimately promote insurance reimbursement for education of cancer survivors.

The third highest need identified in this study was related to family or interpersonal relationships and religious and spiritual problems. Patients particularly showed a high need for spousal support. This finding is similar to findings of a previous study reporting that colorectal cancer survivors with spouse have better QoL [31]. Therefore, it would be necessary to include the spouse or family members when educating colorectal cancer survivors so that they can assist these survivors in dealing with problems.

The fourth highest need was psychological need. Women had a higher psychological need than men, similar to findings of a similar study on cancer patients [30]. Furthermore, patients with Stage II cancer had a higher psychological need than patients with Stage I or III cancer. This might be because Stage I patients have less concern for recurrence than Stage II patients. In addition, Stage III patients probably have frequently met with and received support from medical staff while receiving chemotherapy to lower the possibility of recurrence. Among psychological problems, patients particularly had a deep fear about recurrence. Because cancer survivors find it difficult to express their psychological difficulties [32], medical staff should closely monitor these patients.

Colorectal cancer survivors had the least need for physical symptom management. This result is similar to findings of a previous study [2] reporting that patients' physical needs decline after treatment over time. However, survivors had high supportive care needs for hand and feet tingling and reduced sensation. This might be due to the fact that

37.4% of these patients had Stage III cancer and thus received oxaliplatin.

According to our study, about 20.0% of colorectal cancer survivors had moderate or more severe anxiety or depression. This finding was similar to results of a previous study [33], but lower than what was reported in studies on colorectal cancer patients receiving chemotherapy [34,35]. This might be due to differences in study population. Our sample consisted of Stages I–III colorectal cancer patients who had a high potential for being cured. However, the previous study [33] included patients with more advanced cancer with less potential for being cured. Furthermore, our patients probably had a lower incidence of developing negative emotions as they had fewer treatment-related acute symptoms than those who received chemotherapy and had fewer symptoms than those with a more advanced cancer. However, depression and anxiety are among factors that can increase cancer mortality [36]. Therefore, it is important for medical staff caring for survivors to pay attention and endeavor to resolve survivors' psychological problems.

Our participants had better QoL than colorectal cancer patients who received chemotherapy in another study [35] presumably because our participants had fewer chemotherapy-related symptoms. Meanwhile, patients who received chemotherapy had the lowest functional QoL [35], whereas our participants had the lowest social/family related QoL. This is probably due to the fact that survivors who have completed treatment are given less attention and care from family members and other people than those who are currently undergoing treatment.

Our results on relationships among supportive care needs, anxiety, depression, and QoL of colorectal cancer survivors were similar to those of Sakamoto et al.'s study[37], which examined supportive care needs of colorectal cancer patients receiving chemotherapy. Our results were close to those of Santin et al.'s study[15], which suggested that the inability to meet needs of these patients could reduce their QoL. Our results were also similar to a previous study revealing that survivors of Korean breast cancer with QoL problems reported a higher degree of supportive care needs [38]. Thus, satisfying colorectal cancer survivors' supportive care needs could lower their level of depression and anxiety and increase their QoL.

Although it is difficult to compare factors affecting colorectal cancer survivors' supportive care needs because of the lack of relevant studies, one study that investigated colorectal cancer patients receiving chemotherapy [37] found that gender was a major factor that influenced patients' supportive care needs. In contrast, we found that anxiety and the period after treatment were factors that significantly influenced supportive care needs of Korean colorectal cancer survivors. However, in this research, the QoL was not a factor affecting supportive care needs. The reason might be because the QoL of colorectal cancer survivors was not different from that of the general population [39]. As breast cancer survivors with QoL problems show higher levels of unmet needs [38], further studies on the influence of QoL on supportive care needs should be conducted for other types of cancer survivors.

Results of our research were similar to those of previous studies that indicated that patients who completed treatment recently had high supportive care needs [32] and that anxiety was associated with supportive care needs and QoL in breast cancer survivors [40]. Our results were also similar to results of a previous study on factors influencing supportive care needs of breast cancer survivors in South Korea [38]. This means that supportive care needs of cancer survivors may increase immediately after treatment because of anxiety about new changes, although it is believed that supportive care needs are decreased as patients adapt to life [41]. Therefore, a patient's emotional state should be evaluated immediately after treatment. If the patient has a high degree of anxiety, the priority of management should be considered. Support should also be given to patients so that survivors can adapt to life well.

It would be important to recognize the need for survivor management immediately after completion of colorectal cancer treatment. Interventions should be provided to manage survivors' emotional problems such as anxiety. Supportive care needs of colorectal cancer survivors identified in this study could be used as basic data for implementing education and intervention programs for colorectal cancer survivors. This study particularly provides a basis for what needs to be focused on when designing programs for managing survivors in the field of oncology nursing. This research also sets the standard for beginning the management of a survivor. We believe that if there is a growing interest in survivor nursing with an increase in nursing intervention among survivors, the field of oncology nursing will be continuously broadened.

Limitations

This study included a convenience sample of patients in a single institution. Hence, findings of this study have limited generalizability. Furthermore, patients with Stage IV colorectal cancer were excluded. Therefore, additional studies should be performed to further evaluate Stage IV colorectal cancer patients who have completed the treatment.

Conclusion

Colorectal cancer survivors showed the highest need for health care staff and social support. Their supportive care needs were correlated with anxiety, depression, and QoL. The period after treatment and anxiety had significant effects on their supportive care needs. Based on these results, we can infer that interventions that can help reduce anxiety should be provided immediately after treatment completion to meet supportive care needs of colorectal cancer survivors. Eventually, procedures are required at the start of colorectal cancer survivor management to evaluate the emotional state of survivors. This study is the first one that identifies supportive care needs of colorectal cancer survivors in South Korea. Our findings could serve as a basis for developing interventions to address supportive care needs of colorectal cancer survivors.

Conflict of interest

The authors have no conflicts of interest to disclose.

Characteristics	Mean ± SD/N (%)		Supportive care needs	t/F (p)	Information, education	t/F (p)	Psychological problems	t/F (p)	Physical symptoms	t/F (p)	Family, friend, religious	t/F (p)	Health care staff, social	t/F (p)
Gender														
Men	66	(57.4)	1.11 ± 0.55	−2.17 (.032)	1.28 ± 0.76	−1.91 (.059)	0.98 ± 0.73	−2.55 (.012)	0.70 ± 0.54	−1.46 (.146)	1.05 ± 0.81	−1.92 (.057)	1.48 ± 0.69	−1.27 (.208)
Women	49	(42.6)	1.36 ± 0.66	1.56 ± 0.78	1.36 ± 0.84	0.86 ± 0.64	1.35 ± 0.81	1.66 ± 0.80	Age (yr)	57.32 ± 9.56				
									≤50	20	(17.4)	1.36 ± 0.63	2.18 (.118)	1.68 ± 0.77

3.19 (.045)	1.37 ± 0.82	1.93 (.150)	0.70 ± 0.70	0.67 (.513)	1.25 ± 0.72	2.70 (.072)	1.75 ± 0.68	1.57 (.212)	51~60	49	(42.6)	1.29 ± 0.64	1.48 ± 0.79	1.21 ± 0.86
0.85 ± 0.59	1.35 ± 0.84	1.61 ± 0.77	≥61	46	(40.0)	1.08 ± 0.54	1.20 ± 0.73	0.98 ± 0.70	0.72 ± 0.53	0.97 ± 0.81	1.42 ± 0.72	Education		
≤High school	64	(55.7)	1.28 ± 0.63	1.12 (.265)	1.42 ± 0.88	0.26 (.795)	1.24 ± 0.86	1.38 (.170)	0.83 ± 0.58	1.08 (.281)	1.21 ± 0.80	0.53 (.595)	1.63 ± 0.74	1.10 (.272)
≥College	51	(44.3)	1.15 ± 0.57	1.38 ± 0.62	1.03 ± 0.72	0.71 ± 0.60	1.13 ± 0.85	1.47 ± 0.74	Religion					
No	42	(36.5)	1.05 ± 0.56	−2.28 (.024)	1.22 ± 0.78	−1.88 (.063)	1.01 ± 0.82	−1.33 (.187)	0.61 ± 0.50	−2.22 (.028)	0.83 ± 0.64	−3.87(.001)	1.42 ± 0.69	−1.51 (.135)
Yes	73	(63.5)	1.31 ± 0.62	1.50 ± 0.76	1.22 ± 0.79	0.86 ± 0.62	1.38 ± 0.85	1.64 ± 0.76	Occupation					
No	33	(28.7)	1.29 ± 0.69	0.78 (.437)	1.45 ± 0.88	0.39 (.697)	1.31 ± 0.85	1.41 (.161)	0.86 ± 0.69	1.06 (.293)	1.18 ± 0.93	0.03 (.977)	1.56 ± 0.79	0.00 (.997)
Yes	82	(71.3)	1.19 ± 0.57	1.38 ± 0.74	1.08 ± 0.78	0.74 ± 0.54	1.18 ± 0.78	1.56 ± 0.72	Period since treatment (mo)	24.95 ± 25.31				

									<6	30	(26.1)	1.56 ± 0.62[a,b]	5.14 (.002)	1.85 ± 0.84[c,d]
5.61 (.001)	1.44 ± 0.85	2.25 (.086)	1.07 ± 0.63[e,f]	4.26 (.007)	1.52 ± 0.77	2.49 (.064)	1.88 ± 0.68	3.04 (.032)	6–12	20	(17.4)	1.03 ± 0.54[a]	1.11 ± 0.64[c]	1.09 ± 0.83
0.56 ± 0.45[e]	1.00 ± 0.69	1.33 ± 0.67	13–24	21	(18.2)	1.21 ± 0.50	1.38 ± 0.65	1.16 ± 0.70	0.79 ± 0.56	1.02 ± 0.68	1.57 ± 0.73	>24	44	(38.3)
1.08 ± 0.60[b]	1.24 ± 0.74[d]	0.96 ± 0.76	0.66 ± 0.56[f]	1.10 ± 0.92	1.44 ± 0.76	Current stage								
I	42	(36.5)	1.10 ± 0.60	1.64 (.199)	1.33 ± 0.79	1.06 (.351)	0.90 ± 0.78[g]	3.84 (.024)	0.66 ± 0.63	1.36 (.262)	0.98 ± 0.89	1.97 (.144)	1.52 ± 0.72	0.08 (.923)
II	30	(26.1)	1.36 ± 0.64	1.58 ± 0.75	1.41 ± 0.82[g]	0.89 ± 0.59	1.24 ± 0.81	1.58 ± 0.82	III	43	(37.4)	1.24 ± 0.58	1.35 ± 0.78	1.19 ± 0.76
0.80 ± 0.53	1.32 ± 0.74	1.58 ± 0.71	Radiation											
No	90	(78.3)	1.19 ± 0.59	−1.11 (.269)	1.33 ± 0.75	−1.79 (.077)	1.11 ± 0.80	−0.88 (.379)	0.76 ± 0.57	−0.40 (.693)	1.18 ± 0.80	−.0.08 (.936)	1.53 ± 0.74	−0.85 (.399)
Yes	25	(21.7)	1.34 ± 0.65	1.64 ± 0.83	1.27 ± 0.83	0.81 ± 0.65	1.19 ± 0.91	1.67 ± 0.75	Chemotherapy					
No	43	(37.4)	1.07 ± 0.57	−2.04 (.044)	1.27 ± 0.70	−1.41 (.163)	0.93 ± 0.82	−2.20 (.030)	0.67 ± 0.60	−1.41 (.163)	0.99 ± 0.84	−1.92 (.057)	1.41 ± 0.72	−1.68 (.096)

Yes	72	(62.6)	1.31 ± 0.61	1.48 ± 0.81	1.27 ± 0.77	0.83 ± 0.58	1.29 ± 0.79	1.65 ± 0.75	Total			1.22 ± 0.61		1.40 ± 0.78

Characteristics (items)	Total number of items	Range	Mean ± SD/N (%)
Anxiety	7	0~3	0.67 ± 0.49
Normal			92 (80.0)
Mild			16 (13.9)
Moderate to severe			7 (6.1)
Depression	7	0~3	0.73 ± 0.46
Normal			90 (78.3)
Mild			18 (15.6)
Moderate to severe			7 (6.1)
Quality of life	36	0~4	2.90 ± 0.53
Body condition	7	0~4	3.46 ± 0.61
Social and family status	7	0~4	2.29 ± 0.86
Emotional state	6	0~4	3.17 ± 0.68
Functional status	7	0~4	2.74 ± 0.96
Other factors related to colorectal cancer	9	0~4	2.86 ± 0.61

Variables	Anxiety	Depression	Quality of life
r(p)			Supportive care needs

.64 (.001)	.50 (.001)	−.32 (.001)	Anxiety
	.73 (.001)	−.58 (.001)	Depression

Variables	Supportive care needs				
B	SE	β	t	p	(Constant)
10.37	18.89		0.55	.584	Gender
2.01	4.23	.04	0.47	.636	Religion
8.11	4.19	.14	1.93	.056	Period since treatment
−4.03	1.60	−.18	−2.51	.013	Chemotherapy
7.21	4.16	.13	1.73	.086	Anxiety
4.10	0.90	.51	4.54	.001	Depression
1.511	1.00	.17	1.51	.134	Quality of life

DETAILS

Subject:	Medical prognosis; Cancer surgery; Baldness; Cancer therapies; Fecal incontinence; Hospitals; Peripheral neuropathy; Colorectal cancer; Surveillance; Alopecia; Radiation therapy; Spirituality; Education; Chemotherapy; Anxiety
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Document 25 of 29

Structural Equation Model of the Quality of Working Life among Cancer Survivors Returning to Work

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ABSTRACT (ENGLISH)

SummaryPurpose
This study aimed to construct and validate a model of the quality of working life (QWL) among cancer survivors returning to work.

Methods
A cross-sectional study was developed. Participants included 204 cancer survivors in the extended cancer survivor stage, 6 months after returning to work, who were treated at two tertiary hospital cancer centers. The data were analyzed with SPSS 22.0 and AMOS 20.0 for confirmatory factor analysis to assess the hypothesis fit and verify the hypothesis.

Results
Factors affecting cancer survivors' quality of working liferesulted in cancer stigma and social support (explanatory power was 43.1%) and the model showed acceptable goodness of fit. In the final model, cancer stigma had a significant direct effect on social support and indirect effect on organizational health, employee health, and QWL. Additionally, social support had significant direct effect on organizational health, employee health and QWL.

Conclusion
Based on the results of this study, there is a need to develop strategies and effective intervention programs that can increase the support of supervisors and colleagues for improving overall quality of work life. Furthermore, the development of policies and intervention programs to reduce cancer stigma for the purpose of transforming perceptions through education and public relations which are indirect factors that affect the quality of work life, can contribute to improving the quality of work life for cancer survivors.

FULL TEXT

Introduction

Cancer is the number one cause of death worldwide, with a global yearly increase of 18.1 million and death rate of 9.6 million. In South Korea, 3.4% of the population has cancer, which means it afflicts one out of every 29 people [1] Due to the recent development of early diagnosis and treatment technologies, cancer survival rates have also been continuously increasing, e.g., from 54.0% in 2005 to 70.6% in 2016, in the case of 5-year relative survival rate. In 2018, worldwide, the total number of people who were still alive within 5 years of a cancer diagnosis, called the 5-year prevalence, was estimated to be 43.8 million. This number is higher than that noticed in Western countries [1,2]. Because of such an increase in the cancer prevalence rate, interest in the importance of cancer survivors' ability to work and return to work is emerging [2]. For cancer survivors, returning to work is a recovery process and an important part of their cure [3]. It is associated with recovery of normalcy and self-esteem, which affect survivors' quality of life, in addition to providing a sense of financial security by securing a source of income.

Despite the importance of employment and work in managing the return to a normal social life and the quality of life of cancer survivors, the rate of South Korean cancer survivors returning to work is only 30.5%, which is lower than that prevailing in overseas countries (63.5%) [4]. The reasons for this include not only an individual's health status but also prejudice and discrimination against the work competence of cancer patients, as well as the lack of resources, information, and emotional support from superiors and colleagues, and the lack of stable management systems in the organizational community [5]. These multiple factors impede survivors' successful return to work, leading to job changes and resulting in a reduction in overall quality of life by increasing cancer survivors' job stress [5]. Indeed, the job turnover rate in South Korea in 2014 due to cancer was 47.0–53.0%, and the possible non-retirement rate of cancer survivors was reported to be 47.0% lower than that of the general public [6]. Accordingly, improving quality of working life (QWL) is important for work readjustment and retention of cancer survivors returning to work [7].

There have been studies on the QWL of cancer survivors, such as those designed to develop measurement scales [3,7] and the studies of Jin and Lee [10] who identified job stress, workplace spirituality, and fatigue as influencing factors of the QWL of cancer survivors. The overall quantum of relevant studies, however, is insufficient. QWL refers to the satisfaction and sense of well-being in psychological and emotional dimensions experienced by an individual worker while working to achieve organizational goals, and it can be considered an integral part of overall quality of life [8]. The QWL of cancer survivors is expected to be low because their quality of life overall is lower than that of non-cancer patients. In particular, understanding the characteristics of organizational culture is important for the improvement of the QWL because the QWL of cancer survivors is mainly influenced by job stress caused by the characteristics of organizational culture [9,10]. The reason for this is that the characteristics of organizational culture, such as negative social perception related to cancer survivors returning to work, devaluation [3], prejudice, and discrimination [5] against the work competence of cancer patients, affect not only the quality of life but also the QWL of cancer patients [11]. Consequently, the characteristics of organizational culture should be considered in identifying the level of cancer patients' quality of life and relationships among the relevant variables.

In the Culture-Work-Health-Model (CWHM), the organizational culture is the main effect factor for the health of organization and employee and priority factor for improving the QWL. In a study on the structural model of QWL based on the CWHM, organizational culture, social support, organizational health, and employee health were found to be factors affecting QWL [12,13]. On the other hand, previous studies that were not based on the CWHM have reported that cancer survivors who returned to work experience cancer stigma, such as social isolation, alienation, criticism, feelings of guilt, a sense of shame, and self-condemnation, because of the negative organizational culture toward cancer patients [14,15] and the experience lowers their quality of life and makes them perceive their health status negatively [16]. On the other hand, social support from superiors and colleagues in an organization helps workers perceive their health positively [13,17] and contributes to the organization's ability to reach stability [13,18].

As discussed above, various factors such as cancer stigma—which is a feature of negative organizational culture toward cancer survivors—social support, and organizational and personal health status work complexly in the QWL of cancer survivors who have returned to work. Since previous studies, however, are fragmentary toward the QWL of cancer survivors and have limitations in identifying causal relationships among relevant factors [7,10] more research is needed to provide a theoretical basis that can improve QWL. Accordingly, the purpose of the present study was to establish and test a structural model of the QWL of cancer survivors who have returned to work using the main concepts of the CWHM as a theoretical basis and applying influencing factors of the QWL of cancer survivors found in previous studies. The findings of the present study will establish a theoretical basis for future studies on the QWL of cancer survivors and will provide valuable basic data for finding intervention methods and developing programs to improve QWL.

Conceptual framework

The conceptual framework was constructed based on Peterson and Wilson's (2002) CWHM and empirical studies on the effects of the QWL of cancer survivors. The conceptual framework was composed of organizational culture, management system, organizational health, employee health, and QWL, which are key concepts of the CWHM [19]. The paths of main concepts were presented that cancer stigma which were part of organizational culture had direct influence on social support received from supervisors and colleagues [20] and one-way paths in which cancer stigma directly affected the overall quality of working life of cancer survivors [11]. Social support affects the health of employees with cancer and organizations [13,21] because a greater amount of social support means a greater contribution to cancer survivors' job performance which are components of organizational health [18]. This present study also established social support to directly affect organizational and employee's health. In addition, social support had a direct influence path to QWL based on the report that social support for cancer survivors directly affects their quality of life in previous studies [21]. In the case of the concept of employee health and organizational health, the present study presented a direct influence path from employees and organizational health to QWL [22] because the balance through the interactions between employees and organizational health in the CWHM can improve QWL [9]. The subordinate concepts constituting the main concepts presented in the conceptual framework of the present study were selected based on the findings of previous studies. Cancer stigma is composed of negative experiences from surroundings, such as social isolation at work, detachment, discrimination and sense of guilt, attribution of the cancer to oneself, and the experience of insufficient medical support. These are risk factors for returning to work and for job retention [4,15] and they negatively affect cancer survivors' quality of life [11]. Social support includes emotional support that cancer survivors receive from superiors and colleagues, as well as help and informational support for job performance [23]. Organizational health consists of external health, such as productivity and environment and task performance suitability for achieving goals. Organizational health also includes internal health, such as vitality and community oriented [24] while employee health consists of perceived health status [25]. Last, the QWL of cancer survivors who return to work consists of the value of work, meaning of work, work perception, atmosphere of work environment, Understanding and recognition of organization for cancer survivors in the organization, and health-related problems [7].

Hypothesized model

The hypothesized model suggested in this study is depicted in Figure 1. When QWL was used as an endogenous variable; exogenous variables that directly affected QWL included cancer stigma, social support, organizational health, and employee health. Subsequently, organizational health was used as an endogenous variable. The exogenous variables that directly affect organizational health included social support and employee health, and cancer stigma on the other hand, had an indirect influence. When employee health was used as an endogenous variable, the exogenous variable that directly affected employee health was social support, while cancer stigma had an indirect influence. When social support was used as an endogenous variable, cancer stigma was set as an exogenous variable that directly affected social support.

Methods Study Design

This study employed a cross-sectional design used structured equation modeling. A hypothetical model was constructed based on the relationship between factors related to the QWL of cancer survivors who returned to work. Cross-sectional data were collected, and then the fitness of the model and the hypotheses were tested.

Participants

The sample included is a structural equation modeling (SEM) analysis that needs to be larger than 10 times the number of estimated parameters [26]. The number of free parameters to be estimated in this study was 18. As such, the study sample 204 participants clearly satisfied the minimum sample size of 180. Over 220 questionnaires were distributed and 210 questionnaires were returned. Among the returned questionnaires, 6 were excluded from the analysis due to missing data. Participants were eligible if they were cancer survivors in the extended stage that 2-5 years after being diagnosed with cancer [27] with a period of 6 months passed after returning to work. Because cancer survivors' return rate to work is the highest 12–18 months after cancer treatment [28] and domestic research, which has reported that workers’ readjustment after a career break or job rotation takes 3–6 months on average, even if it is the same work or employment [29].

Ethical Consideration

This study was approved by the Institutional Review Board of the Keimyung University (Approval no. 40525-201810-HR-95-03), and the investigation conformed to the principles outlined in the Declaration of Helsinki. Approval from relevant institution directors where data collection took place was obtained. After explaining the purpose and intention of survey, all participants provided written informed consent before completing the questionnaires.

Measurements

There was a total of 23 items for the general characteristics of the participants, including sociodemographic (six items), occupation-related (seven items), cancer-related (seven items), and return-to-work-related (three items) characteristics. For all other instruments, use agreements were obtained from the original authors or authorized agencies of the instruments via email.

Cancer stigma

Cancer stigma was measured using the Korean version of the Cancer Stigma Scale (KCSS) developed by So et al. [5], which has a total of 24 items in six subdomains: social isolation, distancing or avoiding, discrimination, guilt, attribution, and lack of medical support, measured on a 4-point scale. Reliability, as measured by Cronbach's r, was 0.89 in the study of So et al. [5], and Cronbach's r for each subdomain in the present study was social isolation: .92; distancing or avoiding: .92; discrimination: .90; guilt: .77; attribution:.85; and lack of medical support: .49.

Social support

For social support, a total of eight items on a 5-point scale—four items for supervisor support and four items for colleague support—from the Social Support Questionnaires developed by House (1980) were used. In the study of House [30] reliability was not reported separately for supervisor support and colleague support, whereas Korean version scale reported the Cronbach's α for supervisor support and colleague support as .85 and .78 [31]. The Cronbach's α for supervisor support and colleague support in the present study were .85 and .79, respectively.

Organizational health

For organizational health, the Organizational Health Questionnaire (OHQ) developed for Korean employees by Kim and Yu [24] was used. The OHQ is composed of a total of 31 items in four subdomains: environment fit (eight items), work way fit (nine items), vitality (eight items), and community oriented (four items) on a 5-point scale. In the study of Kim and Yu [24], Cronbach's α were environment fit: .88; work way fit: .94; vitality: .94; and community oriented: .91. Cronbach's α in the present study were environment fit: .92; work way fit: .93; vitality: .90; and community oriented: .91.

Employee health

For the health of cancer survivors who have returned to work, perceived health status was measured using the Self-Report Health Scale (SRHS) developed by Lawston et al. [32]. The scale consists of a total of three items (two items on current health status and one item on health status compared to that of others), measured on a 5-point scale. Cronbach's α in the study of Lawston et al. was .76 [32] and Cronbach's α in the present study was .87.

Quality of Working Life

QWL was measured using the Quality of Working Life Questionnaire for Cancer Survivors (QWLQ-CS) developed by de Jong et al. [7], which has a total of 23 items in five subdomains: meaning of work (four items), perception of work (five items), atmosphere of work environment (five items), understanding and recognition of organization (five items), and problems of health situation (four items), measured on a 6-point scale. Cronbach's α in the study of de Jong et al. [7] was .91. In Korean version of QWLQ-CS, Cronbach's α was .89 [10]. Cronbach's α of each subdomain in the present study was meaning of work:.94; perception of work: .98; atmosphere of work environment: .91; understanding and recognition of organization: .86; and problems of health situation: .91.

Data Collection

Data were collected from February 12 to March 31, 2019. A researcher visited the directors of nursing at each hospital to obtain permission for the data collection. Data were collected from outpatients who met the inclusion criteria. The risks and benefits of taking part in the study, background of the study, and measures taken to preserve confidentiality were explained to each participant. Participants were then asked for their informed consent. Afterward, they were given sufficient time, approximately 30-40 minutes, to answer a questionnaire.

Data Analysis

Data were analyzed using SPSS 22.0 and AMOS 20.0 for Windows (IBM Corp., Armonk, NY, USA). General characteristics of participants and normal distribution of the data were analyzed using descriptive statistics, including frequencies, percentage, means, standard deviations, skewness, and kurtosis. Missing values were estimated using the expectation maximization methods in SPSS, the reliability of the instruments was evaluated using Cronbach's α. A confirmatory factor analysis (CFA) was performed to verify the validity of each variable. Structural equation model (SEM) testing is a two-step approach that was used to perform a measurement model analysis that indicated the relationship between the factors and variables in Step 1, and the structure model linking the factors shown in the hypothetical model set by the researcher was verified in Step 2. To verify the validity of the potential variables in the measurement model, a CFA was performed, and the adequacy of the hypothetical model was evaluated using Amos version 20.0. To evaluate the goodness of fit of the model, the following fit indices and criteria were used: χ^2, normed χ^2, Root mean-Square Residual (RMR), Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Root

Mean Square Error Approximation (RMSEA), Standardized Root Mean-Square Residual, (SRMR), Comparative Fit Index (CFI), and Tucker–Lewis Index (TLI). The significance of the pathway of the SEM was analyzed using the regression weight standard error (SE), standardized estimated (β), critical ratio (CR), and *p* value, and explanatory power was calculated using Squared Multiple Correlation (SMC). The significance for the structural model path was identified using the regression weight, Standard Error (SE), Standardized estimate (one path was identified), and *p* values, and the explanatory power of the endogenous variable was calculated using Squealed Multiplier Communication (SMC). The significance of the effects of the independent variables on the dependent variables was verified by applying the bootstrapping method.

Results General characteristics of participants

The demographic, cancer-related, job-related, and return-to-work-related characteristics of the participants are presented in $^{\text{Table 1}}$. Of the 204 participants, the average age was 50.3 ± 7.58 years, 151 (74.0%) were married and 98 (48.1%) were university graduates. With regard to occupational sector, service and sales were 89 (43.6%), followed by health and social work 65 (31.9%) and education and public sector were 29 (14.2%). The average length of working years 11.7 ± 9.39 years, most participants had fixed working type (77.6%) and clerks by work position (54.9%). The cancer diagnosis of participants, breast cancer was the most common (47.5%), followed by thyroid cancer (18.6%) and gastrointestinal cancer (14.2%). The periods of sick leave by cancer treatments, most participants were below 6 months (36.3%), followed by over 1 year (24%) and both treatment and work (22.1%), the majority of participants returned to same workplace (63.7%).

Descriptive statistics of measured variables

The mean, standard deviation, and internal consistency reliability of each of the subscales were calculated in SPSS and are reported in $^{\text{Table 2}}$. Since normality of collected samples are usually tested using SEM for an analysis that uses the Maximum Likelihood Estimate (MLE), the test was performed. The results indicated that normality was ensured because the absolute values of all skewness and kurtosis were 2 or less and 3 or less, respectively. Confirmatory factor analysis was conducted using maximum likelihood, and variables with a factor loading of 0.5 or less, which were “lack of medical support” of cancer stigma and “problem of health situation” of the quality of work life, were removed. Cronbach's α coefficients values of this study were .77 or higher for all measuring instruments and in the case of the “What is your current state of health?” that is general health condition oneself was selected as a representative item based on the previous study [33].

Analysis of Structural Equation Model Validity of measurement model

The model was assessed using maximum likelihood to test the normality of the data. The results showed that the data were normally distributed with the absolute values of skewness and kurtosis under one. In addition, the reliability and validity of the measurement model were tested using confirmatory factor analysis. The analysis of the goodness of fit of the measurement model theoretically established showed that $\chi^2(p)$ = 199.60 (p 2(p) and the GFI index, satisfied the criteria, confirming the goodness of fit of the measurement model.

Convergent validity was the level of consistency among the variables when measuring latent variables; each latent variable is greater than recommended cutoff .70 which satisfied the convergent validity. The construct reliability of all latent variables in the present study was .70 or higher, the convergent validity was confirmed. And discriminant validity requires low correlation between the measurement values obtained when different concepts are measured, the AVE values of this study were greater than the square of the correlation coefficients (r) of all factors, discriminant validity between the factors was confirmed in the present study. Nomological validity assesses the consistency between the direction of the hypothetical relationships between the latent variables and the direction obtained from the actual data; nomological validity in the present study was confirmed because the correlation was found to be in the predicted direction.

Validity of path model

The final goodness-of-fit statistics of hypothetical model, the path model was as follows: χ^2 = 211.58 (*p* 2/df = 2.23, GIF = .89, AGFI = .84, CFI = .93, TLI = .92, RMR = .04, SRMR = .06 RMSEA = .80 ($^{\text{Table 3}}$). Among them, χ^2 and the GFI indices did not fit the criteria; because the χ^2 values are very sensitive to the sample size and the complexity of the model, and the null hypothesis (H_0) is strict, other goodness-of-fit indices, in addition to the χ^2 value, should also be considered. In the present study, the χ^2 index can be supplemented because the Q (χ^2/df) index, which is less sensitive to the sample size, and the TLI, which can complement the limitation of χ^2, fit the criteria. In addition, since the GFI index is highly affected by the sample size and simplicity, the AGFI and CFI are considered together. In the present study, the hypothetical model was confirmed as the final structural model without modification because all goodness-of-fit indices, except for the χ^2 and GFI indices, satisfied the recommended criteria.

The direct influence path from cancer stigma to the QWL in the hypothetical model of which the goodness of fit was confirmed in the present study was rejected ($^{\text{Figure 1}}$). Accordingly, an alternative model was established excluding the direct influence path from cancer stigma to the QWL, and the analysis of the goodness of fit indices of the two models showed that the indices met the criteria. The comparison of goodness of fit between hypothetical and alternative models using the χ2 test was non-significant. The goodness of fit of the hypothetical model was considered to be good, however, since the SRMR of the hypothetical model was .06, it was slightly lower than that of the alternative model (.07) and closer to zero ($^{\text{Table 3}}$). Therefore, the present study selected the hypothetical model as the final model, and the paths of the measurement variables are presented in $^{\text{Figure 1}}$.

Effect analysis of path model

Influence paths among the concepts in the path model of the quality of work life of cancer survivors returning to work established with the measurement variables such as cancer stigma, social support, organizational health, workers' health, and the quality of work life based on the CWHM are as follows ($^{\text{Figure 1}}$). Cancer stigma had significant influence on social support (β = −0.34, p

Next, $^{\text{Table 4}}$ shows the standardized direct, indirect and total effects of variables. Social support was found to have a direct effect on QWL and cancer stigma had an indirect effect on QWL (β = −0.21, p = .005). Furthermore, social support had direct effect on organizational health and employee health. Cancer stigma had an indirect effect on organizational health (β = −0.23 *p* = .005) and employee health (β = −0.16, *p* = .008) also. Employee health, however, was found to have no significant influence effect on organizational health and QWL. Organizational health was also found to have no significant effect influence on QWL. Consequently, consequently, the direct effect of social support (β = 0.43, *p* = .025) and the indirect effect of cancer stigma (β = −0.21, *p* = .005) were found to have an influence on QWL. The variables that affect QWL, which was the final endogenous variable, explained 41.3% of the variance and seven out of the 10 hypotheses were statistically significant.

Discussion Main contributions

The QWL score (4.27 out of 6 points) of cancer survivors returning to work in the present study was lower than scores in previous studies, 4.39 points [10] and 4.84 points [7] The reason may be attributable to the fact that the subjects in the present study were in the extended survivorship stage (2-5 years) as described by Mullan [27], unlike previous studies, and the quality of life in that survivorship stage appears to have been revealed [34]. It appears that the QWL of the cancer survivors in the extended survivorship stage was also lower than the QWL in previous studies as the level of their psychological stress was found to be higher than that of survivors in the acute and permanent stages. Consequently, this finding indicates that cancer survivorship stages should be considered first as disease-related characteristics when conducting research and establishing policies related to the QWL of cancer survivors in the future.

Social support for cancer survivors who returned to work was found to be a key variable that has a direct positive effect on the QWL. The finding is similar to the findings of previous studies [33,35]. That used similar items and reported a direct positive effect of social support on the QWL of non-cancer patients. In addition, the findings of a previous study which emphasized that the support from superiors and colleagues is the actual social support system for cancer survivors, can be considered to support the findings of the present study [18]. Health management of cancer survivors who returned to work, employer's attention and consideration of the work environment [36] and positive perception and support from superiors and colleagues in the direct relationship network are important factors for the improvement of the QWL. Accordingly, mutual support among organizational members to strengthen social support that have positive influence on the work readjustment and improvement in job performance of cancer survivors, and the development of education and programs to increase the sense of fellowship are necessary [37]. In addition, the effect of integrated social support including the support of family, medical staff, and friends, which were identified as valuable social support system for cancer survivors who returned to work, on their health has to be investigated in future studies.

The direct effect of cancer stigma, which is the measurement variable of organizational culture, to the QWL was rejected, but the negative effect of indirect and total effect was similar to the findings of previous studies [13,33,35]. That is, the higher the level of cancer stigma experienced by cancer survivors who returned to work, the lower the support that patients perceive from their superiors and colleagues, and the QWL will eventually decrease. It can be seen as reflecting work-centered culture which is the characteristics of organizational culture in South Korea [15]. There are presenteeism which one cannot be absent from work even for illness [33] and prejudice and stigmatization by organizational members against cancer and cancer survivors [4]. Accordingly, it is necessary to develop and apply integrated palliative care programs that reflect the characteristics of cancer stigma that affect the psychological, physical, and social aspects of cancer survivors [38], include post-traumatic growth [39], resilience [39] and self-efficacy [21] which the influence was proven in previous studies. Furthermore, repeated and extended research is necessary in future studies to compare and analyze stigma experienced by workers with chronic illnesses such as cancer and even healthy workers since stigma is found in organizational culture such as discrimination, prejudice, and isolation that can be experienced even by employees who are not afflicted with cancer, and can be reflected on the over-all organizational health status. In addition, cancer stigma was found to have an indirect influence on the health of the organization and workers with social support acting as a moderator. This finding is partially similar to the results of previous studies which found that workplace discrimination, i.e., stigma, experienced by workers influences turnover intention, which reflects organizational health [12,40]. In addition, the finding is supported by previous studies that reported a significant statistical correlation between cancer stigma and workers' health [16] and workers’ health level increases in a healthy and positive organizational culture [9]. Although cancer stigma effects the employee health and organizational health, it can be controlled by perception of social support such as superiors and colleagues. This is because the negative organizational culture, cancer stigma is delivered through the superiors and colleagues to employees and community. Therefore, it is necessary that the development and application of education and promotion programs for improving of perception of cancer survivors who returning work.

Social support is shown to have a positive direct influence on workers’ health, which is similar to the findings of previous studies that used similar measurement items [33,35] but different from the findings of LaRocco et al. [41] who reported that the support of family and friends is more related to personal health problems than the support from superiors and colleagues [41]. Accordingly, replication studies using measurement instruments, which include the support of family and friends, are necessary. The direct positive effect of social support on organizational health is similar to the findings of a previous study which reported that organizations with a high level of support from superiors and colleagues positively assess organizational environment and work atmosphere, which can be considered as organizational health [41]. The OHQ used in the present study to measure organizational health is an integrated scale that reflects both external and internal wellbeing, and it can be used to develop intervention programs to build healthy organizational culture by comparing and analyzing internal and external organizational health status according to the support from superiors and colleagues [24].

In summary of these findings, the higher the cancer stigma experienced by cancer survivors who returned to work, the lower the cancer survivors' perception of support from superiors and colleagues. Such low social support can ultimately be considered to decrease the QWL, which is a subjective satisfaction experienced from the physical and human environment at work. In addition, because cancer stigma, which reflects organizational culture, is conveyed to cancer survivors through superiors and colleagues, and it negatively affects organizational and workers’ health, the findings of the present study can contribute to the establishment of practical policies for successful return to work and the development of effective intervention strategies and programs to strengthen social support and to alleviate cancer stigma through approaches from various dimensions for the improvement of the QWL of cancer survivors who returned to work.

Discussion on the unsupported hypotheses

A direct effect from cancer stigma to QWL that has not been attempted in previous studies, was attempted and set up for QWL in the present study was based on CWHM. However, it was rejected, which is a different outcome from previous studies that were able to confirm significant causal relationships between cancer stigma and the quality of life. It is a concept in the overall quality of life that includes the QWL, but it is subjective and a specific satisfaction as experienced by the individual employees, it can be different concept from the overall quality of life. In addition, organizational culture is delivered to individual workers through organizational management system according to CWHM, the QWL of cancer survivors also appears to be positively or negatively influenced by supervisors and colleagues who the direct connection network of workers who are cancer survivors rather than the direct effect of organizational culture. Therefore, extended research that includes not only the QWL of cancer survivors but also the overall quality of life is suggested for future studies.

The present study confirmed significant negative indirect effect and total effects of cancer stigma on the QWL with social support acting as a moderator, and the finding is similar to that of previous studies [13,33]. In addition, the hypothetical paths of the positive effects of employee health on organizational health and the QWL were rejected in the present study. This finding is different from that of previous studies [13,33] that confirmed the path in which the employee health measured with one item as the present study influences organizational health and the QWL. The reason may be due to different measurement instruments from previous studies, which determined paths between employee health, organizational health, and the QWL variables. Another reason may be due to Self-Report Health Scale (SRHS) which measured workers' health, used only one item: "What is your current state of health?" [32]. Although SRHS is commonly used for cancer patients [42], it has limitations in reflecting the health status of cancer survivors with diverse and complex health problems for extended survivorship which appears to have affected the results [39]. In addition, it may be due to differences in subjects from previous studies. Since cancer is a chronic disease that continues to be influential in every aspect of life even after treatment is terminated [22,27], the self-rated health level of cancer survivors who returned to work is considered to be different from that of previous studies of non-cancer patients. Therefore, the future studies should apply the measurement instrument that including the health status of cancer survivors in extended survivorship who experience fear, anxiety, fear of recurrence, and the uncertainty of health [39].

Furthermore, the path from organizational health to the QWL was non-significant in the present study, which is different from the results of previous studies, which found that organizational health was the key factor for the QWL in studies on the structural model of the QWL [13,33]. The reason is that the present study used OHQ to measure organizational health instead of single items such as presenteeism [13,33] and turnover intention [12] which were found to be the influencing factors of workers' health and the QWL in previous studies. The OHQ is a general organizational health measurement tool developed for healthy workers, and the tool appears to be limited in reflecting characteristics such as value, meaning, and commitment to the changed organization after cancer diagnosis of cancer survivors who returned to work. That is because cancer survivors who returned to work experience changes in the meaning of work and workplace, and changes in values that put themselves as the top priority over work and workplace [2]. Consequently, replicated and expanded studies that use variables such as presenteeism, absence from work, changing jobs, and increased sick leave that can reflect the interest and support of the organization for the health status of cancer survivors who returned to work are necessary in the future.

Research strength and limitation

The present study is the first study that attempted to build a theoretical framework and model of the QWL of cancer survivors who returned to work based on the Culture-Work-Health-Model (CWHM) and has various significances in the field of nursing.

In terms of nursing theories and research, the significance lies in testing the CWHM, which has previously been tested on healthy workers, but now tested on cancer survivors who returned to work and whose social interest and participation are increasing, and establishing a comprehensive model that includes the characteristics of the work environment and human relationship of cancer survivors such as cancer stigma and support from superiors and colleagues. The present study also has its significance in contributing to the expansion of knowledge in the field of nursing in that it prepared a theoretical foundation that can strengthen the grounds of CWHM theory and is also applicable to the QWL of workers with chronic illness such as cancers, in addition to providing basic data to various studies related to cancer patients in the country who are returning to work, which are still in a nascent stage.

In terms of nursing practice, the results of this study will contribute to developing effective approach strategies and intervention programs for cancer survivors' successful return to work. Furthermore, it would be applied in the management of cancer rehabilitation and the quality of life through the return of cancer survivors to workplace and their work, which tends to increase continuously.

The limitations of the present study are as follows.

In this study, we developed a structural equation model of the quality of working life among cancer survivors returning to work. Contrary to the culture-work-health model (CWHM) proposed by Peterson and Wilson [[19]] and the model used in this study revealed that cancer stigma indirectly affects the quality of working life of cancer survivors. Social support mediates the relationship between cancer stigma and quality of working life by reducing negative stigma toward cancer survivors. In turn, this improves the survivors' quality of working life. The participants of this study were cancer survivors in an extended survival stage, during which their health conditions began to stabilize. As such, the results cannot be generalized to other cancer patients, such as those in different survival stage. This study also found that employee health did not directly affect quality of working life. However, depending on the survival phase of the individual, employee health may have varying degrees of influence. Future studies must thus compare quality of working life models for cancer survivors in different survival and treatment phases to reveal the factors that directly or indirectly affect quality of working life. Moreover, the employee health assessment tools used in this study have limited efficacy for cancer survivors with complex health conditions. The effects of health on quality of working life must be reevaluated with a tool that can effectively assess the complicated health conditions of cancer survivors. Furthermore, the findings of the present study are difficult to generalize to the entire community of cancer survivors who returned to work because the present study was conducted without taking into account the different types of cancer. The present study was a cross-sectional study that investigated the phenomena of the sample from the population in the same period and has limitations in clearly identifying causal relationships among variables included in the model.

Conclusion

The present study identified cancer stigma and social support as statistically significant variables for the QWL of cancer survivors who have returned to work, of which, social support was found to have greater explanatory power, and these variables explained 43.1% of QWL. On the other hand, paths in which employee health influenced organizational health and organizational and employee health influenced QWL were statistically non-significant, resulting in a rejection of the research hypothesis. Therefore, cancer stigma and support from superiors and colleagues, which were determined to be important factors with direct and indirect influences on the QWL of cancer survivors who have returned to work, may contribute to the exploration and search for measures to improve their QWL. Specifically, they can be used as basic data for preparing promotion and education programs at organizational and social levels, programs to strengthen the sense of a bond with superiors and colleagues—which are social support resources in the organization—and preparation of measures that can increase the self-efficacy and resilience of cancer survivors to reduce cancer stigma and strengthen the support system of superiors and colleagues. Ultimately, not only their QWL but also their overall quality of life will be influenced by this.

Author contributions

All authors participated in designing the study. J.J.H. carried out statistical analysis and wrote the manuscript. L.E.J. supervised the statistical design, interpretation results and wrote the manuscript.

Conflict of interest

All the authors report no conflicts of interest relevant to this article.

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Characteristics		Categories	N (%)
Sociodemographic factors	Gender	Men	35 (17.2)
Women	169 (82.8)	Age (years)	≤30
14 (7.0)	40s	75 (37.0)	50s
92 (45.0)	60s	23 (11.0)	Marital status
Unmarried	42 (20.6)	Married	151 (74.0)
Others (divorced, widowed, etc.)	11 (5.4)	Number of children	None
52 (25.5)	1	26 (12.7)	2
107 (52.5)	≥3	19 (9.3)	Educational level
≤High school	69 (33.8)	College	98 (48.1)
Graduate school	37 (18.1)	Religion	Yes
152 (74.5)	No	52 (25.5)	Occupation-related factors
Occupational sector	Education and public sector	29 (14.2)	Health and social work
65 (31.9)	Service and sales	89 (43.6)	Productive work

21 (10.3)	Working years	≤10	117 (57.4)
11~20	55 (26.9)	21~30	23 (11.3)
≥30	9 (4.4)	Working type	Shift
48 (23.5)	Fixed	36 (66.7)	Others
20 (9.8)	Work position	Clerks	112 (54.9)
Managers	62 (30.4)	Others	30 (14.7)
Monthly income (10,000 won)	≤150	42 (20.6)	150~250
68 (33.3)	250~350	46 (22.5)	Main source of income in family
Yes	89 (43.6)	No	115 (56.4)
Cancer-related factors	Types of diagnosed cancers	Breast Cancer	97 (47.5)
Thyroid Cancer	38 (18.6)	Gynecological Cancer	15 (7.4)
Gastrointestinal Cancer	29 (14.2)	Others	25 (12.3)
Stage	I	104 (50.9)	II
71 (34.8)	Over III	29 (14.3)	Periods after cancer diagnosis from 2019

1	3 (1.5)	2	62 (30.4)
3	30 (14.7)	4	38 (18.6)
5	71 (34.8)	The number of types of cancer treatments (past history)[a]	1
67 (32.8)	2	61 (30.0)	3
55 (26.9)	over 4	21 (10.3)	The number of types of cancer treatments in progress (at present)
None	99 (48.5)	1	98 (48.0)
2	7 (3.5)	Return-to-work-related factors	Periods of sick leave
Both treatment and work	45 (22.1)	≤6 months	74 (36.3)
6months~12 months	36 (17.6)	≥12 months	49 (24.0)
Return to same workplace	Yes	130 (63.7)	No

Latent variables	Measurement variable	Scale Ranges	Mean ± SD	Cronbach's α	Skewness	Kurtosis	Standardized estimate(β)	S.E	C.R. (p)	CR	AVE
Cancer Stigma	Total	1–4	1.88 ± 0.50							0.95	.81

Social isolation		1.65 ± 0.59	.92	0.32	−1.08	0.87					Distancing or avoiding
	1.66 ± 0.56	.92	0.19	−0.94	0.90	0.06	17.54*			Discrimination	
1.98 ± 0.71	.90	0.08	−0.99	0.89	0.07	17.04*			Guilty		2.12 ± 0.63
.77	0.03	−0.10	0.59	0.08	9.27*			Attribution		1.98 ± 0.65	.85
0.18	−0.62	0.66	0.08	10.78*			Social support	Total	1–5	3.31 ± 0.57	
					0.72	.62	Supervisor support		3.22 ± 0.74	.85	−0.14
−0.20	0.60					Colleague support		3.39 ± 0.66	.79	−0.27	−0.12

0.55	0.15	5.46*			Organizational health	Total	1–5	3.41 ± 0.52			
			0.95	.83	Environment fit		3.36 ± 0.62	.92	0.06	1.18	0.78
				Work way fit		3.35 ± 0.62	.93	−0.43	0.72	0.90	0.09
13.07*			Vitality		3.35 ± 0.58	.90	−0.48	0.88	0.79	0.08	11.72*
		Community oriented		3.61 ± 0.56	.91	−0.50	0.77	0.70	0.08	10.05*	
	Employee Health	Perceived Health status	1–5	3.31 ± 0.65	.87	−0.13	0.17	0.63			0.80
.80	Quality of work life	Total	1–6	4.27 ± 0.70							0.86
.62	Meaning of work		4.52 ± 1.01	.91	−0.75	0.24	0.68				

Perception of work		4.52 ± 0.91	.85	−0.75	0.91	0.76	0.08	12.86**			Atmosphere of work environment
	4.52 ± 0.92	.91	−0.67	0.46	0.95	0.12	10.52**			Understanding and recognition of organization	

	X^2(p)	X^2/df	GFI	AGFI	CFI	TLI	RMR	SRMR	RMSEA
Hypothetical model	211.58 (<.001)	2.23	.89	.84	.93	.92	.04	.06	.08
Alternative model	211.67 (<.001)	2.20	.89	.84	.93	.92	.04	.07	.08
Acceptable range	p > .05	<3.00	≥.90	≥.80	>.90	>.90	≤.05	<.08	≤.08

Endogenous Variable	Exogenous Variable	Direct effect(β)	Indirect effect(β)	Total effect(β)	SMC	Hypothesis	
D	I	Social Support	Cancer Stigma	−.34***		−.34***	.113
A		Employee Health	Social Support	.46***		.46***	.211
A		Cancer Stigma		−.16*	−.16*		
A	Organizational Health	Social Support	.59***	.08	.67*	.471	A
R	Employee Health	.18		.18		R	
Cancer Stigma		−.23*	−.23*		R	A	Quality of Work Life
Cancer Stigma	−.02	−.21*	−.23*	.413	R	A	Social Support
.43*	.18	.61*		A	R	Employee Health	.13
.03	.16		R	R	Organizational Health	.17	

DETAILS

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Psychometric Evaluation of the Korean Version of the Student Evidence-Based Practice Questionnaire (S-EBPQ)

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ProQuest document link

ABSTRACT (ENGLISH)

Purpose

Evidence-based practice (EBP) is a key competency that undergraduate nursing students need to learn, as EBP competence is essential for the effective implementation of EBP. However, few studies have comprehensively assessed the aspects of EBP competence using a reliable and valid measure specific to Korean nursing students. This study aimed to translate the Student Evidence-Based Practice Questionnaire (S-EBPQ) into Korean and evaluate its psychometric properties.

Methods

The original S-EBPQ was translated into Korean. After a pilot test, a convenience sample of 249 college students with more than four weeks of clinical training experience was selected from three universities in September 2017. Reliability and construct validity were evaluated using exploratory and confirmatory factor analyses. Concurrent validity was evaluated by correlating the measure with informatics competency.

Results

The exploratory factor analysis revealed four factors that explained 66.3 of the variance. The confirmatory factor analysis yielded a 4-factor structure ($\chi 2/df = 1.52$, $p < .001$, standardized root-mean-square residual = .07, root-mean-square error of approximation = .07, goodness of fit index = .84, comparative fit index = .91). The Cronbach's α was .81 for the total scale. The scale's correlation with informatics competency was r = .55.

Conclusions

The Korean S-EBPQ is a reliable and valid tool that has utility for assessing EBP competence in Korean nursing students and for making comparisons of the EBP competence of nursing students from other countries.

FULL TEXT

Introduction

Evidence-based practice (EBP) involves a scientific evidence-based problem-solving method that is essential for improving healthcare quality and patient outcomes [1]. Nurse's EBP competency refers to the knowledge, attitudes, and implementation of EBP utilized in nurses' daily working life [2]. While instruments to measure clinical nurses' EBP competency have focused on applying EBP to patient care to provide reliable healthcare [2], tools assessing students' EBP competency need to focus on the acquisition of knowledge and attitudes toward EBP, as well as the related learning skills [3,4]. Furthermore, undergraduate nursing students' EBP competency is critical as it influences their future behavior and application of EBP [5,6]. EBP has been emphasized as a key competency that undergraduate nursing students need to master before graduation [3].

Evaluating nursing students' EBP competency is needed to understand their acquisition of EBP-related education [2]. Unlike nurses in practice, nursing students are not in an environment where EBP competency is directly applicable [2]. Thus, their EBP competency should be evaluated in different ways.

Some instruments have been developed to measure EBP in nursing students; however, they have limitations. For instance, the Nurses' Readiness for EBP was designed for use among nurses. Previous studies assessing EBP competence in undergraduate nursing students in Korea have used measures originally designed for clinical nurses or medical students, focusing on knowledge or attitudes related to EBP competence [7,8]. The Evidence-Based Practice Evaluation Competence Questionnaire (EBP-COQ), developed for nursing students [6], was only partly evaluated in Korea; the skill subscale was not included in the evaluation [7]. Therefore, there is a need for a reliable and valid instrument that can measure EBP competence more comprehensively and is comparable to measures used in other populations.

The Student Evidence-Based Practice Questionnaire (S-EBPQ) was developed to assess EBP competence in nursing students, based on the steps of EBP [9] and the recommendations of the Bologna Process [6] that have stated that nursing curricula should promote the development of EBP-related knowledge, attitudes, and skills [10]. An evaluation of the S-EBPQ identified an internally consistent scale with 21 items on four subscales: Frequency of Practice, Attitude, Retrieving and Reviewing Evidence, and Sharing and Applying EBP. The S-EBPQ is an appropriate instrument for evaluating EBP-related knowledge and attitudes and its implementation in an educational environment [10]. It has been validated with nursing students in the United Kingdom, Australia, and China [10–12]; Recently, S-EBPQ was applied to Korean nursing students [13]. However, some items were loaded on different factors compared to the original tool, and the need for further research was suggested as construct validity assessment for the subscales of the original tool was not conducted [13].

Informatics competency is a factor affecting EBP competency [14]. As its significance for improving the efficiency of nursing practice has been demonstrated, informatics competency has emerged as an important competency [7,15]. Additionally, with the recent increase in the utilization of various information technologies for performing EBP, the importance of informatics competencies as a measure of the ability to perform and use EBP has also been highlighted [15,16]. Prior research has shown that information literacy education can be utilized to improve EBP knowledge [17,18]. Therefore, informatics competency is suitable for comparison with EBP competency.

This study aimed to translate the S-EBPQ into Korean and then evaluate the psychometric properties of the Korean version of the S-EBPQ. The findings would provide evidence concerning the validity of a tool that can be used to assess EBP competence in Korean nursing students. Furthermore, a Korean version of the S-EBPQ would enable cross-country comparisons with undergraduate nursing students of other countries.

Methods Study design

Researchers employed a methodological study design to translate the S-EBPQ [10] into Korean and evaluate its validity and reliability.

Participants

Participants included junior and senior undergraduate students from three nursing colleges located in three cities in South Korea. Only undergraduate students with more than four weeks of clinical training experience were included. The total number of participants was 260, considering the recommendation of having a sample that was at least 10 times the number of items for factor analysis, as well as the possible dropout rate [19]. Due to incomplete questionnaires, the final sample included 249 participants.

Data collection

Data were collected from the three nursing colleges in September 2017. After obtaining permission to conduct research at the three universities, self-reported questionnaires were distributed to students. An explanatory statement and a consent form were attached to each questionnaire. Students were asked if they understood the purpose of the study and instructed to sign the consent form confirming that they understood and voluntarily agreed to participate in the study. They were also reassured that their anonymity would be guaranteed and that the study results obtained would only be used for research purposes. The first author collected the completed questionnaires in a sealed envelope, and small gifts were provided to participants who completed the questionnaire.

Instruments

The S-EBPQ is a scale to assess the EBP competency of undergraduate nursing students [10]. The S-EBPQ has 21 items and four subscales: Frequency of Practice (six items), Attitude (three items), Retrieving and Reviewing Evidence (seven items), and Sharing and Applying EBP (five items). Each item is measured on a 7-point Likert scale. Higher scores indicate higher EBP competence. The reliability of the tool was examined based on the item response theory, and its construct validity was evaluated using an exploratory factor analysis [10]. The Cronbach's α coefficients for the factors ranged from .76 to .91 [10]. In this study, the S-EBPQ was translated in accordance with the World Health Organization guidelines [20]. After the initial translation, four experts, including two nursing professors with experience in the development and translation of tools, one translator, and one field expert, reviewed the translation's appropriateness. Next, the S-EBPQ was back-translated by a bilingual expert, and any differences in meaning from the original version of the S-EBPQ were adjusted in the final version. After a pilot test of 20 undergraduate junior and senior nursing students using cognitive interviewing, the final version was used for the survey.

The Informatics Competency Tool was used with the permission of the original developers [21] and the author who translated the scale into Korean [22]. The tool has 30 items and five subscales: Basic Computer Usage (ten items), Medical Informatics-Related Software Usage (seven items), Computer-Related Information Management (six items), Perception of Informatics (five items), and Information Search Using the Internet (two items). Each item is measured on a 5-point Likert scale, with higher scores indicating better informatics competence. Given that informatics competency is an important factor in performing EBP [21], this index was viewed as being appropriate for evaluating the concurrent validity of the S-EBPQ. The items containing phrases, such as "my hospital" were revised to be written as "I," and the verbs were revised to be preceded by "may" to be applicable for students. The revised questionnaire was used after conducting a pilot test.

Data analysis

The data were analyzed using IBM SPSS Statistics 20 and Amos 20.0 software (IBM Corp., Armonk, NY, USA), with two-sided tests at a significance level of .05. The general characteristics of the participants were summarized using frequencies, percentages, means, and standard deviations. Each item's normality was evaluated with regard to skewness and kurtosis. The criteria of the absolute value of skewness less than 3 and the absolute value of kurtosis less than 10 were used [23]. Corrected item-total correlations were calculated.

The construct validity was evaluated using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The total sample of 249 was randomly divided into two separate subsamples. The first half of the sample (n = 124) was used for EFA, and the second half (n = 125) was used for CFA. The EFA was performed using a varimax rotation of the principal component analysis (PCA). Prior to factor analysis, the Kaiser-Meyer-Olkin (KMO) test (≥.60) and Bartlett's test of sphericity (*p* 24]. Items with a factor loading of ≥ .50 were selected [25]. Next, in the CFA, the goodness of fit index (GFI), comparative fit index (CFI), standardized root-mean-square residual (SRMR), and root-mean-square error of approximation (RMSEA) were assessed. For GFI and CFI, with a cut-off value of .80, optimal goodness of fit was determined when the values were .90 or higher [26]. For RMSEA, a value of less than .08 indicated high goodness of fit, while a value of less than .10 indicated moderate goodness of fit [27]. For SRMR, the cut-off value of ≤.80 was used [23]. We also considered modification index values above 10 in order to improve the model fit, if necessary [28,29].

Convergent validity was assessed using construct reliability (CR), with the cut-off value of >.70, and average variance extracted (AVE) [30]. AVE > .50 indicates good convergence [30], while AVE > .40 is considered acceptable [31]. Discriminant validity was determined by comparing the factor's AVE square root value and the correlation between the factors of the instrument [30].

For concurrent validity, Pearson's correlation coefficient was used to assess the relationship between EBP competence and informatics competence in nursing, which has been shown to be correlated [7,15]. Cronbach's α was calculated to determine the reliability of the S-EBPQ.

Ethical considerations

The study was performed with the approval of the Kyung Hee University's Institutional Review Board (KHSIRB-17-063(NA), KHSIRB-18-019(EA).

Results Participants' characteristics

The mean age of the participants was 23 years (SD = 1.16), a large majority were women (88.8%), and slightly more than half (53.0%) were in their senior year. Table 1 shows the participants' general characteristics.

Item analysis

Table 2 shows the results of item analysis. The corrected item total correlations were found to be .44 to .74, which exceeded .30 [24]; therefore, no items were deleted. The skewness of each item ranged from −1.14 to 0.17, and the kurtosis ranged from −0.39 to 0.92; thus, both values satisfied the guidelines for normality (Table 2).

Construct validity EFA

Both the KMO test result of .82 and Bartlett's test of sphericity (χ^2 = 1562.85, *p* 1.0. The factor loadings ranged from .62 to .85, with four factors explaining 66.3% of the total variance (Table 3). There was no cross-loaded item based on the factor loading of ≥ .50.

CFA

The CFA was performed with the original S-EBPQ 4-factor structure (Figure 1). The model fit indices were χ^2 = 334.23 (*p* 2/*df* = 1.83, SRMR = .07, RMSEA = .08, GFI = .80, and CFI = .85. Since some values did not meet the recommended levels, the model was revised using model modification indices. After setting the covariance between errors associated among four item-pairs (3–9, 6–19, 10–11, and 15–16), the model fit indices were as follows: χ^2 = 271.44 (*p* 2/*df* = 1.52, SRMR = .069, RMSEA = .07, GFI = .84, and CFI = .91. The Korean translated version of the S-EBPQ exhibited a 4-factor structure, which was the same as the original measure and the current EFA. Regarding the convergent validity, the result showed that the AVE values ranged from .46 to .52, and CR values were above .70 (Table 3). The standardized factor loadings in the CFA ranged from .57 to .93. Regarding discriminant validity, the square roots of AVE, ranging from .68 to .72, were greater than the correlation coefficient for each factor.

Concurrent validity

There was a significant positive correlation between the S-EBPQ total score and the total score on the Informatics Competency Tool. Significant correlations were also found between the S-EBPQ subscale scores and the Informatics Competency Tool score (Table 4).

Internal consistency reliability

The Cronbach's α for the S-EBPQ was .81. The internal consistency of the four factors ranged from .73 to .83 (Table 2).

Discussion

The S-EBPQ is a measurement tool that assesses EBP competency in undergraduate nursing students. In the present study, we assessed the psychometric properties of the Korean translated version of the S-EBPQ. The findings showed that the Korean S-EBPQ had acceptable reliability and validity, suggesting that it could be a useful scale to measure EBP competence in Korean nursing students.

The construct validity was verified using EFA, CFA, and concurrent validity analysis. The EFA identified four factors. It was consistent with those of the original S-EBPQ and previous studies [10–13]. The explanatory power of the 4-factor model was 66.26%, which was similar to the findings in previous studies [12,13]. In addition, there was no cross-loaded item. This result was similar to the finding of one previous study [12] but differed from the finding of another study showing that Item 6 was cross-loaded between two factors of "Frequency of Practice" and "Sharing and Applying EBP." [11] Although the Australian study removed the cross-loaded item [11], we retained all items based on the EFA results.

The CFA demonstrated an acceptable fit for the original 4-factor structure. Although the revised model exhibited a better fit, the CFA indices indicated that the 4-factor structure did not fit well with the data. This result differed from the findings of previous studies in Australia and China in that the fit indices indicated that the four factors fit the data well [11,12]. Such differences may be due to the sample characteristics with different educational backgrounds. For instance, to become a registered nurse, Australia's nursing education features three-year programs [32,33]. The Australian study's participants were students enrolled in an EBP course, generally in the third year of study [11]. China's nursing education comprises various levels, such as a three-year nursing program for the Diploma, a three-year associate nursing degree program for the Advanced Diploma, and a five-year bachelor of the nursing program, based on a biomedical model [33,34]. Participants in the Chinese study were undergraduate nursing students in a bachelor's program [12]. Korea's undergraduate nursing curriculum has a four-year duration; although EBP education is not mandatory in the undergraduate program, recent attempts have been made to implement it as an independent subject [35,36]. Additionally, our sample size was slightly smaller than the generally recommended sample size of at least 300 [25]. It might result in a less strong model fit than in previous studies [11,12].

Supporting the validity of the CFA, both convergent validity and discriminant validity were also confirmed. Additionally, in the present study, the total and subscale scores positively correlated with the Informatics Competency Tool score, providing support for the instrument's concurrent validity.

The internal consistency reliability coefficients of the total Korean S-EBPQ and its subscales were higher than .70. This is consistent with Cronbach's α for the subscales in the original S-EBPQ (.77–.91) and the Chinese version of S-EBPQ (.70–.92) [12]. Furthermore, the item-total correlations ranged from .44 to .74, which was acceptable, suggesting that the Korean S-EBPQ had adequate reliability [19].

Overall, the findings of this study demonstrated that the translated S-EBPQ is a reliable and valid tool. Therefore, it can be used to measure EBP competence in undergraduate nursing students in Korea. Competence in EBP has been one of the competencies needing further assessment in the training of undergraduate nursing students [3]. Future research might consider using this validated Korean version of the S-EBPQ in a comparison of Korean undergraduate nursing students' competence with students from other countries.

There are several limitations to this study that deserve mentioning. First, the findings have limited generalizability, as the sample only included junior and senior students from 4-year nursing programs at three nursing colleges. Therefore, studies need to be conducted with samples of nursing students from other colleges. Second, although the suitability of the present tool was confirmed, the CFA showed that the four-factor structure did not fit well with the data; thus, further research is needed to confirm the present findings with a larger sample.

Conclusions

The S-EBPQ was originally developed for nursing students. Therefore, it was expected to provide further differentiated information compared with other preexisting tools. The Korean translated S-EBPQ exhibited acceptable reliability and validity in this study. As such, this tool can be used in the assessment and training of Korean nursing students and used as a method to compare undergraduate nursing students' EBP competency.

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Unblinded ethics statement

The study was performed with the approval of the Kyung Hee University's Institutional Review Board (KHSIRB-17-063(NA), KHSIRB-18-019(EA)).

Conflict of interest

The authors declare no conflict of interest.

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Characteristics	Category	n (%)
Gender	Men	28 (11.2)

Women	221 (88.8)	Year in college
Junior	117 (47.0)	Senior
132 (53.0)	Satisfaction with their major	Dissatisfied
13 (5.2)	Moderate	83 (33.4)
Satisfied	153 (61.4)	Nursing research subject
Completed	169 (67.9)	None
80 (32.1)	Statistical subject	Completed
105 (42.2)	None	144 (57.8)
Research experience	Yes	107 (43.0)

Subscale/Item	Mean ± SD	Skewness	Kurtosis	Corrected item-total correlation	Cronbach's α
Frequency of Practice	4.61 ± 0.86				.74
1. Formulated a clearly answerable question	4.31 ± 1.10	−0.51	0.72	.58	
2. Tracked down the relevant evidence	4.70 ± 1.11	−0.36	0.46	.60	
3. Critically appraised, against set criteria	4.23 ± 1.15	−0.25	−0.15	.63	
4. Integrated the evidence	4.55 ± 1.12	−0.33	0.39	.62	
5. Evaluated the outcomes of your practice	4.63 ± 1.09	−0.39	0.24	.73	
6. Shared this information with colleagues	5.23 ± 1.26	−0.91	0.92	.54	

Attitude	5.09 ± 1.00				.77
7. I resent having my clinical practice questioned	4.95 ± 1.16	−0.54	0.49	.48	
8. Evidence-based practice is a waste of time	5.46 ± 1.41	−1.14	0.91	.52	
9. I stick to tried and trusted methods	4.84 ± 1.28	−0.60	0.07	.44	
Retrieving and Reviewing Evidence	4.26 ± 0.82				.73
10. Research skills	3.63 ± 1.00	−0.09	−0.25	.62	
11. Converting your information needs	3.79 ± 1.05	−0.19	−0.39	.68	
12. Awareness of major information types	4.64 ± 1.17	−0.19	−0.03	.68	
13. Knowledge of how to retrieve evidence	4.61 ± 1.09	−0.33	0.41	.63	
14. Ability to analyze critically	4.15 ± 1.07	0.17	−0.08	.74	
15. Ability to determine how valid	4.43 ± 1.09	−0.41	−0.39	.66	
16. Ability to determine how useful	4.55 ± 1.05	−0.61	0.44	.57	
Sharing and Applying EBP	4.64 ± 0.80				.83
17. Ability to identify gaps	4.17 ± 1.03	−0.38	0.69	.62	
18. Ability to apply information	4.38 ± 0.97	−0.16	−0.01	.67	

19. Sharing of ideas and information with colleagues	5.21 ± 1.06	−0.56	0.29	.66	
20. Dissemination of new ideas	4.83 ± 1.09	−0.30	−0.16	.58	
21. Ability to review your own practice	4.62 ± 1.07	−0.19	0.05	.72	
Total Scale	4.57 ± 0.69				.81

Subscale	Item	EFA (n = 124)				CFA (n = 125)				
Factor				λ	C.R.	p	CR	AVE	1	2
3	4	Retrieving and Reviewing Evidence	15	.82	.08	.16	.01	0.67	6.08	
.87	.50	11	.80	.00	.16	.18	0.66		<.001	
	10	.78	.08	.23	.19	0.59	6.82	<.001		
14	.78	.05	.23	.19	0.78	7.01	<.001			16
.76	.09	.21	.05	0.67	6.02	<.001			13	.75
.02	.23	.05	0.82	7.00	<.001			12	.74	.06

.27	.09	0.72	6.47	<.001			Frequency of Practice	5	.12	.85
.20	.24	0.77	6.33		.84	.46	3	.15	.81	.07
.03	0.63		<.001			2	.05	.80	.08	.04
0.73	6.42	<.001			1	.06	.80	.04	.04	0.58
5.17	<.001			4	.05	.80	.08	.06	0.70	6.14
<.001			6	.10	.62	.34	.10	0.64	5.68	<.001
		Sharing and Applying EBP	20	.21	.01	.81	.15	0.70	7.20	
.84	.52	19	.34	.13	.79	.03	0.75		<.001	
	17	.27	.11	.70	.05	0.63	6.34	<.001		
18	.44	.11	66	.06	0.67	7.03	<.001			21
.45	.21	.62	.07	0.85	8.34	<.001			Attitude	7
.16	.03	.07	.83	0.93			.74	.50	9	.11
.13	.02	.76	0.57	4.87	<.001			8	.15	.11
.14	.76	0.57	4.24	<.001			Eigenvalue		7.11	3.57

1.93	1.31						Percent of the total variance explained		33.9	17.0
9.2	6.2						Percent of cumulative variance		33.9	50.9
60.1	66.3						Kaiser-Meyer-Olkin measure of sampling adequacy			
	.82						Bartlett’s test of sphericity		Approx. Chi-square	
1562.85										df
210										Sig

S-EBPQ	Informatics Competency
Full Scale	.55*
Frequency of Practice	.44*
Attitude	.38*
Retrieving and Reviewing Evidence	.47*
Sharing and Applying EBP	.46*

DETAILS

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Effectiveness of a home-based exercise program among patients with lower limb spasticity post-stroke: A randomized controlled trial

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ABSTRACT (ENGLISH)

Purpose

To evaluate the effectiveness of advanced practice nurse–guided home-based rehabilitation exercise program (HREPro) among patients with lower limb spasticity post-stroke.

Methods

This randomized controlled study recruited 121 patients with lower limb spasticity post-stroke. Intervention ($n = 59$) and control ($n = 62$) groups underwent 12-month HREPro and conventional rehabilitation, respectively, after discharge. The Fugl–Meyer assessment of spasticity measurement, modified Ashworth scale of motor function, 10-Meter Walk Test of walking ability, and Barthel index of activities of daily living (ADL) were evaluated at 0, 3, 6, and 12 months after discharge.

Results

Significant differences were found in spasticity degree, motor function, walking ability, and ADL at 6 and 12 months after discharge between the control and intervention groups. Lower limb spasticity and ADL in the intervention group were significantly improved.

Conclusion

HREPro is effective for rehabilitation of patients with lower limb spasticity post-stroke and has favorable home application.

FULL TEXT

Introduction

Stroke is the third most common cause of death after coronary heart disease and cancer in most Western countries [1,2]. A previous epidemiological survey showed that in China there are 1,596 stroke patients per 100,000 people [3]. Furthermore, almost 70.0% of patients with stroke are reported to suffer from functional disabilities [4]. Lower limb motor function, a prerequisite for performing routine activities of daily life, is often impaired after stroke, causing restrictions in functional mobility [5,6]. Lower limb spasticity is a common consequence of stroke [7], and results from a combination of upper motor neuron syndromes [8]. Spasticity is a velocity-dependent condition that appears to increase during tonic stretch reflexes and hyperexcitability, and is associated with exaggerated tendon jerks [9]. Spastic motor disorder interferes with rehabilitation and leads to joint contractures that cause pain, stiffness, and reduced range of motion of the joint. This restricts the patient's functional mobility and affects activities of daily living

(ADL), thereby incurring a large burden on stroke survivors and society [10]. Thus, it is important to seek an effective rehabilitation protocol for stroke patients with lower limb spasticity.

Previous studies have demonstrated the effects of various rehabilitation programs, such as robotic-assisted rehabilitation (a new training technology dependent on robot assistance), neuromuscular electric stimulation (which stimulates the muscles using surface electrodes to excite the peripheral nerve fibers resulting in eventual improvements in the neurophysiological and clinical outcomes), extracorporeal shock wave (pneumatically generated pulsed sound waves are converted into precise ballistic shock waves and transmitted to a target area to achieve rehabilitation), mirror therapy (a rehabilitation method based on the principle of plane mirror imaging to stimulate vision and combine rehabilitation training programs), and bilateral leg exercises in improving motor control among stroke patients [11–13]. However, most patients are unable to complete these treatments because of the prohibitive cost of the equipment, which subsequently limits their recovery [14]. Home-based rehabilitation programs, which are safe, inexpensive, and easy-to-implement, have been developed for stroke rehabilitation using different technologies [15]. Randomized trials have evaluated whether nurse-led, home-based rehabilitation programs, such as home-based physical activity incentive and education programs [16], and home-based gaming exercises [17], can positively influence recovery after stroke. Home-based hand rehabilitation has been shown to significantly increase the self-reported function and quality of movement of the impaired hand after chronic stroke [18]. In addition, home-based rehabilitation decreases the level of disability and correspondingly improves functional recovery among patients with motor impairments [19]. Home-based rehabilitation is particularly important for patients who cannot attend supervised training sessions outside their homes [20]. In China, home-based rehabilitation is in its infancy; however, a previous study concluded that home-based traditional Chinese exercise improves the short-term balance ability in patients post-stroke [21]. Exercise training is strongly recommended for patients post-stroke [21,22], and the time spent in hospital may not be sufficient to prepare patients for further rehabilitation. To the best of our knowledge, no study has reported the effects of home-based rehabilitation exercise programs (HREPros) for patients with lower limb spasticity post-stroke.

Therefore, the purpose of the present study was to investigate the effectiveness of an HREPro, led by an advanced practice registered nurse (APRN), to manage patients with lower limb spasticity within 12 months of stroke. This study hypothesized that HREPro would significantly improve recovery of motor function of post-stroke lower limb spasticity.

Methods Participants

The study participants were post-stroke inpatient who had been admitted to the Department of Neurology at the Second Affiliated Hospital of Wenzhou Medical University, China, from January 2015 to January 2018. The required sample size was calculated using G*Power 3.1. The effect size was estimated from a study on home-based physical activity incentive and education programs in the subacute phase of stroke recovery [16]. Based on the effect size (cohen's d = 1.66) and an alpha level set to 0.05, the initial power analysis indicated that 42 participants per group were required to reach 80.0% statistical power. Of a total of 164 patients who expressed interest in participating, 121 completed the study and were subsequently divided into the intervention group (IG; *n* = 59) and control group (CG; *n* = 62) by random allocation. Inclusion criteria were as follows: (1) patients clinically diagnosed with stroke that demonstrate lower limb spasticity, and (2) patients able to comprehend and follow instructions. Exclusion criteria were as follows: (1) patients suffering from cognitive impairment (Mini Mental State Examination 23] and (2) patients with anxiety or depression before the stroke (Hamilton Anxiety Scale and Hamilton Depression Scale ≥7) [24,25].

Study Design

This randomized, single-center, patient-blinded study enrolled patients with lower limb spasticity post-stroke who presented to a teaching medical hospital from January 2015 to January 2018. Every patient who met the eligibility criteria was allotted a serial number by the computer with those having an odd number designated as the IG and those having an even number as the CG. The IG underwent HREPro, whereas CG underwent the conventional rehabilitation protocol. This randomized group intervention study was structured using a quasi-experimental, pre-post, CG design. All patients were assessed before (at 0 month) and at 3, 6, and 12 months after initiation of rehabilitation to compare the effectiveness of both programs.

Control Group

Patients in the CG were provided conventional rehabilitation after discharge from the hospital. This included issuing a rehabilitation manual for stroke (standard health education, consisting of information on physical activity, drugs, diet, follow-up time, etc.), performing telephonic follow-up (within 1 month), and completing follow-up medical appointments for assessment of recovery at 3, 6, and 12 months.

Intervention Group

Patients in the IG were provided with an HREPro in addition to the conventional rehabilitation regimen. The HREPro was an individually tailored, year-long rehabilitation intervention program, conducted at the participants' homes by an ARPN who had received professional physiotherapy training. The HREPro consisted of familiarizing the patient with navigating their home environment, as well as psychological preparation, and an exercise component. A nurse, during their first visit, evaluated the home environment, modified any environmental hazards, and guided the patient regarding how to walk safely in their home. The program involved fostering meaningful communication between the nurse and the patient. This helped the nurse understand each patient's specific concerns, including the fear of falling and satisfaction with particular walking aids. This, in turn, enabled them to motivate the patient on the basis of their own self-sufficiency. It was hoped that this would improve the patients' confidence in their own recovery and also help optimize program adherence. A comprehensive exercise program was used, which mainly included strengthening the lower limb muscle groups with exercises, such as joint training, sit-ups, balance training while standing, standing, bending to pick things up, straight leg-lifting, and climbing stairs. The exercise regimen was formulated with a view to reducing lower limb spasticity and improving mobility after stroke (Table 1). Patients underwent three exercise sessions per week during the first 3 months, supervised by an APRN, with each session lasting 30 minutes. This was followed by one supervised session per week, during the next 3 months. Thereafter, the frequency of the supervised exercise dropped to once a month, and once every other month, up to 12 months. HREPro was guided by the APRN with the assistance of family members who participated in all training sessions. If the patient encountered any difficulty during the whole training period, they could communicate with the nurse via e-mail or phone at any time.

Outcome assessments

The outcome assessment for both groups were performed by one trained and certified nurse practitioner before, and at 3, 6, and 12 months after initiation of the respective rehabilitation programs.

Fugl–Meyer assessment of motor function

The Fugle-Meyer assessment (FMA) was applied to assess the motor function of the lower limbs of each patient, which has been shown to have acceptable test-eretest and inter-rater reliability, and construct validity [26,27]. This test consisted of Hip/knee/ankle movement and coordination, achilles /genicular tendon reflex. Fifty items were included in the FMA. A three-point ordinal scale (0, cannot perform; 1, perform partially; 2, perform completely) was adopted for each item. The total score (using 17 parameters: The FMA scale can assess the motor function of the upper and lower limbs. the 17 items selected in this study are used to access the motor function of the lower limbs.) for the affected lower limb was 34 points. Therefore, a higher score indicated greater motor function.

Modified Ashworth scale for spasticity measurement

The Modified Ashworth scale (MAS), an assessment tool with good inter- and intra-rater reliability for measuring spasticity [28], is a five-point rating scale with scores ranging from 0 to 4, where 0 indicates no increase in muscle tone and 4 indicates that the affected limb is rigid during flexion or extension. MAS was measured by calculating the degree and point of resistance when a muscle was manually stretched to assess the tension in the lower limb muscles in stroke patients. A lower score denotes less spasticity.

10-Meter Walk Test for assessment of gait speed and step size

The 10-Meter Walk Test was used as a responsive and functional measure to assess the walking ability, gait, and speed of the patients over short distances (a typical distance of a household setting), which has demonstrated good reliability and validity across multiple patient populations and in individuals with known gait impairments [29]. In this study, patients were asked to walk 10 meters at their own comfortable pace. The average value of the three-step lengths at the central 6 meters mark, of a 10-meter walkway was determined by measuring the distance between the footprints. The time taken to walk 10 meters was also recorded using a stopwatch to calculate the gait speed.

Barthel Index for assessment of ADL

The Barthel Index (BI) was used to evaluate the patient's ability to perform ADL, which has been shown to give good reliability and validity in stroke patients [30]. The index includes three actions associated with mobility (on level surfaces, during transfers, and on stairs), and seven activities associated with self-care (bathing, feeding, dressing, grooming, bladder and bowel evacuation, and toilet use). Among these items, bathing and grooming are scored on an interval scale of 0–5, whereas dressing, feeding, bladder and bowel evacuation, toilet use, and stair climbing are scored on an interval scale of 0–10. The capacity to transfer and ambulate on level surfaces are scored on an interval scale of 0–15. The total score ranges from 0 to 100. A higher score indicates greater level of physical independence of the stroke patient.

Data analysis

Data input was managed using EpiData 3.0 software and the analysis was performed with SPSS 19.0 (IBM Corp., Armonk, NY, USA) statistical software. Measurements are expressed as mean ± standard deviation. Student t test for numerical variables and Pearson Chi-square test for categorical variables were applied to compare clinical and demographic characteristics before intervention. The comparison between two groups was analyzed by Student t test. Generalized estimating equations were used to compare the trend of FMA, MAS score, Gait Speed (m/sec), Step Size(m) and BI between the two groups of stroke patients. A p **Ethical considerations**

The study was approved by the ethics committee of the Second Affiliated Hospital &Yuying Children's Hospital of Wenzhou Medical University, Wenzhou, Zhejiang, China (Approval no. L-2019-11). An informed consent was obtained from each patient or their respective proxy (due to patient age) before the beginning of the study. The protected healthcare information was only used for this study.

Results Demographic and clinical features of the stroke patients

Figure 1 shows the flow diagram of this study. Of 164 patients enrolled in the study, 24 declined to participate, 11 were withdrawn after randomization (5 patients from the IG and 6 patients from the CG), five were lost to follow-up (3 patients in the IG and 2 patients in the CG), and three refused to continue (3 patients in the IG and 0 patient in the CG). Thus, a total of 121 stroke patients completed the study and were randomly assigned to the IG (N = 59) and CG (N = 62). The mean age in the IG and CG was 55.41 ± 6.78 years and 56.41 ± 6.13 years, respectively. No significant differences in baseline demographic parameters and clinical features, including age, gender, level of education, residential location, duration of stroke, type of stroke, and SF-36 physical component score were identified between the groups (Table 2).

Comparison of Fugl-Meyer assessment and Modified Ashworth scale scores of the two groups

There were no significant differences observed between the FMA scores in the IG and CG at 0 (the baseline) (t = 0.57, p = .572) and 3 months after initiation of rehabilitation (t = 1.43, p = .153). FMA scores of the IG patients were significantly greater than those of the CG patients at the 6- and 12-month follow-ups (t = 6.14, p t = 8.03, p t = −2.27, p = .031; t = −3.66, p p p p p = .002), but there was no significant between-group effect (MAS: F = 1.15, p p = .302). These results indicated that the comparisons of lower limb extremity motor performance and spasticity of IG patients showed great improvement than CG patients. However, no significant difference in MAS scores were identified at 0 or 3 months between the two groups (t = 0.32, p = .721; t = 0.85, p = .393, respectively) (Table 3).

Comparison of gait speed and step size of the two groups

At 0 and 3 months, the between-group differences in gait speed (t = −0.76, p = .451; t = 0.63, p = .532, respectively) and step size (t = −0.75, p = .464; t = −0.39, p = .691, respectively) were not statistically significant. However, the gait speed of the IG patients was significantly higher than the CG patients at 6 months (0.64 ± 0.31 vs. 0.53 ± 0.29, t = 2.02, p = .042) and 12 months (0.75 ± 0.32 vs. 0.58 ± 0.31, t = 2.97, p t = 2.24, p = .032; 0.71 ± 0.28 vs. 0.54 ± 0.27, t = 3.41, p p = .003; step-size: F = 8.91, p = .001) and interaction effect (gait speed: F = 5.45, p = .010; step-size: F = 5.93, p = .008), but there was no significant between-group effect (gait speed: F = 0.69, p = .376;

step-size: F = 0.49, *p* = .537) (Table 3).

Comparison of Barthel Index score of the two groups

We further assessed the ADL of the two groups by assessing the BI score. As shown in Table 3, the BI scores among intervention patients gradually increased over time and were significantly higher than those of the CG patients, especially at the 3, 6, and 12-month follow-ups (*t* = 2.26, *p* = .033; *t* = 4.75, *p* = .002; *t* = 6.05, *p* p p p = .122) (Table 3).

Discussion

This study showed that HREPro led by a trained APRN produced significantly greater improvements in motor performance, spasticity, walking ability, and ability to perform ADL among patients with lower limb spasticity post-stroke than that achieved through conventional rehabilitation. To the best of our knowledge, this is the first study to investigate the possible functional effectiveness of a progressive and semi-supervised HREPro for the rehabilitation of patients with lower limb spasticity post-stroke.

Home-based rehabilitation programs have been demonstrated to be at least as good as hospital-based postoperative rehabilitation programs for patients in terms of achieving functional improvement (including pain relief, walking, balancing, and achieving functionality) [31]. In addition, home-based exercise programs have also been reported to be effective in improving functional mobility and quality of life in sedentary elderly people, even without constant supervision during exercise [32]. Although exercise has been recommended post-stroke, few people exercise after stroke, and even fewer commence long-term exercise [33]; hence, innovative interventions are required to promote and maintain exercise after stroke. Based on these previous studies, this study investigated the possible functional effectiveness of HREPro led by a trained ARPN for patients with lower limb spasticity post-stroke.

The results showed that the FMA scores among patients in the IG were higher than those among patients in the CG at 6 and 12 months after initiation of the respective rehabilitation regimes. Furthermore, the MAS scores among IG patients decreased significantly compared with those of CG patients at 6- and 12-month follow-ups, indicating a significant improvement in lower limb spasticity. This may be attributed to the increased number of motion repetitions along with a larger envelope of motion and multijoint coordination. It is known that lower limb motor recovery correlates significantly with gait speed and step size [34], which can be assessed with the 10-Meter Walk Test. Studies have shown that strengthening exercise of the ankle joint can improve mobility in patients after stroke [35]. The gait speed and step size among patients in the IG were also significantly improved 6 months after initiation of rehabilitation compared with those among patients in the CG, which may be associated with increased joint exercise in IG patients. Overall, the results showed that patients in the IG had a significantly improved lower extremity motor performance with reduced spasticity compared with that of patients in the CG at 6 and 12 months post-stroke, which suggests that the HREPro is not effective in the short-term but can effectively improve lower limb spasticity in the long-term. It has been reported that home-based rehabilitation programs improve the functional capacity of patients with motor impairment, as indicated by the BI [19]. The ADL of the two groups were assessed using the BI, and the scores achieved by the intervention patients were found to be significantly higher than those obtained by the CG patients, which demonstrated that HREPro greatly improved the patients' ability to perform their ADL over time.

The exercises for this study were selected based on their applicability in the home environment, simplicity, no requirement of equipment, and focus on activating the joint and relaxing the muscle. A previous study on home-based exercise led by a nurse was noted to be effective for patients with cardiovascular disease, which increased the participation and adherence rates of the patients [36]. The HREPro in this study was led and followed up by a trained ARPN, which benefited patients with long-term exercise. In addition, the longitudinal design of the study allowed us to assess the effects of HREPro over time (over 3, 6, and 12 months).

However, the present study has a few limitations. Firstly, the study did not evaluate the range of motion of the lower limb joints or adjustment of the muscle tone, which are restricted by lower limb spasticity. Secondly, as this study is a semi-supervised, home-based study, which may affect the frequency of exercise sessions and generate a risk of bias. Lastly, this was a single-center study with a small number of participants, which limits the statistical power of the results derived from the study. Thus, more extensive multicenter studies with larger cohorts are warranted to evaluate and establish the effectiveness of HREPro for stroke patients with lower limb spasticity.

Conclusion

This single-blind, randomized controlled study provides evidence that APRN-guided HREPro is beneficial in the recovery of patients with lower limb spasticity post-stroke by promoting the recovery of motor function, reducing muscle spasticity, improving walking ability, and enhancing ADL. Thus, HREPro, an effective intervention guided by APRN with favorable home application, may be beneficial for improving lower limb spasticity in post-stroke patients at their homes. Rehabilitation nurses can guide patients in continuing their home-based exercise program. Overall, the present study provides evidence for the benefits of an HREPro in the recovery of lower limb spasticity post-stroke. Further longitudinal, large-scale, multicenter, and double-blind randomized controlled studies are required to corroborate the findings of this study.

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Conflict of interest

There are no conflicts of interest.

Exercise	Performance	Repetitions
Ankle back extension training	Keep patient with supine position, hold the upper end of the ankle by one hand and press down, hold the upper of the foot by another hand and move up. The extension angle shall not exceed 20°	Hold 5–15 s at end range, repeat 15 times or more per day
Ankle plantar flexion training	Keep patient with supine position, hold the upper end of the ankle by one hand and press down, hold the upper of the foot in one hand and move down. The flexion extension angle shall not exceed 50°	Hold 5–15 s at end range, repeat 15 times or more per day
Ankle varus and valgus training	Keep patient with supine position, hold the upper end of the ankle by one hand and press down, hold the upper of the foot by another hand and move inside/outside. The angle shall not exceed 30°	Hold 5–15 s at end range, repeat 15 times or more per day
Hamstring stretch training	Keep patient with supine position, press knee joint by one hand and another hand hold the heel, then move the lower limb upward. The angle shall not exceed 80°	Hold 5–15 s at end range, repeat 15 times or more per day
Hip and knee flexion training	Keep patient with supine position, press knee joint by one hand and another hand holds the heel, make the hip and knee flex	Hold 5–15 s at end range, repeat 15 times or more per day

Hip abduction and adduction training	Keep patient with supine position, press knee joint by one hand and straight move the lower limbs inward/outward	Hold 5–15 s at end range, repeat 15 times or more per day
Sit-up and standing balance training	Extend hands forward, stay standing and maintain balance	Maintain 5–10min, repeat 4 times per day
Standing and bending to pick up	Slowly bend over and pick up ground items after standing	Repeat 10 times or more per day
Straight leg lifting	Keep patient with supine position and straighten lower limbs	Hold 5–15 s at end range, repeat 15 times or more per day
Climbing stairs	Slowly climb stairs to improve lower limb coordination	Maintain 10–20min, repeat 2 times per day

	IG (n = 59) Mean ± SD or N (%)	CG (n = 62) Mean ± SD or N(%)	t/χ^2	p
Age (yrs)	55.41 ± 6.78	56.41 ± 6.13	.85	.391
Men	41 (68.3)	44 (73.3)	.16	.692
Education attainment				
None	4 (6.8)	5 (8.1)		
Low	35 (59.3)	36 (58.1)		
Middle	12 (20.3)	12 (19.3)		
High	8 (13.5)	9 (14.5)	.52	.493
Location of residence				
Urban	35 (59.3)	36 (58.1)		
Rural	24 (40.7)	26 (41.9)	.31	.591
Disease duration (mo)	3.41 ± 0.79	3.23 ± 0.82	.22	.224
Stroke type				

Cerebral infarction	25 (42.4)	27 (43.55)		
Cerebral hemorrhage	34 (57.6)	35 (56.45)	.31	.583
SF-36 Physical Component Scale	57.34 ± 10.23	55.21 ± 11.19	1.09	.284

	Pre-test	Post-test at 3 months	Post-test at 6 months	Post-test at 12 months	Sources	F	P
FMA of spasticity measurement							
IG(Mean ± SD)	12.66 ± 3.01	14.82 ± 3.16	21.23 ± 3.71	24.82 ± 3.31	Group	1.42	.172
CG(Mean ± SD)	12.36 ± 2.78	14.03 ± 2.91	17.19 ± 3.53	20.16 ± 3.07	Time	14.31	<.001
t	0.57	1.43	6.14	8.03	Group*Time	6.91	.007
p	.572	<.001	<.001	<.001			
MAS of motor function							
IG(Mean ± SD)	3.32 ± 0.81	3.19 ± 1.02	1.89 ± 1.08	1.07 ± 0.89	Group	1.03	.199
CG(Mean ± SD)	3.27 ± 0.71	3.04 ± 0.92	2.35 ± 1.15	1.69 ± 0.97	Time	16.32	<.001
t	0.36	0.85	–2.27	–3.66	Group*Time	7.73	.004
p	.721	.393	.031	<.001			
Gait speed							
IG(Mean ± SD)	0.34 ± 0.19	0.45 ± 0.25	0.64 ± 0.31	0.75 ± 0.32	Group	0.83	.263
CG(Mean ± SD)	0.37 ± 0.24	0.42 ± 0.27	0.53 ± 0.29	0.58 ± 0.31	Time	7.41	.003

t	–0.76	0.63	2.02	2.97	Group*Time	5.92	.011
p	.451	.532	.042	<.001			
Step size							
IG(Mean ± SD)	0.31 ± 0.21	0.41 ± 0.26	0.59 ± 0.24	0.71 ± 0.28	Group	0.63	.472
CG(Mean ± SD)	0.34 ± 0.23	0.43 ± 0.29	0.49 ± 0.25	0.54 ± 0.27	Time	8.45	.001
t	–0.75	–0.39	2.24	3.41	Group*Time	7.81	.003
p	.464	.691	.032	<.001			
BI							
IG(Mean ± SD)	36.64 ± 7.85	59.43 ± 10.19	69.64 ± 11.52	85.38 ± 14.53	Group	1.83	.105
CG(Mean ± SD)	35.13 ± 8.17	55.38 ± 9.54	60.45 ± 9.74	71.43 ± 10.61	Time	14.93	<.001
t	1.04	2.26	4.75	6.05	Group*Time	9.98	<.001
p	.311	.033	.002	<.001			

DETAILS

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Document 28 of 29

Causal Attributions and Quality of Life of Korean Breast Cancer Survivors

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ABSTRACT (ENGLISH)

Purpose

The purpose of this study was threefold: to explore the causal attributions of breast cancer, examine underlying factors of the attributes, and determine their relationship to quality of life among Korean breast cancer survivors.

Methods

The study used a descriptive correlational design, which included quantitative survey questionnaires and an open-ended question to complement the study. Three hundred and three breast cancer survivors were recruited from two university hospitals in South Korea, between January and April 2018. The causal attributions were explored using the Illness Perception Questionnaire Revised and an open-ended question. The survivors' quality of life was assessed using the Functional Assessment of Cancer Therapy for Breast Cancer. The quantitative analysis was performed using the SPSS 25.0 software package; the ATLAS.ti 8 software was used for thematic analysis.

Results

Quantitative and qualitative data of 321 and 238 breast cancer survivors, respectively, were analyzed. “Stress and worry” and “diet or eating habits” were believed to be the two most likely causes of breast cancer. Eleven new causal attributes emerged from the analysis. Being diagnosed with breast cancer at an older age ($p < .05$), having received chemotherapy ($p < .05$), and holding nonbehavioral causal attributes ($p < .001$), were significantly related to lower quality of life.

Conclusion

There were differences between the survivors' beliefs on their causes of disease, and causal factors available from the literature. As the survivors' causal attributes were significantly related to their quality of life, healthcare providers should individually assess and incorporate these attributes into their care.

FULL TEXT

Introduction

Breast cancer is by far the most commonly diagnosed cancer in women [1]. Although the global incidence of breast cancer has declined from 25.1% in 2012 to 11.6% in 2018, it is still ranked second after lung cancer, by a small margin [1,2]. During the same period, the global mortality has declined from 14.7% to 6.6%, raising the number of breast cancer survivors [1,2]. In 2017, similar to global trends, breast cancer ranked second among new cancer cases in Korean women [3]. The average increase rate in yearly new diagnosis of breast cancer is 4.6%, whereas other cancers (e.g., stomach, colon, liver, thyroid, cervical) show decreases in average yearly diagnosis rates [3]. The five-year and 10-year breast cancer survival rates are 93.2% and 87.7%, respectively [3]. This diagnosis rate is higher than other cancers, including stomach cancer (74.6% and 66.8%) and cervical cancer (80.2% and 77.2%) [3]. This trend implies that the population living with breast cancer is increasing and will continue to increase [3]. The management of physical and psychosocial symptoms, caused either by breast cancer or therapy, have therefore gained particular importance [4].

According to Weiner's attribution theory, the understanding of the cause of a phenomenon influences the future expectations, related emotions, and behavioral motivation [5]. The theory includes the three properties of locus, stability, and controllability [5,6]. Locus refers to where a person believes the causes are from (internal vs. external) [6]. Stability refers to whether a person believes the causes are changeable (stable vs. unstable) [6]. Lastly, controllability refers to whether a person believes the causes are in their control [6]. Based on these properties, a person perceives causal attributions [6]. The theory propounds that individual's perceived causal attribution is more important in shaping personal experiences of a certain life event than the understanding of the real cause [7]. Therefore, the attribution theory is often used to understand individual attitudes and perceptions related to disease [8], motivation, and compliance to treatments [7,9].

The causal attributes of cancer survivors have been studied among people with childhood cancer [10], lung cancer [11] and breast cancer [12,13]. In particular, causal attribution was found to be associated with the fear of cancer recurrence and psychological well-being in women with breast cancer [12]. Therefore, the understanding of individual causal attributes is believed to be helpful in providing nursing education and psychological support [13]. A study conducted in Australia reported that many of the women in that cohort attributed their breast cancer to stress, chance or bad luck, and aging [12]. Similar findings were found in a study conducted in France, which reported stress, genetic causes, hormones, and poor diet as the four most possible causes of breast cancer [13]. However, relatively few studies have been conducted in Asian countries.

Based on Bernard Weiner's attribution theory and the aforementioned studies, we hypothesized that causal explanations influence individuals' overall emotions and behaviors, which consequently influence overall quality of life (QoL). Considering that Korea is an Asian country with a high incidence of breast cancer [14], it would be meaningful to explore the causal attributes of breast cancer and their associations with QoL. This study aimed to 1) explore causal attributes of breast cancer among Korean breast cancer survivors, 2) examine underlying factors of causal attributes, and 3) determine the relationships between causal attributes and the survivors' QoL. Weiner's attribution theory underpinned our study. The three properties of causal attributes were explored through the first aim. The property of controllability was examined in detail through the second aim. The influence of attributes on a person's disease experience was explored through the third aim.

Methods Study design

The study used a descriptive correlational design, which included quantitative survey questionnaires and an open-ended question. After answering a list of quantitative survey questionnaires, the participants were asked to describe the three most likely causes of their breast cancer in their own languages. This triangulation was used for the first aim of the study: to achieve comprehensive data of the causal attributes of breast cancer among Korean survivors (i.e., a relatively less frequently studied population) and to identify any new or culturally specific causal attributes that were not included in the quantitative questionnaire [15,16].

Sample and settings

Breast cancer survivors were recruited from the two university hospitals in South Korea between January and April 2018, using a convenience sampling method. The data collection of each participant was done on the day of recruitment. The two university hospitals were chosen as they were major hospitals of the authors' affiliated university. Both hospitals were private university hospitals with over 500- and 800-bed capacities, respectively. The sample size was calculated based on the multiple regression, using the G*Power 3.1.9.2 analysis software [17]. A sample size of 296 was suggested for this study, with a power of .80, alpha level of .05, and an effect size of .30. We recruited 330 participants based on the rate of discontinuation of follow-up among cancer survivors, reported in a previous study [18]. This sample size was adequate for the exploratory factor analysis (EFA), another analytic method used in this study [19]. Female breast cancer survivors who could read, speak, and understand the Korean language, and voluntarily signed the informed consent form, were included in the study. Breast cancer survivors with stage 4 cancer or diagnosed cognitive impairments were excluded from the study.

Data collection

This cross-sectional study was approved by the Institutional Review Board of the authors' affiliated institution (Approval no. XC17QEDI0080S). The research team consisted of the project investigator and two research assistants who visited each of the two hospitals two days a week. The research assistants were graduate-level nursing students who do not work in the participating hospitals. The study was explained to the collaborating physicians of breast cancer outpatient units. They were asked to hand out study advertisement leaflets to the survivors who visit their office and meet the inclusion criteria of the study. Once the survivors complete their physician visits, the research assistants guided them to a separate room. To minimize the response bias, the survivors learned more about the study, signed informed consent, and answered the 10-minute length study questionnaires without the presence of their healthcare providers.

A total of 165 participants were enrolled from the first hospital and 168 from the second hospital. For the validity of the study, the six participants from each hospital who missed over 10% of the total questions were excluded from the study [20]. The missing data of the remaining participants' were assessed for missing at randomness, and all analyses were conducted with full information maximum-likelihood estimation [21]. Data from 159 and 162 participants of each hospital were included in this study.

Study instruments

A total of 12 items were based on demographic (e.g., age and region) and disease-related factors (e.g., breast cancer stage and treatment). The causal attributes of breast cancer were assessed using the “causes” dimension of the Illness Perception Questionnaire Revised (IPQ-R) [22]. The dimension has a list of 18 possible causes of illness (e.g., stress, hereditary, diet or eating habits) and a free text section to state the three most important factors that they believe have caused the illness. The 18 items were rated from “strongly disagree” to “strongly agree.” For the purposes of this study, we scored each item based on an article [23] from the IPQ-R scoring guideline [24] as follows: “strongly disagree” = 1; “disagree” = 2; “neither agree nor disagree” = 3; “agree” = 4; “strongly agree” = 5. The Korean version of IPQ-R [24] demonstrated a Cronbach's α of .87. The “causes” dimension analyzed in this study demonstrated a Cronbach's α of .85. In addition to these quantitative questions, the participants were asked to describe the three most possible causes of their breast cancer in plain language. This open-ended question was asked to explore how participants described the causal attributes in their own language and to identify any new causal attributes that were not included in the IPQ-R.

The participant's QoL was measured using the Functional Assessment of Cancer Therapy for Breast Cancer (FACT-B) [25]. It has 37 items scored on a five-point Likert scale. The FACT-B has five subscales: physical sense of well-being assessed from seven items (score range: 0–28), social well-being from seven items (score range: 0–28), emotional well-being from six items (score range: 0–24), functional well-being from seven items (score range: 0–28), and breast cancer–specific well-being from 10 items (score range: 0–40). The Korean version of the FACT-B was used in this study; it demonstrated a Cronbach's α of .73.

Data analysis

The SPSS 25.0 statistical software package (IBM Corp., Armonk, NY, USA) was used to analyze quantitative data. The ATLAS.ti 8 software package (ATLAS.ti Scientific Software Development GmbH, Berlin, Germany) was used to analyze the qualitative data from the IPQ-R “causes” dimension. The participants' demographic and disease-related factors were analyzed using descriptive analyses. For the first aim of the study, the causal attributes of the participants were analyzed using descriptive analyses and were ranked from the most to the least likely cause. The participants' free text data, explaining their belief on the causal attributes, were analyzed using the thematic analysis of elementary contexts methods [26]. This analytic method was chosen over content analysis as it provides flexibility in coding and better explains the relatively new phenomenon [27]. We followed the analytic process by Braun and Clarke [28]. First, the research team repeatedly read the data to get familiarized. Second, the participants' first, second, and third beliefs on the causes of their breast cancer were coded separately. The 18 causes from the IPQ-R were used as initial codes. Third, any new emergent causes were labeled as new codes and clustered into themes. Fourth, the themes were reviewed and ranked by the number of code occurrences.

For the second aim of the study, EFA was performed to further examine the underlying relationships among causes [29]. The detailed eight steps suggested by Henselmans et al. [30] were used for performing EFA. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and the Bartlett's test of sphericity were used for checking factorability of the data [29]. The KMO exceeded .60 in our study, which meant the data are adequate for performing EFA [29]. The number of factors was decided based on the results of the scree plot, parallel analysis, and an Eigen value of over 1.00 [29,31]. A factor loading cutoff of .40 was applied to this analysis [29]. Finally, the identified item clusters were examined for statistical and clinical/theoretical significance.

To determine the relationships between the causal attributes and the survivors' QoL, the third aim of the study, Spearman's rank-order correlation analyses were performed between each causal attribute and the survivors' QoL. Next, univariate and hierarchical regressions were performed using the identified factors from EFA and demographic and disease-related factors. The independent variables included in the regression were based on previous studies [12,13].

Results Characteristics of the participants

The participants' demographic and disease-related factors are summarized in Table 1. The mean age of the participants was 55.56 years. Their mean age at diagnosis was 52.08 years, and time since diagnosis was 3.47 years. Most of the participants had stage 1 (43.6%) or stage 2 (37.5%) breast cancer. A total of 26.3% and 12.1% of participants reported having hormone receptor–positive and human epidermal growth factor receptor 2–positive breast cancer, respectively. Many participants were receiving adjuvant hormonal therapy (42.7%). In the course of their treatment, 58.3%, 44.5%, and 40.2% of the participants reported having received surgery, radiation therapy, and chemotherapy, respectively. The participants' total QoL scored 92.28 of 148 (62.4%). The subscores or QoL related to physical well-being was the highest (scored 20.33 of 28; 72.6%) and breast cancer–specific QoL was the lowest (scored 22.53 of 40; 56.3%).

Causal attributes of breast cancer (aim #1)

Quantitative data. The causal attributes of breast cancer are presented in Figure 1. The top five most likely causes of breast cancer, as per the participants' beliefs were “stress or worry” (3.95 ± 1.01; mean ± standard deviation), “diet or eating habit” (3.41 ± 1.04), “altered immunity” (3.38 ± 1.06), “over work” (3.38 ± 1.03), and “poor medical care in my past” (3.37 ± 1.13). The least five causes that participants indicated were “accident or injury” (1.87 ± 0.94), “smoking” (1.94 ± 1.06), “alcohol” (2.12 ± 1.14), “a germ or virus” (2.45 ± 0.98), and “hereditary” (2.64 ± 1.27). The variation in participants' responses was highest for “hereditary” and lowest for “accident or injury.”

Qualitative data. A total of 238 participants provided answers to the open-ended question on their belief on the causal attributes. A total of 16 of 18 causes from the IPQ-R appeared (i.e., causes “a germ or virus” and “my own behavior” did not appear in qualitative data). The first and second most frequently mentioned causal attributes of breast cancer were similar to that of quantitative data, which were “stress or worries” and “diet or eating habits.” “Stress or worries” was mentioned 177 times (29.8% of all codes). “Diet or eating habits” was mentioned 79 times (13.3%). “Poor medical care in my past” was the third most frequently mentioned (8.2%), “hereditary” and “my personality” were the fourth (5.7%), and “overwork” was the fifth (5.0%).

In addition to the causes from the IPQ-R, 11 causes were newly identified from the participants' responses constituting 11.6% of all codes. Some of the participants thought that they had breast cancer because their body was too cold or was born to be weak (“physical constitution”). The use of medication, including hormonal replacement and oral contraceptives, was mentioned as possible causes (“medication”). Some believed that being overweight or obese caused breast cancer (“weight”). The exposure to electromagnetic radiation and chemicals from the working and living environments (“exposure”), not having breastfed their child, or breastfeeding for a short period (“breast feeding”) were believed to cause their breast cancer. “Fatigue” and “anger” were often mentioned as the causes of breast cancer. Some of the survivors attributed their breast cancer to being nulliparous or a past experience of abortion (“pregnancy”). Low-quality sleep from doing night shifts, irregular sleeping hours, and lack of sleep were another causal attributes of breast cancer (“sleep disturbances”). One participant each attributed breast cancer to her doctor not providing adequate screening tests (“screening tests”) and to diabetes (“another illness”), respectively.

Factors of causal attributes (aim #2)

The initial analysis including all 18 causes yielded five factors. The causes “aging” and “chance or bad luck” had very low loading and was excluded from the analysis. Factors 4 and 5 comprised two and one cause, respectively; this was unfavorable for EFA (Each factor is recommended to have at least three items). Moreover, the reliability of factor 4 was .52, which was also unfavorable for EFA. Therefore, we decided to limit the factor analysis to the top 10 causes that the participants indicated as the cause of breast cancer (Table 2).

The KMO Measure of Sampling Adequacy of these 10 causes was .814. The Bartlett's test of sphericity was significant (X^2 = 818.52, *p* 29].

Factor 1 was labeled “nonbehavioral” causes. Factor 2 was labeled “behavioral” as it included the following causes: “poor medical care in my past,” “my own behavior,” and “diet or eating habits.” The Cronbach's α of factors 1 and 2 were .76 and .77.

Relationships between causal attributes and the QoL (aim #3)

Table 3 demonstrates the correlations between each of the 18 causal attributes and the survivors' QoL. Except for the causal attributes of heredity, alcohol, smoking, and immunity, the other causal attributes showed statistically significant negative correlations to QoL. The relationships between the identified factors from EFA and the survivors' QoL are shown in Table 4. The findings of univariate analysis showed that the survivors' year since diagnosis (*F* = 1.58, *p* = .029), having advanced cancer (*F* = 11.37, *p* F = 1.84, *p* = .012), and factor 2 (behavioral causal attributes) (*F* = 2.00, *p* = .029), were significantly related to their QoL.

The first model of hierarchical regression, which included demographic factors, explained 3.1% of the variance in the overall QoL among breast cancer survivors. However, it was statistically insignificant. The entry of identified factors from EFA explained an additional 12.0% of the variance in the overall QoL (R^2 change = .11; R^2 = .15, *p* p = .049) and 2 (β = −.15, *p* = .040). In addition, the participants' age at diagnosis (β = −.14, *p* = .013) and factor 1 (nonbehavioral causal attributes) (β = −.30, *p* **Discussion**

In this study, the causal attributes of breast cancer and their relationships to the survivors' QoL were examined among Korean breast cancer survivors. The differences between breast cancer survivors' beliefs on the causes of breast cancer and causal factors available from experts and the literature were noted from the study findings. The causal factors of breast cancer, which are supported by convincing evidence in the literature include both, nonbehavioral (e.g., age and genetics) and behavioral (e.g., physical inactivity, alcohol consumption, and shorter duration of breast feeding) factors [32,33]. In this study, however, the cause “aging” ranked 11th, “hereditary” ranked 14th, and “alcohol” ranked 16th among the 18 causal attributes. The most of the survivors reported “stress or worry” (ranked 1st) or “diet or eating habits” (ranked 2nd) to be the cause of their breast cancer. This finding was consistent with that of a qualitative study that explored causal attributes among Chinese American, Korean American, and Mexican American breast cancer survivors [34]. The three common causal themes were stress, diet, and fatalism [34]. On the contrary, the findings in previous studies with predominantly Caucasian participants were different. In a study on 322 breast cancer survivors in Canada, the most frequently mentioned cause of breast cancer was stress (42.2%), while diet (15.5%) was relatively less mentioned [35]. Similarly, a systematic review on 22 studies, mostly conducted in Western countries, reported stress, family history, and fate as being the most possible causes of cancer, while life style factors (e.g., diet and physical activities) were reported to be less possible [12]. Individual beliefs on health and behaviors are frequently reported to be influenced by culture [34]. Therefore, to provide personalized and effective nursing care, individual cultures and beliefs need to be considered [5,35].

The newly identified causal attributes may be interpreted as unique beliefs of Asian and, particularly, Korean breast cancer survivors. These findings supplement the aforementioned findings from the quantitative analysis by providing causal attributes through survivors' own words (rather than choosing from predetermined causal options). The causal attributes of “physical constitution” included concepts of yin-yang imbalance (a belief that their body was too cold, and this caused breast cancer) [36]. This belief may be understood from a body–mind–spirit model in health, which provides a holistic understanding of individual health being influenced by personal and environmental traits [37]. The causal attribute of “anger” may be interpreted from the perspective of Hwabyung, a culture-related anger syndrome, in Korea [38]. This syndrome is listed in the Diagnostic and Statistical Manual of Mental Disorders, fifth edition [39]. A cluster of symptoms generated by chronically, mostly culturally, suppressed anger is called the Hwabyung syndrome [38]. This interpretation needs to be further explored, as no previous studies have explored Hwabyung as a risk factor for cancer. On the other hand, several studies have found suppressed anger as a risk factor for cancer [40,41] or have found no relationship between anger and cancer [42]. Additional studies are needed to explain the causal attribute of anger. Considering these newly emerged factors may help to provide culturally sensitive care to survivors [34].

The findings of the exploratory factor analysis showed that many participants attributed their breast cancer to the nonbehavioral factors (e.g., emotional state, family problems, and stress), rather than the behavioral factors (e.g., poor medical care, diet or eating habits). This finding is consistent to the findings of systematic review on causal attributes, which recommended the increase of awareness of lifestyle/behavioral attributes [32]. Many of the behavioral factors (e.g., overweightness, physical activities) reported to be risk factors for breast cancer are also influential factors in cancer recurrence and prognosis [35,43]. Nurses can support healthier lives among survivors life by providing education on these behavioral factors, which include healthy eating and increasing physical activity [44]. Breast cancer survivors with more of nonbehavioral causal attributes reported a lower overall QoL in this study. In previous studies, causal attributes such as emotional states (e.g., depression or anxiety) or personality traits (e.g., neuroticism) have been shown to have significant relationships with the QoL [45]. It is possible that survivors feel hopeless because they believe that their cancer was caused by factors they had no control over or could not change. For instance, studies on women with hereditary breast cancer have reported high levels of tension and depression, which were not easily relieved despite patient education or help from support groups [46]. Considering the QoL for Korean breast cancer survivors has been emphasized because of their relatively higher survival rate and longer life expectancy than other cancer types. Thus, identifying and addressing factors related to their QoL is important [3].

Study limitations

The present study has several limitations. First, more factors related to breast cancer could have been included in the analysis model. Age at menarche, age at first pregnancy, parity, and length of breast feeding are some of the factors related to breast cancer risk factors and prognosis [43]. Collecting and analyzing these data would allow further exploration of possible influences on the survivors' QoL. Second, the study relied on responses of breast cancer survivors. Many of them did not know their specific cancer type (e.g., hormone receptor positive or negative). Because treatments and disease experience vary by tumor subtypes, collection of reliable data is important [47]. Chart reviews may be included in future studies, in addition to participants' response. Third, the study's internal validity may be lower because it asked open-ended questions to explore the causal attributes of the disease soon after asking about the attributes through multiple choice questions. The participants' answers to the open-ended questions could have been affected by the previous multiple choice questions. Fourth, only 74% of the participants who provided quantitative answers for the causal attributes answered an open-ended question and provided qualitative answers regarding the causal attributes. This lower response rate may be explained by the participants' busy outpatient schedules, because survivors often visit multiple providers or receive follow-up tests during their regular visits. Considering that many of the survivors suffer from peripheral neuropathy as a side effect of their treatment, it is possible that it was uncomfortable for survivors to write phrases and sentences. The research assistants could have asked the participants if they needed additional support to answer this open-ended question. Fifth, the generalizability of the study findings is limited, as it included nonrepresentative Korean breast cancer survivors from a limited number of hospitals.

Implications for nursing

Several suggestions emerged for the nursing practices. First, the differences among breast cancer survivors' beliefs on the causes of breast cancer need to be individually assessed and considered in nursing, as they are significantly related to QoL. In particular, special consideration is needed for survivors who believe their cancer is from nonbehavioral causal factors, as they tend to report a poor QoL. Second, more emphasis needs to be placed on behavioral factors. The survivors can benefit from health educations which provide evidence-based information for healthier lifestyles/behaviors. Third, the new causal attributes that emerged from this study may be considered in health care. As beliefs on health and behaviors are influenced by culture, understanding culturally specific factors would be helpful in clinical practices. In this sense, findings of this study can be useful in designing future interventions for this specific population.

Conclusions

This study explored causal attributes among Korean breast cancer survivors. While ranking the 18 causal attributes of the IPQ-R from the most to the least possible, 11 new causal attributes were identified through this study. As seen in previous studies, the most frequently mentioned causal attributes were stress/worry and diet/eating habits. The newly identified causal attributes need to be further explored in future studies, as they might be specific to Korean breast cancer survivors. Special consideration is needed for survivors who were diagnosed with breast cancer at an older age, received chemotherapy, and hold nonbehavioral causal attributes, as they tend to have a lower QoL. The understanding of causal attributes in breast cancer survivors and their correlation with QoL will allow nurses to deliver more efficient care and education to survivors.

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Conflict of interest

The authors declare that they have no conflict of interest.

Characteristics			Mean ± SD or N (%)
Age (years)			55.56 ± 10.21
Age at diagnosis			52.08 ± 10.04
Years since diagnosis			3.47 ± 3.52
Breast cancer	Stage	0 (DCIS)	7 (2.4)
1	127 (43.6)	2	109 (37.5)
3	40 (13.7)	4	8 (2.7)
Type	HR (positive)	75 (26.3)	HER2 (positive)
33 (12.1)	Current treatment	Type	Hormonal therapy
137 (42.7)	Chemotherapy	80 (24.9)	Radiation therapy
38 (11.8)	Past treatment	Surgery	Partial mastectomy
137 (43.4)	Mastectomy	47 (14.9)	Hormonal therapy
69 (21.5)	Chemotherapy		129 (40.2)

Radiation therapy	143 (44.5)	Quality of life

Rank	Causes	Factor 1: nonbehavioral	Factor 2: behavioral	Communalities
8	My emotional state	.76	.11	.59
6	Family problems or worries	.69	.19	.51
1	Stress or worry	.65	.12	.44
3	Altered immunity	.62	.06	.39
4	Overwork	.58	.34	.46
10	My personality	.57	.23	.38
7	Pollution in the environment	.46	.31	.33
5	Poor medical care in my past	.14	.83	.72
9	My own behavior	.18	.79	.66
2	Diet or eating habits	.18	.78	.63
Variance (%)		37.0	13.1	
Cronbach's α		.76	.77	

Variables	Spearman's correlation	Variables	Spearman's correlation
1. Stress or worry	−.156 (.005)	10. Family problems or worries	−.253 (<.001)
2. Hereditary	−.037 (.511)	11. Overwork	−.183 (.001)
3. A germ or virus	−.154 (.006)	12. My emotional state	−.327 (<.001)
4. Diet or eating habit	−.119 (.033)	13. Aging	−.179 (.002)
5. Chance or bad luck	−.167 (.003)	14. Alcohol	−.082 (.142)

6. Poor medical care in my past	−.177 (.001)	15. Smoking	−.089 (.112)
7. Pollution in the environment	−.120 (.032)	16. Accident or injury	−.138 (.013)
8. My own behavior	−.133 (.017)	17. My personality	−.244 (<.001)
9. My mental attitude	−.293 (<.001)	18. Altered immunity	−.084 (.134)

Variables	Univariate analysis		Hierarchical regression analysis							
Model 1				Model 2				F	p	B
SE (B)	β	p	B	SE (B)	β	P	(Constant)			102.75
6.98		<.001	144.51	9.43		<.001	Age at diagnosis	1.21	.201	−0.21
0.12	−.10	.084	−0.30	0.12	−.14	.013	Year since diagnosis	1.58	.029	0.46
0.39	.08	.230	0.49	0.36	.08	.178	Advanced cancer (Stage 3,4)	11.37	<.001	1.63

1.54	.06	.288	1.66	1.45	.06	.252	Surgery for breast cancer (Yes)	0.02	.881	0.34
3.52	.01	.924	0.13	3.32	.00	.968	Hormonal therapy for breast cancer (Yes)	0.99	.321	3.17
3.47	.06	.361	2.72	3.27	.05	.406	Chemotherapy for breast cancer (Yes)	2.54	.113	−6.60
3.35	−.15	.049	−6.52	3.15	−.15	.040	Radiation therapy for breast cancer (Yes)	0.27	.605	0.70

3.43	.02	.838	0.38	3.24	.01	.907	Factor 1 (nonbehavioral causal attributes)	1.84	.012	
			−1.34	0.27	−.30	<.001	Factor 2 (behavioral causal attributes)	2.00	.029	
			−0.57	0.49	−.07	.246	R^2/ R^2 change	.319		.03
.15/0.11				F	—		1.43			.194

DETAILS

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Document 29 of 29

Illness Experiences of Adults with Spina Bifida: Protecting the Whole Self

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ABSTRACT (ENGLISH)

SummaryPurpose

To understand and describe the illness experiences of adults with spina bifida (SB) which is an incurable birth defect and chronic condition that must be managed throughout life.

Methods

A qualitative study using grounded theory was adopted. Data were collected through individual interviews with 16 adults with SB between 2016 and 2017 in South Korea. All interviews were audiotaped, and the transcribed data were analyzed using constant comparative analysis.

Results

The basic socio-psychological process that underlies the illness experiences of adults with SB was identified as protecting the whole self. This consists of three stages: strict self-concealment, attempting self-disclosure, and balancing between self-concealment and self-disclosure. These stages reveal a process of establishing a firm sense of self by freeing oneself from the shame and stigma of society. Three different patterns of living emerged as a result: living as a non-disabled person, living as a marginal person between non-disabled and disabled, and living as a disabled person.

Conclusion

Adults with SB struggle to protect their whole self while managing their chronic conditions by having to constantly balance between self-concealment and self-disclosure. Intervention for adults with SB needs to be based on the stage of sociopsychological maturation. In the early stage, intervention needs to be focused on self-concealment to help establish a firm sense of self. On the other hand, in the later stage when psychological maturity occurs, an intervention that focuses on self-disclosure would be helpful so as not to be isolated from society.

FULL TEXT

Introduction

Spina bifida (SB) is a congenital birth defect caused by an incomplete closure of the neural tube and the spine. It is a disease classified as incurable and one that should be managed throughout life as a chronic condition. The prevalence of Koreans with SB has been increasing. The cases have increased from 2.7 SB cases per 10,000 live births between 2005 and 2006 [1] to 8.1 between 2008 and 2014 [2]. The rate of surviving to adulthood has also increased and ranges from 75.0% to 85.0% [3,4], resulting in a proportional increase of adults living with SB.

There are three types of SB: occulta, meningocele, and myelomeningocele. Myelomeningocele is the most serious type. While people with SB occulta and meningocele experience few or no symptoms, those with myelomeningocele experience more symptoms, ranging from mild to severe, including complete paralysis with bladder and bowel dysfunction, an inability to walk, and cognitive impairment. Those with severe symptoms are later exposed to various secondary complications, including pain, urological problems such as renal insufficiency, pressure ulcers, obesity, hypertension, and sexual dysfunctions [5–7]. Management typically begins soon after birth and may include bladder and bowel management regimens. It is reported that about 70% of people with SB have to manage urinary and/or fecal incontinence [8].

During childhood and adolescence, people with SB not only experience difficulties in managing physical symptoms and complications from the disease but also face psychosocial difficulties mainly due to teasing and bullying by their peers, especially at school [9–12]. In addition, most of them have further difficulties adapting to school because SB often affects learning abilities related to appropriate developmental tasks. They are also highly dependent on their parents who are often overprotective of their children [12,13], hindering autonomy and independence [14,15].

After becoming an adult, most adults with SB have a hard time establishing and maintaining a normal social life. Although they have learned self-management during childhood and adolescence, they still have various psychological and social problems that come along with managing their physical symptoms [16,17]. They tend to be more isolated and depressed when compared with control groups [18]. Their sexual function is reported to be very low [19–21], and their quality of life is also reported to be low [22,23]. And for those with severe difficulties controlling incontinence or with more severe levels of disability, normal social participation, such as dating, marriage, and employment, is especially restricted [20,24].

In South Korea, there had only been a few studies on this, but that has changed in recent years with research being conducted on children and adolescents to investigate factors affecting self-management [25] and the effectiveness of the bowel management programs [26,27]. Of those, only one study examined the sexual function and quality of life of adults with SB [28]. Also, most studies were conducted using quantitative methods, describing cause and effect or other variables specific to those studies. Thus, a more in-depth and comprehensive understanding of the lives of adults with SB is greatly needed for health professionals to better establish effective patient-centered interventions that could help those affected by this condition lead more productive lives and have a higher quality of life.

One of the advantages of a qualitative-method study is it produces an in-depth and comprehensive understanding of the participants' lives from their own perspectives rather than the researchers'. Among the many different qualitative methods available, grounded theory is based on symbolic interactionism, which is a theoretical approach to understanding the relationship between humans and society [29]. It assumes that people act on the premise of a shared understanding of meaning within their social context. Thus, using a grounded theory method would be very helpful to understand what kinds of problems adults with SB encounter while interacting with others and also how their actions and interactions are influenced by others while solving the problems they encounter. In sum, it would be beneficial to analyze and understand patterns of communication, interpretation, and adjustment between adults with SB and those with whom they interact.

This study used grounded theory to develop an explanatory theory of how adults with SB construct their own social realities by gaining a more substantive, data-driven view of these people. The research question for this study is “What is the adjustment process of the adults with SB?”

Methods Data collection

To recruit the participants, one of the researchers (first author) explained the purpose of the study to the president of the Korean Spina Bifida Patients Association (KSBPA) and asked her to introduce us to adults with SB who were articulate, reflective, and willing to share their illness experiences with the interviewer. The first two participants were recruited in this way. Then, theoretical sampling [30,31] was used to identify what data were needed to ensure that we had obtained exhaustive information. That is, the decision about what information to collect after the first two participants were interviewed was made by developing codes and categories that emerged from the initial analysis. The subsequent participants were recruited using snowball sampling [32], whereby those already in the study recruited other participants from among their acquaintances. In addition, physicians and nurses in an outpatient clinic for SB at one hospital were asked to introduce us to those who they presumed to be the most articulate adults with SB. The researcher contacted eligible participants by telephone. Only one refused to participate in the study due to the fear of privacy infringement.

Data were collected and analyzed between November 2016 and February 2017 in Seoul. Data collection was completed when the theoretical saturation was regarded to be accomplished at the end of the interview with the 16th participant. Among the 16 participants, 8 participants were interviewed in a hospital seminar room on the day of their hospital visit and the remaining participants at their homes. The semistructured interview began with open-ended questions, such as “Can you please tell me about your personal experiences related to your condition?” During the interview, they were encouraged to talk in detail about their experiences in their own terms. The interviewer listened carefully, using prompting questions and nonverbal cues, such as nodding, to obtain free-flow information that is considered to be highly credible. A list of previously prepared open-ended questions was also used to collect data on various issues in more depth. As the data collection and analysis were performed simultaneously, codes and categories that were identified during the initial analysis were used as interview questions in the later stages of data collection. Sociodemographic data were also collected after each interview (Table 1).

The average interview time was 2 hours, ranging from 1 to 4.5 hours. All interviews were audio-recorded and transcribed verbatim. To ensure the accuracy of the transcribed data and to supplement unclear data, follow-up interviews were conducted with all participants at least once by mobile phone or *Kakao Talk,* which is a *WhatsApp*-style messaging service in Korea.

Data analysis

The data were analyzed by two researchers. First, one researcher (first author) analyzed the data. Then, the initial analysis was reviewed by the other investigator, and any discrepancies were discussed and revised. The data were analyzed using constant comparative analysis through inductive processes by comparing consistencies, similarities, and differences. Coding procedures such as open coding, axial coding, and selective coding were used to build a theory from the data [30].

The actual processes were as follows: Open coding was performed after data were obtained from the first and second participants. For open coding, codes and categories were created by comparing relevant similarities and differences. Based on the codes and categories that emerged, more data were collected to examine and develop categories, their properties, and their dimensions. The analysis was expanded by comparing the codes and categories of each participant in this way. Axial coding was then carried out using a paradigm linking related categories to the causal conditions, phenomena, contextual conditions, intervening conditions, action/interaction strategies, and consequences. For selective coding, the core category was identified as *protecting the whole self*. All other categories were then integrated around this core category.

Data saturation in this study was reached after interviewing the 16th participant; by that point, no new information could be obtained, and further coding was no longer feasible.

Rigor

To ensure the rigor of this study, we used the qualitative evaluation criteria proposed by Sandelowski [33]. To ensure the credibility of the data, we made an effort to select information-rich participants using theoretical sampling and snowball sampling. Semistructured interviews with open-ended questions, audio-recordings, and verbatim transcriptions of all interviews also helped us to establish credibility. We followed the procedures of grounded theory to ensure the credibility of the analysis and interpretation.

We used memos during the whole process of analysis not only to develop codes and categories but also to identify relationships abstracted on a higher level of analysis in the later coding process. One of the researchers (first author) worked as a nurse teaching self-catheterization to patients with SB and their families for about 10 years and also worked as an outside advisor for the KSBPA. Writing memos on those professional experiences helped raise awareness about the subtleties of meaning within the data. We also used bracketing, which is a method to avoid harmful effects that may taint the research process due to the researchers' prior experiences and preconceptions [34]. In this way, the research process could be rooted solely on the research topic and questions. Credibility in our study was also assured by receiving feedback about the results of the analysis from three participants. Using data saturation to describe the illness experiences as thoroughly as possible also helped ensure credibility.

For fittingness or transferability, we included sociodemographic and medical characteristics of the participants in the report. Thorough descriptions using well-developed categories in multiple contexts helped increase the possibility that the findings would have meaning to other groups or in other contexts. To ensure auditability, we described the data collection and analysis procedures in detail and included quotations from the participants in the findings. Confirmability, which is related to whether the researchers minimized prejudice and maintained neutrality, was secured by establishing credibility, fittingness, and auditability.

Ethical considerations

Before the research was conducted, it was approved by the Research Ethics Review Committee (IRB No H-1611-012-804) at the Seoul National University Hospital where the researchers were employed. One of the researchers approached eligible participants and explained the purpose of the study. The specific goals and procedures of the study were explained to the potential participants in detail, along with assurances of anonymity and privacy. The duration of the interviews and the fact that they would be voice recorded were also explained. The participants were also informed that they were able to discuss their discomfort and withdraw from the study at any time during the interview without any penalty. After providing answers to all questions from the eligible participants, the researchers encouraged them to make a careful, voluntary decision to participate in the study. Before each interview began, written, informed consent was obtained from all participants, and a nominal monetary reward was given to them.

Results

The participants' sociodemographic information is described in Table 1. Nine participants were male. The average age was 30 years, ranging from 22 to 45 years. All but three were single, and nine of them declared no religion. Seven of them reported having an occupation, and six were currently attending college or graduate schools. Regarding medical diagnoses, eight had myelomeningocele, and the remaining eight had a lipomyelomeningocele. Nine participants reported having urinary incontinence and eleven had fecal incontinence. Fourteen participants needed intermittent urethral catheterization, ranging from three to eight times per day. All were able to walk on their own except one, who needed a wheelchair.

As a result of constant comparative analysis, *protecting the whole self* was identified as the core category. It represents a basic sociopsychological process in which adults with SB adjust as they interact with themselves and others (Figure 1). It includes three stages: strict self-concealment, self-disclosure attempts, and balancing between self-concealment and self-disclosure. The double-headed arrows in Figure 1 represent a long-term and complex process of moving back and forth from the previous stage rather than moving forward unilaterally or linearly. The causal conditions were identified as *shame* and *stigma*, and the intervening conditions were *understanding and* support *of others* and *degree of illness and physical deformity*. As a consequence, three patterns of living emerged: *living as a non-disabled person*, *living as a marginal person between non-disabled and disabled*, and *living as a disabled person*.

Causal conditions: *Shame* and *stigma*

The causal conditions were caused by exposed incontinence, urethral catheterization, and deformation of the lower limbs. The participants felt shame and stigma for the first time during childhood and adolescence, and these feelings persisted when they became adults. Shame was generated while interacting with themselves; stigma, which causes shame, came from their physical appearance and behaviors. The participants often failed to conceal urinary and fecal soiling, which made them feel ashamed of themselves. They felt more ashamed of fecal soiling than urinary leakage because the odor was not at all controllable. Fecal soiling often occurs at unexpected times, so they are more disheartened by it. One male participant recollected his fecal soiling experiences as follows:*I pooped in my pants a lot of times, although I rarely peed in my pants. Whenever I pooped in my pants, I was so embarrassed and cried hard because the kids already knew the weird smell of poop came from me …(Participant 5)*

The participants were also ashamed of urinary catheterization itself. Female participants felt shameful because they had to search for their urethra using a mirror. It was extremely awful for them to accept. Moreover, males felt shame when holding their penis to insert a catheter by themselves. Those who had started catheterization from birth accepted it relatively easily since they had begun to catheterize themselves during puberty. Nevertheless, whenever someone other than family members noticed them using a catheter, it caused them to feel ashamed, even in adulthood. In the case of urinary catheterization during puberty, however, shame or humiliation was even worse. One of the male participants stated his feelings as follows:*[Urethral catheterization] was so shameful. I was in puberty at that time, in the second grade of middle school. I was too shy and embarrassed to do it by myself, so my mom helped me. It was so embarrassing for me to have my mother help me with that, and I hated doing it. (Participant 5)*

Deformation of the lower limbs also creates a great deal of shame and stigma. Even after undergoing orthopedic corrective surgery during childhood, most of them were not free from the stares of others because they still limped or wobbled while walking. The most fearful thing for them was to be stigmatized as disabled. Sympathy and help from others are usually regarded as supportive. However, these often provoked more shame because they did not want to be treated as disabled. They often fell into this kind of shameful, paradoxical situation with feelings of nervousness and insecurity.*I hated people treating me like a disabled person. I went out to play with my friends, but I honestly didn't use welfare cards or disability cards to get on the subway. The staff at the station told me, noticing my limping, “You can ride with a disability card.” I hated the way they looked at me. (Participant 11)*

Intervening conditions: *Understanding and support of others*, *degree of illness and physical deformity*

The intervening conditions that facilitate or hinder the process of *protecting the whole self* were identified as *understanding and supporting others* and the *degree of illness and physical deformity*. A lack of understanding or support from others led to a more intense shrinking of the self and a prolonged stage of self-concealment. The sources of support differed slightly depending on the participants' developmental stage. Until elementary school, family support was important because family members, especially mothers, had taken the lead in managing the participants' conditions, including urethral catheterization. During the school years, teachers and friends were major supporters in managing incontinence and other disabilities. However, in adulthood, colleagues and acquaintances' understanding and recognition became a more important part of their support systems. In addition, public support services, including welfare and health care benefits for the disabled, greatly helped some participants, especially those with economic instability.

The *degree of illness and physical deformity* of the participants also influenced the *process of protecting the whole self*. The worse the symptoms and physical deformity are, the harder those with SB fight to protect their whole self, which is a basic sociopsychological process.

Core category: *Protecting the whole self*

The core category, *protecting the whole self*, refers to a basic sociopsychological process in which the participants seek to lead a life of personal fulfillment, treating themselves as valuable persons who are not swayed by others, even if they have chronic conditions to manage. *Protecting the whole self* consists of three stages: strict self-concealment, self-disclosure attempts, and balancing between self-concealment and self-disclosure.

Stage of strict self-concealment

This stage is characterized by a period of excessive restraint due to others' cold looks. *Shrinking of the self* and *avoidance of others* were identified as subcategories. This stage can be shortened by understanding and support from colleagues and acquaintances. If the individual has less severe symptoms, he or she is able to endure this stage more easily.

Shrinking of the self

Whenever the participants felt shame due to their exposed incontinence, urethral catheterization, and/or deformation of their bodies, their pride was hurt, and their self-esteem collapsed. They felt negative emotions, such as anxiety, resentment, and self-pity, and had to be vigilant at all times for potentially dangerous situations. For example, male participants, who cannot use urinals like other male friends, could not protect themselves from ridicule even if they could manage their incontinence in a private toilet, and this made them anxious and nervous. Indeed, previous experiences during childhood and adolescence reinforced their negative emotions. One male participant, who had no urinary or fecal incontinence, underwent urethral catheterization four times a day; he explained his experiences as follows:*You know, when you go to the restroom, you are subject to teasing by kids. So, I hate revealing my catheterization, thinking what would happen if it were seen by others. I was frightened of it a lot and got stress about being teased. When I was in the second and third year of middle school, I was bullied most severely. At that time, I was teased because I was short, too. (Participant 14)*

All participants were also disappointed when they had learned that the disease could not be cured. They felt a deep sense of grief and often blamed their parents and doctors for the disgrace of being born. In addition to this resentment, they became mired in feelings of self-pity that they were a worthless person who could not marry or get a job in the future.

Self-defense from others

The participants tried to defend themselves, as they were constantly being intimidated by others. Self-defense included hiding, self-isolation, and self-assertion. Hiding can be thought of as either hiding one's body or hiding incontinence products, such as diapers and urinary catheters, so as not to provide any reason for others to tease them and to avoid unwanted attention from others. Self-isolation, unlike hiding, indicates a strategy of distancing themselves from others and shutting themselves off from relationships. It was used whenever they noticed or felt a strange gaze or attitude from someone around them. Self-assertion, which is the act of asserting their own rights and opinions, is identified as an important strategy to defend themselves. For example, the participants actively tried not to lose in quarrels with their peers who were teasing them. It helped them not only to protect their shrunken self, but also to refuse to be intimidated by the stigma from others anymore.

Stage of attempting self-disclosure

This is a stage in which the participants attempted to expose themselves to others to reduce their psychological burden and to escape isolation brought about by self-concealment. It was accomplished by focusing on themselves rather than being conscious of others. This stage typically began in their early twenties, as they transitioned from a strict school life, and better circumstances to deal with their physical conditions unfolded. For example, using toilets had become easier, and college peers did not make fun of the participants even if they had been seen using diapers or performing catheterizations.

Self-understanding

In this stage, the participants moved toward self-understanding through self-examination, self-acceptance, and self-confidence. As they entered their twenties or college life, they were able to escape from the gaze of others. They began to grasp and reflect on the meaning of others' actions toward them. They also realized that adults' reactions to and interest in their urination or wearing of diapers were much different from those of their former adolescent friends. These mature reactions and the indifference of adults served to change their ways of thinking about their condition as well. That is, they realized that it was wise for them to live with their SB like a friend, a lifelong companion, by keeping complications to a minimum even though it was uncomfortable. They accepted themselves as they began to know how to cherish themselves and respect their value as a person. One 25-year-old male participant stated the following:*When you look at your face in the mirror, is there anyone out there who cannot accept him or herself? Maybe you wish to look more handsome or beautiful. However, you can never reject yourself! Although it was hard for me to accept that the disease is incurable, I accept my disease as mine. (Participant 4)*

Through self-examination and self-acceptance, their sense of self was protected and their self-esteem improved. As they were empowered further with self-confidence, they began to challenge prejudices and stigma by attempting to reveal themselves to others.

Self-disclosure

Most participants tried to open up to others to reduce their psychological burden, which came from self-concealment. This attempt was made possible by their inner reflections, a restoration of self-esteem, and the mature responses and understanding from others. The participants felt the necessity to disclose themselves primarily to people close to them, such as their roommates in a dormitory. Indeed, they had to open up because they knew that their condition could not be hidden. They were also able to disclose themselves because they felt they had nothing to lose by opening up, and it was bothersome to hide their condition all the time.

In disclosing their conditions and sense of self to others, the participants tried to explain their situations actively, but not openly. That is, the participants narrowed down those to whom they could explain their situations, namely, trusted friends who would keep their confidence. They also tried to give the least amount of information possible when asked by others. Then, they evaluated whether their secrets were maintained; this involved continuously undergoing an internal trial and error process where they evaluated the benefits of disclosing their secrets until they finally mastered the strategies of protective self-disclosure. Through cautiously opening up, they began to make a few friends with whom they could get along.*I told my friend that I was urinating with a catheter. He was just surprised but kept the secret. He did not talk about it to his other close friends. After talking with him, I became more comfortable using the toilet when I was with him. (Participant 9)*

Stage of balancing between self-concealment and self-disclosure

This is a period in which there is harmonization between looks from others and the state of mind of the participants. In this period, there is peaceful coexistence with others as well as self-maturation by appropriately controlling self-concealment and self-disclosure. This stage is facilitated mainly by a favorable environment that enables the use of self-management and social welfare systems.

Psychological maturity

As the participants overcame various difficulties, they felt more secure in themselves. The participants were able to ignore negative responses from others regarding their catheterization, incontinence, or bodily deformation. They simply accepted that it was natural for others to respond in such a way. This was not because the others were right, but because it was difficult or meaningless for the participants to explain their disease to others. They were able to protect themselves by focusing on their strengths with positive thinking. They were also empowered and no longer pitied themselves but pitied others who mocked them. Some of them relied on their religion as a way to minimize any damage from being stigmatized. Through this process, they finally found peace of mind with humbleness and gratitude.*I don't feel sorry for the pain or the discomfort my body went through, and I try to grow inside and feel gratitude without looking at my body and comparing it to others', so I'm going to live with real freedom. (Participant 6)*

Coexistence with others

In this stage, the participants establish good relationships with others to maintain a normal life as much as possible. Coexistence refers to existing peacefully together. The participants realized that they had to prioritize their management of urination and incontinence rather than being conscious of others. To this end, most were prepared to have a preconceived self-management plan for the future. Some of them changed their jobs to be self-employed or work in telecommunications, which allowed them to freely use the bathroom and adjust their workload to prevent strain on their bodies. Others became beneficiaries through the National Basic Livelihood Security Program, particularly those whose health had deteriorated.

All participants developed their own definitive criteria for self-concealment or self-disclosure. They were able to decide whether they would conceal or open up about their condition and how much information they would provide. If they were confident that they could completely cover up their conditions, they did so. However, if self-disclosure was more beneficial than self-concealment, participants voluntarily explained their conditions. Finally, they could live more freely by releasing themselves from stigma and other restrictions that had oppressed them for decades.

Consequences: Three patterns of living

Based on psychological maturity, coexistence with others, and levels of adjusted self-disclosure, three patterns of living emerged: *living as a non-disabled person*, *living as a marginal person between non-disabled and disabled*, and *living as a disabled person*. These patterns were also affected by the degree of illness and physical deformity, which was identified as the intervening condition.

Living as a non-disabled person refers to a lifestyle pattern that can make voluntary self-disclosure relatively easy alongside high levels of psychological maturity and coexistence with others. The participants in this pattern were able to easily open up about or cover up their illness to others depending on their own strategies, as their symptoms were mild and could be easily hidden. They tended to open up about themselves to close friends to reduce any psychological burden, but in cases of official relationships, such as at work, they tried to conceal themselves by limiting the scope of interpersonal relationships. Moreover, as most of them have few complications from the condition aside from urinary catheterization, they tended not to see the problem of incontinence and urethral catheterization as a major flaw.

Thus, the participants in this pattern treated themselves as almost normal or not perfectly normal, but not a disabled person. They were rarely restricted to social activities due to their physical conditions. They pursued a stable and typical life path, such as pursuing continued education in graduate school, and employment became a priority for them. They had a higher tendency to take on the challenges of fulfilling their dreams to overcome isolation and emotional withdrawal. Here is one participant's reaction:*I am not a perfectly normal person, but I do not feel like a disabled person, and my urination is something others do not know about unless I tell them. (Participant 9)*

Living as a marginal person between non-disabled and disabled refers to a lifestyle pattern in which the participants have a hard time making voluntary decisions to self-disclose because they are anxious and cannot interact comfortably with others. However, most of them did not treat themselves as disabled and tried to maintain a relatively positive self-image like non-disabled persons. They thought that they could maintain their social life if urethral catheterization and incontinence were not exposed to others. Since the participants in this pattern did not easily open up to others, they could not receive any support from others when needed. For example, in the workplace, they could not open up easily even when they needed a break or needed to care for their incontinence since they had the same workload as others. As a result, when a sudden instance of incontinence occurred, they could not concentrate on their work, resulting in a greater physical and psychological burden. As this vicious cycle repeated, they became more discouraged from pursuing life as a non-disabled person. They often felt that they were stuck in-between. A 42-year-old male participant expressed his agony as follows:*If I could expose my conditions with ease to the others, I think I would not suffer so much from inner conflict… It is an irony for me to live as a normal person in a society. When you are at a borderline between normal and abnormal, your life is like walking on a tightrope. (Participant 3)*

Finally, living as a disabled person refers to a lifestyle pattern in which the participants see themselves as disabled, as do others. The participants in this pattern tended to have visible deformities, such as a limping gait or wheelchair ambulation, in addition to bladder and/or bowel incontinence and catheterization. Thus, they felt more at ease when interacting with others because the attention of others was focused on their gait or wheelchair. Unlike participants with other patterns of living, they did not have to open up about their incontinence or catheterization, which could have caused psychological insecurity. Indeed, they had to focus on managing their physical disabilities and secondary complications, such as pressure ulcers or urinary tract infections, while also seeking economic stability. The participants living as disabled persons mainly depended on the National Basic Livelihood Security Program for living and housing subsidies and welfare to help reduce the burden of medical expenses. The participants in this pattern hoped to be recognized as disabled by the government and were in a situation where they had to prove to the government that they had physical disabilities. Here is one participant's thoughts on the matter:*The biggest benefit of being a basic livelihood security recipient is the medical coverage. The burden of hospital bills has been reduced a lot. I'm trying to maintain my basic qualifications. (Participant 1)*

Discussion

This study was conducted to provide a comprehensive and in-depth understanding of the lives of adults with SB using grounded theory. As a result of the constant comparative analysis from the data collected in the interviews with 16 Korean adults with SB, *protecting the whole self* was identified as a core category or basic sociopsychological process. The participants needed to protect themselves from being hurt as a result of the shame and stigma caused by their physical conditions and behaviors. These findings are associated with studies in which children with SB have lower self-concepts [35,36]. This suggests that self-reinforcement needs to be a central aspect for programs that help people with SB throughout their lives.

This study identified shame and stigma as major causal conditions. This finding is consistent with previous studies on various Korean patients with chronic disease who are stigmatized by society, such as epilepsy patients [37], patients with an ostomy [38], women with eating disorders [39], and adults with hemophilia [40]. Thus, it is necessary to promote public awareness to minimize stigma and to support people with disabilities on a social level.

In this study, fecal incontinence, especially fecal smells, had a more severe impact on shame, stigma, and interpersonal relations than urinary incontinence or lower limb deformation. This finding is consistent with studies showing that fecal incontinence due to various diseases causes negative effects on the quality of life [23,41,42]. This suggests that health professionals should emphasize the importance of regular bowel self-management for Korean SB patients, which has been overlooked.

In the first stage of *protecting the whole self*, the participants tried to conceal themselves from others. This finding is consistent with a study that explored how opening up to others is difficult in reality when it involves incontinence in the workplace [43]. Our study findings suggest that self-concealment needs to be considered as a positive strategy and, thus, be integrated into the development of a psychosocial intervention to recover from a shrunken sense of self. In this stage, adults with SB were anxious and resentful and tried to avoid others by hiding and isolating themselves. These findings support other studies that describe the emotional distress of adults with SB [20,44] and social isolation among adults with SB [45]. This indicates that psychosocial intervention focusing on self-identity achieved by raising self-esteem and self-confidence is greatly needed in the early stages of adjustment among adults with SB.

In the second stage, the participants tried to open up to others to overcome psychological problems and isolation. This finding is similar to findings from other studies on opening up to others, including studies focused on protective opening up [46] and preventive opening up [47]. It is important to note that being open is needed to maintain a job [48]. Our study's findings further show that self-disclosure and opening up to others were facilitated by continuously evaluating through trial and error and by improving self-understanding. We suggest that self-help group activities would not only support the participants when they face psychological burdens but would also allow them to share useful strategies established from trial and error with each other.

The final stage was identified as balancing self-concealment and self-disclosure. In this stage, the participants showed psychological maturity and could coexist with others, armed with self-defense strategies based on appropriate levels of self-disclosure. However, they preferred cautious self-disclosure rather than active openness. This was mainly due to SB's status as a rare congenital disease, making it difficult for them to explain the condition to others and ensure their understanding in Korea. Considering this very real dilemma, health professionals need to understand and acknowledge that although self-disclosure is an important strategy, interventions need to be carefully developed by considering effective ways to help patients open up about their condition and balancing between self-concealment and self-disclosure.

This study identified three patterns of living as a consequence of these processes. These patterns were mainly categorized according to the level of adjusted self-disclosure. This finding is somewhat similar to a study of adolescents with SB on self-understanding with respect to their physical disability, which found three primary types of identity: identity as overcoming disability, identity as objectifying disability, and identity as integrating disability [49]. The current study adds to this existing literature about physical disability in adolescents by providing a more comprehensive understanding and insight into the lives of adults with SB, which can be helpful in creating patient-specific interventions for these adults.

This study has some limitations that should be considered while interpreting the results. Since culture is an important factor that can influence how people think and behave, an application of the findings is limited to those countries where cultural contexts are similar to Korea. Korea has a collectivist culture [50] that stresses harmony in interpersonal relationships, while individualistic cultures stress the needs of the individual over the needs of the group. Thus, the findings reflect interdependent characteristics of the participants' interactions within their own social realities.

The application of the findings is further limited because it did not involve those with cognitive impairment or severe psychological withdrawal. Additionally, most of the participants were single and young adults; therefore, issues regarding marriage and sexual life did not emerge as major categories. Based on these issues, more exploratory research focusing on marriage and sexual life is needed to obtain a more comprehensive picture of the lives of adults with SB.

Conclusion

The results of this study could help health professionals develop effective patient-centered programs by providing rich information and insights into the lives of adults with SB. *Protecting the whole self* is the basic sociopsychological process that explains how adults with SB adjust to their environment while managing their chronic conditions. Self-concealment was found to be a basic strategy in the early stage of this process, while self-disclosure was a major strategy in the later stage. Therefore, there is a need to develop patient-specific interventions based on the patient's sociopsychological stage. In the early stage, intervention needs to be focused on self-concealment rather than self-disclosure to establish a firm sense of self, which can be hindered by shame and stigma. However, in the later stage, when psychological maturity occurs, intervention focusing on self-disclosure is helpful to keep people with SB from becoming isolated. The findings also suggest that it is necessary to assess the pattern of living before developing patient-specific interventions.

Conflict of interest

No conflict of interest has been declared by the authors.

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No.	Gender	Age (years)	Marital status	Religion	Occupation	Diagnosis	Urinary incontinence	Fecal incontinence	No. of daily CIC	Ambulation
1	Man	35	Single	Protestant	Self-employed	MMC	No	Yes	5	Wheelchair
2	Man	25	Single	No	College student	MMC	Yes	Yes	3	Walk
3	Man	42	Single	Protestant	Self-employed	LMMC	Yes	Yes	3~5	Walk
4	Man	25	Single	No	Part-time worker	MMC	Yes	Yes	6~8	Walk
5	Man	22	Single	No	College student	LMMC	Yes	No	5~6	Walk
6	Woman	45	Married	Protestant	Full-time worker	LMMC	Yes	Yes	6~7	Walk
7	Woman	21	Single	No	College student	MMC	No	No	8	Walk
8	Man	33	Married	Protestant	Full-time worker	MMC	Yes	Yes	3~4	Walk
9	Woman	25	Single	No	College student	LMMC	Yes	No	6	Walk
10	Woman	33	Single	Catholic	Full-time worker	LMMC	No	Yes	0	Walk
11	Woman	31	Single	No	Graduate student	LMMC	No	No	3~5	Walk
12	Man	25	Single	No	College student	MMC	Yes	Yes	0	Walk
13	Woman	35	Married	Protestant	House wife	MMC	Yes	Yes	4~6	Walk
14	Man	32	Single	No	None	MMC	No	No	4	Walk

15	Man	35	Single	No	None	LMMC	No	Yes	5	Walk
16	Woman	22	Single	Buddhist	Full-time worker	LMMC	No	Yes	4~6	Walk

DETAILS

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Park, S., In, S. J., & Min, D. (2021). Factors associated with the need for breastfeeding information among women with gestational diabetes mellitus: A cross-sectional study. Asian Nursing Research, 15(3), 210-214. doi:https://doi.org/10.1016/j.anr.2021.05.002

PurposeAnalyzing information based on individual needs can maximize the effectiveness of education, leading to changes in personal health behaviors. This cross-sectional descriptive survey study aimed to identify the characteristics of mothers who experienced gestational diabetes mellitus and correlate the factors associated with their information needs.MethodsThe participants were 298 women between the ages of 20 and 49 years who were pregnant and diagnosed with gestational diabetes at the time of the study, or who were diagnosed with gestational diabetes mellitus within five years after delivery. The average age of the participants was 34.28 years. After comparing participants’ demographics, diabetes, and breastfeeding-related characteristics according to their need for information on breastfeeding, a multiple logistic regression analysis was performed.ResultsFactors associated with participants’ need for information on breastfeeding were economic conditions, usual body mass index, current pregnancy, and experience of breastfeeding.ConclusionThe findings can be used to implement programs that meet the needs of these women and help improve maternal and pediatric health and quality of life.

Lim, J. M., & Cho, O. (2021). Effects of home-and-workplace combined exercise for patients with ankylosing spondylitis. Asian Nursing Research, 15(3), 181-188. doi:https://doi.org/10.1016/j.anr.2021.03.001

PurposeThe purpose of this study was to investigate the effects of home-and-workplace combined exercise on physical function, depression, and work-related disability in patients with ankylosing spondylitis.MethodsThis study adopted a non-randomized quasi-experimental design. Fifty-two patients were recruited: home-and-workplace combined exercise (n = 17), home exercise (n = 18), and control group (n = 17).ResultsThe home-and-workplace combined exercise group showed improvement in spinal mobility and pulmonary function and significantly lower absenteeism and overwork impact than the home-exercise group and control group. The home-and-workplace combined exercise and home exercise groups showed a higher level of activity improvement than the control group.Conclusionhome-and-workplace combined exercise can be recommended to patients with ankylosing spondylitis to enhance their physical function, including spinal mobility and pulmonary function, and reduce work-related disability.

Zhou, H., Wang, X., Du, R., Cheng, X., Zheng, K., Dong, S., . . . Wang, T. (2021). The work experience of newly recruited male nurses during COVID-19: A qualitative study. Asian Nursing Research, 15(3), 203-209. doi:https://doi.org/10.1016/j.anr.2021.05.001

PurposeThis study was to investigate the work experience of newly recruited male nurses during the COVID-19 pandemic.MethodsWith a phenomenological approach, this qualitative study was adopted semistructured interviews by phone or video calls. A total of 9 male nurses newly recruited for the COVID-19 wards in Chinese hospitals were interviewed for this study. And Colaizzi's method was applied for evaluation in the data analysis.ResultsBased on our findings, three themes were extracted. First, the newly recruited male nurses showed negative emotions at the beginning of COVID-19 epidemic, which was caused by changes in working conditions and content, but also prompted the nurses to change the way of coping with the crisis. Second, they gradually mastered the working skills and psychological training to cope with COVID-19 and developed a positive attitude toward life and a high sense of professional responsibility. Finally, we learned about their needs to respond to public health emergencies such as the COVID-19 pandemic.ConclusionCOVID-19 is a disaster for all of humanity. The newly recruited male nurses are an important force in emergency rescue. Although they suffered from short-term negative emotions, they quickly adapted to the crisis. In order to better prepare for future emergencies, the disaster response capacity of newly recruited male nurses needs to be further improved. In addition, newly recruited male nurses have a strong demand for timely and personalized career development guidance.

Wen-sheng, H., Lu, S., Meng-yan, X., Min-cong, Z., Zhen-ming, Y., & Yue-yue Deng. (2021). Behavioral responses of pregnant women to the early stage of COVID-19 pandemic in the network era in china: Online questionnaire study. Asian Nursing Research, 15(3), 215-221. doi:https://doi.org/10.1016/j.anr.2021.06.003

PurposeThe aim of this study was to examine the behavioral responses of pregnant women during the early stage of Coronavirus Disease 2019 (COVID-19) outbreak.MethodsWe recruited 1,099 women to complete an online questionnaire survey from February 10 to February 25, 2020. The subjects were divided into two groups (the pregnant women group and the control group).ResultsConcerns about infection: most of the participants watched the COVID-19 news at least once a day. Protective behaviors: the utilization rate of pregnant women (often using various measures) was higher than that of nonpregnant women. Exercise: 30.6% of the pregnant women continued to exercise at home, whereas in the control group, this percentage was 8.4%. Spouse relationship: 38.8% of the subjects' relationship improved, whereas only 2.3% thought the relationship was getting worse.ConclusionPregnant women had some unique behavioral responses different from that of nonpregnant women. It is important to understand the behavioral responses of pregnant women in this network era.

Seo, S. M., Jeong, I. S., Song, J. Y., & Lee, S. (2021). Development of a nomogram for carbapenem-resistant enterobacteriaceae acquisition risk prediction among patients in the intensive care unit of a secondary referral hospital. Asian Nursing Research, 15(3), 174-180. doi:https://doi.org/10.1016/j.anr.2021.02.005

PurposeThis study aimed to identify the risk factors of carbapenem-resistant Enterobacteriaceae (CRE) acquisition to build a nomogram for CRE acquisition risk prediction and evaluate its performance.MethodsThis unmatched case-control study included 352 adult patients (55 patients and 297 controls) admitted to the intensive care unit (ICU) of a 453-bed secondary referral hospital between January 1, 2018, and September 31, 2019, in Busan, South Korea. The nomogram was built with the identified risk factors using multiple logistic regression analysis. Its performance was analyzed using calibration-in-the-large, the slope of the calibration plot, concordance statistic (c-statistic), and the sensitivity and specificity of the training set, subsets, and a new test set.ResultsThe risk factors of CRE acquisition among ICU patients at a secondary referral hospital were Acute Physiology and Chronic Health Evaluation II score at the time of admission, use of a central venous catheter and a nasogastric tube, as well as use of cephalosporin antibiotics. At 20.0% of the predicted CRE acquisition risk in the training set, the calibration-in-the-large was 0, slope of the calibration plot was 1, c-statistic was .93, sensitivity was 85.5%, and specificity was 84.8%. The performance was relatively good in the subsets and new test set.ConclusionThe nomogram can be used to monitor the CRE acquisition risk for ICU patients who have a similar case mix to patients in the study hospitals. Future studies need to involve more rigorous methodology and larger samples.

Du, J., Zhang, L., Xu, C., & Qiao, J. (2021). Relationship between the exposure to occupation-related psychosocial and physical exertion and upper body musculoskeletal diseases in hospital nurses: A systematic review and meta-analysis. Asian Nursing Research, 15(3), 163-173. doi:https://doi.org/10.1016/j.anr.2021.03.003

PurposeNurses' musculoskeletal diseases (MSDs) are worldwide prevalent and are considered to be a costly occupational injury. This study aims to investigate the relationship between exposure to occupation-related psychosocial factors, physical workload, and upper body musculoskeletal diseases among hospital nurses.MethodsAn electronic search was implemented using nine databases with June 2019 as the latest search date. English and Chinese studies were chosen, and data were independently and separately extracted by two investigators. Pooled odds ratio (OR) and its 95% confidence interval (CI) were estimated for each subset, using the fixed or random-effects model, following heterogeneity between studies for research synthesis. The source of heterogeneity was explored through subgroup, sensitivity, and meta-analyses.ResultsEighteen studies were included in the meta-analysis. Most participants were women (51.4%–100.0%), aged between 20 and 60. A correlation was found between high job demand and the prevalence of low back pain (OR = 1.41; 95% CI = 1.23-1.62). Total job strain was related to the risk of low back pain (OR = 1.71; 95% CI = 1.15-2.55), neck pain (OR = 1.67; 95% CI = 1.26-2.20), shoulder pain (OR = 1.62; 95% CI = 1.06-2.48) and back pain (OR = 1.45; 95% CI = 1.10-1.91). Furthermore, the physical workload was significantly associated with the prevalence of low back pain (OR = 1.76; 95% CI = 1.32-2.35), neck pain (OR = 1.17; 95% CI = 1.08-1.27), shoulder pain (OR = 1.59; 95% CI =

1.37-1.85) and back pain (OR = 1.66; 95% CI = 1.45-1.90).ConclusionThere were significant associations between occupational strain, more physical workload and upper body MSDs, but the evidence advocating a growth risk in MSDs due to low levels of social support is quite weak.

Yao, Y., Long, T., Pan, Y., Li, Y., Wu, L., Fu, B., & Ma, H. (2021). A five-step systematic therapy for treating plugged ducts and mastitis in breastfeeding women: A Case–Control study. Asian Nursing Research, 15(3), 197-202. doi:https://doi.org/10.1016/j.anr.2021.04.001

PurposeThis study aimed to describe the clinical response to five-step systematic therapy (FSST) in the management of plugged ducts and mastitis. FSST was a comprehensive milk stasis dredging treatment, which contained five steps to make the milk out of the plugged duct.MethodsThis retrospective study included 922 breastfeeding women, 714 with plugged ducts, and 208 with mastitis who received FSST from June to September 2017. The breast pain score, swelling degree, and range of breast induration were recorded pre-FSST and post-FSST.ResultsAfter a single FSST, pain score and swelling degree were significantly improved (both p < .001) in all cases. After FSST, the mean breast pain relief score was 1.69 ± 0.70, whereas the mean swelling fade away degree was 1.61 ± 0.62. In the subgroup analysis, pain score and swelling degree were significantly improved (both p < .001) in the plugged ducts group and the mastitis group. The score of pain relief in the plugged ducts group was less than that in the mastitis group (1.63 ± 0.68 vs. 1.91 ± 0.70, t = 5.30; p < .001), whereas improvement of swelling fade away was greater in the plugged ducts group than the mastitis group (1.65 ± 0.64 vs. 1.48 ± 0.56, t = 3.49; p = .001). The composition ratio of changes in induration range between the two groups was statistically different (Pearson χ2 = 137.87, p < .001), of which more obvious improvement in the plugged ducts group than the mastitis group (χ2 = 25.65, p < .001).ConclusionFSST can relieve pain, reduce breast swelling and range of induration, and for plugged ducts or mastitis varied degree differently.

Kang, H., & Jung-Won, A. (2021). Model setting and interpretation of results in research using structural equation modeling: A checklist with guiding questions for reporting. Asian Nursing Research, 15(3), 157-162. doi:https://doi.org/10.1016/j.anr.2021.06.001

PurposeThis study develops a checklist with guidelines for the methods and important factors to consider in research using structural equation modeling (SEM).MethodThe paper discusses the factors to consider in the process across the three stages of 1) model setting, 2) model evaluation and modification, and 3) interpretation and reporting of SEM-based studies.ResultsThe authors present a checklist for researchers during the stages of model setting, model evaluation and modification, result analysis, and reporting, along with examples of figures and tables with explanations.ConclusionA checklist will help to improve the reporting quality of SEM-based studies.

Yu, M., Yang, M., Ku, B., & Mann, J. S. (2021). Effects of virtual reality simulation program regarding high-risk neonatal infection control on nursing students. Asian Nursing Research, 15(3), 189-196. doi:https://doi.org/10.1016/j.anr.2021.03.002

PurposeVirtual reality simulation can give nursing students a safe clinical experience involving high-risk infants where access to neonatal intensive care units is limited. This study aimed to examine the effects of a virtual reality simulation program on Korean nursing students' knowledge, performance self-efficacy and learner satisfaction.MethodsA nonequivalent control group design was applied. Senior nursing students were divided into an experimental group (n = 25) experiencing virtual reality simulation and routine neonatal intensive care unit practice and a control group (n = 25) having routine neonatal intensive care unit practice. The program consisted of three scenarios: basic care, feeding management and skin care and environmental management for prevention of neonatal infection. The total execution time for the three scenarios was 40 minutes. The simulation created immersive virtual reality experiences using a head-mounted display with hand-tracking technology. Data were collected from December 9, 2019, to January 17, 2020, and were analyzed using descriptive statistics and the t-test, paired t-tests, Mann-Whitney test and Wilcoxon signed-ranks test.ResultsCompared to the control group, the experimental group showed significantly greater improvements in high-risk neonatal infection control performance self-efficacy (t = −2.16, p = .018) and learner satisfaction (t = −5.59, p < .001).ConclusionThe virtual reality simulation program can expand the nursing students' practice experience in safe virtual spaces and enhance their performance self-efficacy and learning satisfaction.

Ra, J. S. (2021). Evaluation of a mobile-based maternal feeding education program for overweight prevention in infants. Asian Nursing Research, 15(2), 136-143. doi:https://doi.org/10.1016/j.anr.2021.02.001

SUMMARYPurposeThe purpose of this study was to evaluate a mobile-based maternal feeding education program for overweight prevention in infants based on breastfeeding attitude, breastfeeding self-efficacy, breastfeeding duration, recognition of hunger and satiety cues of infants, and knowledge regarding providing solids foods.MethodsA nonequivalent control group pretest-posttest design was used for the study. Participants included 15 primiparas in the experimental group and 14 primiparas in the control group in all the follow-up tests. Using self-reported questionnaires in electronic format, data were collected four times (before the intervention, 1 month after childbirth, 3 months after childbirth, and 6 months after childbirth). Using SPSS 24 version, independent t-test and repeated-measures analysis of variance were used to test the effects of the mobile-based maternal feeding education program.ResultsThe experimental group showed significantly more positive breastfeeding attitude ($F = 5.28$, $p = .008$), higher breastfeeding self-efficacy ($F = 3.50$, $p = .041$), and increased breastfeeding duration ($t = -2.09$, $p = .046$) than the control group. In addition, the experimental group showed significantly improved knowledge regarding providing solid foods to the infants ($F = 4.86$, $p = .009$) in comparison with the control group. However, for education on recognizing hunger and satiety cues of infants, the mobile-based maternal feeding education program was not effective ($F = 0.23$, $p = .878$).ConclusionAccording to the results of this study, the mobile-based maternal feeding education program has the potential to contribute to overweight prevention in infants.

Hee-Jeong, L., & Jeong, I. S. (2021). Personal listening device use habits, listening belief, and perceived change in hearing among adolescents. Asian Nursing Research, 15(2), 113-120. doi:https://doi.org/10.1016/j.anr.2021.01.001

PurposeThis study aimed to identify personal listening device (PLD) usage habits, listening belief, and perceived change in hearing, and to investigate how the variables related to perceived change in hearing among adolescents.MethodsThe participants were 183 middle school students and 233 high school students from Ulsan. Data were collected by self-reported questionnaires from August 1, 2019, to October 22, 2019, and analyzed with descriptive statistics, $\chi 2$ test, Mann–Whitney U test, and hierarchical multiple logistic regression.ResultsMost students started to use PLDs from elementary school, and mean preferred listening level was 70.13 dB. Mean perceived susceptibility to music-induced hearing loss (MIHL) and perceived barriers to prevent MIHL were 5.18 and 3.40, respectively. Perceived change in hearing was reported on 14.2% of middle school students and 32.2% of high school students, and as the average score of perceived barriers to prevent MIHL increases by one point, the odds of decrease in hearing increase by 2.05 times ($p < .001$) and 1.35 times ($p < .05$), respectively.ConclusionConsidering that most adolescents are exposed to PLD in elementary schools and about a quarter experienced a decrease in hearing after PLD use, educational programs on hearing conservation are required to start as early as in schools. Particularly, knowledge and skills to overcome barriers to prevent MIHL should be emphasized in educational programs.

Jin, X., Xu, X., Qiu, J., Xu, Z., Sun, L., Wang, Z., & Ling, S. (2021). Psychological resilience of second-pregnancy women in china: A cross-sectional study of influencing factors. Asian Nursing Research, 15(2), 121-128. doi:https://doi.org/10.1016/j.anr.2021.01.002

PurposeThe aim of the study was to evaluate the status of psychological resilience among women in their second pregnancy and to investigate the possible influencing factors.MethodsA total of 275 women in their second pregnancy and who met the criteria were surveyed from two public hospitals in China from July 2018 to January 2019. The instruments included the General Self-designed Questionnaire, Connor–Davidson Resilience Scale, Social Support Rate Scale, and 36-item Pregnancy Stress Rating Scale.ResultsThe total psychological resilience score of second-pregnancy women was relatively low. Multivariate regression analysis identified five factors associated with psychological resilience: intimacy with husbands, social support utilization, gender of the first child, high-risk pregnancy of the first child, and the stress caused by worrying about the health and safety of the mother and fetus.ConclusionWomen in their second pregnancy represent a unique population, and their low psychological resilience score deserves attention. Identification of factors contributing to decreased psychological resilience may enable us to design prevention and intervention strategies and to deliver specific psychological supports to pregnant women at high risk of developing negative psychology.

Long, N. H., & Thanasilp, S. (2021). The adaptation of the buddhist death acceptance scale for vietnamese persons with cancer. Asian Nursing Research, 15(2), 144-149. doi:https://doi.org/10.1016/j.anr.2021.02.002

PurposeThis study reports on selected psychometric properties of the adapted Buddhist Death Acceptance Scale (BDAS) for Vietnamese persons with cancer.MethodsThe original 13-item BDAS was developed based on Buddhist perspectives toward death and life and was translated from Thai into Vietnamese. Item content checking with five Vietnamese local experts suggested three items of the original BDAS were irrelevant in Vietnamese culture and hence should be excluded. Psychometric properties of the 10-item BDAS Vietnamese version were tested using a convenience sample of 193 Vietnamese Buddhists with cancer.ResultsThe internal consistency coefficient of the scale was found to be 0.73. Exploratory factor analysis showed that the 10 items of the BDAS Vietnamese version constituted 2 factors, explaining 51.1% of the variance of death acceptance. The first factor was “acceptance of natural process of death” and the second was “preparing for death.” Both factors reflected explicitly Buddhist viewpoints toward death acceptance and were consistent with the original Thai BDAS. However, although similar factors were found, some items in the Vietnamese BDAS did not load to same factors as in the Thai BDAS.ConclusionsThe BDAS Vietnamese version provides an initial suitable measurement for death acceptance among Vietnamese Buddhists. Its availability will enable cross-cultural research to investigate death acceptance among Buddhist patients with cancer in Vietnam. However, the differences in item loadings between the Thai and Vietnamese scales suggest that further conceptual and empirical works to refine the measurement are needed.

Ju-Young, H., & Seon-Hwa Ban. (2021). Effects of Mind–Body programs on infertile women: A systematic review and meta-analysis of randomized controlled trials. Asian Nursing Research, 15(2), 77-88. doi:https://doi.org/10.1016/j.anr.2021.02.003

summaryPurposeThis study was to systematically review randomized controlled trials and conduct a meta analysis. The results of randomized controlled trials were integrated and analyzed to assess the effects of mind-body programs on anxiety, depression, quality of life, and pregnancy rate in infertile women.MethodsUsing electronic databases (i.e., Research Information Sharing Service, Korean Studies Information Service System, Korean Medical Database, National Digital Science Library, Cochrane Library, PubMed, EMBASE, Cumulative Index to Nursing and Allied Health Literature, and PsycARTICLES), 10 of 2,259 studies were included for meta-analysis. To estimate the effect size, a meta-analysis of the studies was performed using RevMan 5.3.ResultsThe mind–body program was effective in relieving anxiety standardized mean difference (SMD) = −3.44; 95% confidence interval (CI) = −5.94, −0.95; p = .007; I2 = 69%] and depression (SMD = −5.79; 95% CI = −10.36, −1.22; p = .010; I2 = 86%). Furthermore, it was effective in enhancing the quality of life (SMD = 7.40; 95% CI = 2.92, 11.88; p = .001; I2 = 53%) and pregnancy rate (SMD = 2.06; 95% CI = 1.08, 3.95; p = .030; I2 = 73%). The mind–body program was found to relieve anxiety and depression in infertile women and improve their quality of life, thereby positively affecting the pregnancy rate.ConclusionThe mind-body program was found to relieve anxiety and depression in infertile women and improve their quality of life, thereby positively affecting the pregnancy rate. The mind-body program needs to be considered to a wider audience for positive effects on emotions and pregnancy outcomes of infertile women.

Hye, J. Y., & Suh, E. E. (2021). Lived experiences of korean young adults after heart transplantation: A phenomenological approach. Asian Nursing Research, 15(2), 89-95. doi:https://doi.org/10.1016/j.anr.2020.10.001
