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Variations of Ovitrap Autocidal Water for Controlling Aedes Aegypti

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Abstract

Dengue fever in Indonesia is still classified as a serious disease because it has increased yearly from 2011 to 2013. This study aims to determine the difference in the effectiveness of various types of water in the queue as a trap for eggs of Aedes aegypti mosquitoes in Bukittinggi. This type of research is experimental. The test used is the Anova test because the data is not normal using the Mann-Whitney test. The research sample used a sampling technique. This study uses primary data which can be seen from the number of trapped Aedes Aegypti mosquito eggs. The results showed that between the straw bales using well water and mineral water, the p-value was (0.421)>α(0.05), meaning that there was no difference between the straw-soaked line with well water and water mineral. Meanwhile, after a statistical test was carried out between the straw bales using mineral water and rainwater, the p-value was (0.008)> α (0.05), (Ho was rejected, Ha was accepted), meaning that there was a difference between the straw-soaked anthers and mineral water and rainwater. Based on the results of various types of attractants on the number of Aedes aegypti mosquito eggs trapped in the applied science laboratory of the University of Fort De Kock, Bukittinggi, the straw-soaked extract with rainwater is more effective because it produces more eggs than the extract soaked in straw with well water and extract soaked in straw with mineral water.

Introduction

Dengue Hemorrhagic Fever (DHF) is a disease caused by the dengue virus which belongs to the Arthropod-Borne virus, the genus Flavivirus, and the Flaviviridae family (Chadee & Ritchie, 2010). DHF is transmitted through the bite of mosquitoes from the genus Aedes, especially Aedes aegypti. DHF can occur throughout the year and can affect all age groups (Wong et al., 2011). The emergence of this disease is related to environmental conditions and people's behavior (Liu et al., 2023). According to WHO data (2014), Dengue hemorrhagic fever was first reported in Southeast Asia in 1954, namely in the Philippines, and then spread to various countries (Isoe et al., 2019). Before 1970, only 9 countries experienced dengue outbreaks. Still, now DHF is endemic in more than 100 countries, including Africa, America, the East Mediterranean, Southeast Asia, and the West Pacific which have the highest incidence of DHF cases (Rowe et al., 2018). The number of cases in America, Southeast Asia, and the West Pacific passed 1.2 million in 2008 and more than 2.3 million in 2010 (Sharp et al., 2019). In 2013 there were 2.35 million cases reported in America, of which 37,687 cases were severe dengue (Cahyati et al., 2017). The development of dengue cases at the global level is increasing, as reported by the World Health Organization (WHO), from 980 cases in almost 100 countries

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in 1954-1959 to 1,016,612 cases in nearly 60 countries in 2000-2009 (Hemme et al., 2022).

Sustainable Development Goals (SDGs) is a continuous program of the MDGs which ended in 2015, consisting of 17 goals and 169 specific targets (Xue et al., 2021). One of these is Goal 3, which is to ensure healthy lives and promote well-being for all people of all ages (Leppla & De Clercq, 2019). In detail, there are 13 targets, the third target is mentioned by 2030 ending the epidemic of AIDS, tuberculosis, malaria, hepatitis, water-borne diseases, infectious diseases, and neglected tropical diseases such as Dengue Hemorrhagic Fever (DHF). Mass trapping can be a low-cost, community-based, and sustainable engagement approach, attractive to complement other tools that can be selected locally within an integrated Aedes management strategy (Jaffal et al., 2023).

To improve dengue prevention and control efforts, one option for long-term vector monitoring is the ovitrap surveillance system, which may offer information about the spatiotemporal distribution of mosquito vectors and population dynamics. Ovitrap: a low-cost, user-friendly, and efficient instrument for tracking dengue vectors (Sasmita et al., 2021). DHF in Indonesia is still classified as a serious disease because every year it has increased from 2011 to 2013. In 2014 it decreased, but in 2015 the cases increased again (CDC, 2024). In 2014, the number of DHF sufferers in Indonesia was reported as 100,374 cases with the number of deaths as many as 907 people (IR / morbidity = 39.8 per 100,000 population and CFR / mortality rate = 0.9%) and an increase in 2015 (Cahyati et al., 2017). In 2015 The number of DHF patients who reported was 1,071 people (IR / morbidity = 50.75 per 100,000 population and CFR / mortality rate = 0.83%) (Cahyati et al., 2022).

In West Sumatra Province, districts/cities affected by dengue have increased every year (Hemme et al., 2022). It is known the number of districts/cities, in 2014 and 2015 there were 18 districts/cities with data for dengue cases, and in 2016 there were 19 districts/cities with dengue cases (Juarez et al., 2021). In 2017 there were 19 districts/cities with dengue cases. This data shows that every district/city in the province of West Sumatra has dengue cases. The number of DHF sufferers per district/city in West Sumatra Province in 2015 was 2,282 cases with 12 deaths (IR = 45.75% per 100,000 population and CFR = 1%). In 2016 the number of cases was 3,985 with 18 cases of death (IR = 75.75% per 100,000 population and CFR = 0.4) (Smoleroff et al., 2023).

Based on data from the last three years, the Bukittinggi City Health Office, the population of the City of Bukittinggi in 2017 with a population of 124,715 people, it was found that there were 380 cases of Dengue Hemorrhagic Fever (DHF) in the last three years (Hajirasoulihaa et al., 2012). In 2017, there were 69 cases and 106 cases in 2016 and the lowest incidence was in 2017 with 69 cases. In 2018 DHF cases increased to 115 cases. Meanwhile, in 2019 from January to June, the number of cases was 106. Thus the morbidity rate increased in 2017 compared to 2016 and 2017(Mahdalena & Komaria, 2021). It is estimated that DHF will still tend to increase and spread more widely (Djiappi-Tchamen et al., 2022). This is because the dengue infectious vectors are widespread both in residential and public places (Acevedo et al., 2021). Apart from that, population density, population mobility, and urbanization have increased in the last 3 decades (Figurskey et al., 2022; Liu et al., 2023). The high incidence of DHF is still needed so efforts to control mosquitoes are needed so that an alternative in environmental management is needed to prevent DHF besides PSN, which is to prey on a device called an oviposition trap (ovitrap). This method has been proven to be successful in reducing the vector density in Singapore by placing 2,000 ovitraps in dengue-endemic areas. One of the ovitrap modifications, namely the autocidal ovitrap model adds the number of trapped eggs. (Djiappi-Tchamen et al., 2022).

Ovitrap is used to detect the manifestation of mosquitoes in new areas that have been previously eradicated. This tool was developed by Fay and Eliason in 1966 and distributed by the CDC. The standard ovitrap is a plastic cup 350 milliliters, 91 milliliters high, and 75 millimeters in diameter painted black on the outside and filled with water ¾ part. And given a layer of paper, wooden slats, or bamboo as a place to lay eggs (Ovitrap). Ovitrap can

help control dengue fever vectors as well as produce monitoring data that is more specific, economic, and sensitive than the traditional Aedes index.(Acevedo et al., 2021).

The tillers used are those that come from plant waste, namely straw. So far, only known straw can be used as animal feed and fertilizer, even though straw can also be an anti-mosquito agent (Mackay et al., 2013). From the results of the straw soaking for a week, it will produce carbon dioxide (CO2) compounds, anomic gases, and octenol which are easily recognized and can stimulate the olfactory nerves of mosquitoes (Lok CK, Kiat NS, 1977). Gases are gases produced by humans and animals when breathing which in fact can help mosquitoes to find prey (Juarez et al., 2021). Carbon dioxide (CO2) is a colorless gas whereas ammonia has a distinctive pungent odor, and octenol is a chemical substance like alcohol (Barrera et al., 2014). Just like carbon dioxide gas, when we breathe, humans and animals also emit ectenol (Liu et al., 2023.) The types of ovitrap material that can be used can be of various kinds, such as the results of research conducted in Jati village in April 2014, the number of positive ovitrap contains Aedes spp eggs which occupy each ovitrap media, there are variations in the number of Aedes spp eggs contained in ovitrap media (Smoleroff et al., 2023). The number of eggs trapped during the 6 observations was 3,090 eggs. The highest number of eggs in the ovitrap is found in straw (Figurskey et al., 2022).

From the results of the study, it is known that soap wastewater does not allow Aedes mosquitoes to live and grow compared to sewage water, dug wells, and water from the Drinking Water Company (PAM). This is because of the factors that affect the resistance and growth of Aedes spp mosquitoes, the pH contained in the soap wastewater is alkaline, namely 12.8. The degree of acidity (pH) of brooding water is a critical factor in determining the survival and growth of Aedes spp. Aedes mosquitoes cannot survive or die when pH <3 and ≥ 12 (Xue et al., 2021). Aedes is not able to develop into adult mosquitoes. In addition to pH, the survival and growth of mosquitoes also depend on the presence of plankton in SGL water and less tap water (3 and 2 types) compared to mixed water such as sewer water (Smoleroff et al., 2023). Brooding of PAM water has almost the same results as breeding water from dug wells. This situation is caused because even though the pH of PAM water is neutral, mosquito mortality is also high. After all, it contains chlorine (Ca OCl2) which is a disinfectant (Mackay et al., 2013).

Method

This research is experimental in which Aedes aegypti mosquitoes receive direct treatment. The Aedes aegypti mosquito is put into the observation cage with a size of 50 cm x 30 cm x 30 cm and then put in a straw soaking with mineral water, soaking straw with rainwater, soaking the straw with well water. The study design was a non-randomized posttest-only control group design. The design of grouping the sample members in the experiment from the control group was not done randomly or randomly. This research was conducted at the Central Science Laboratory of the University of Fort De Kock Bukittinggi in March 2022.

The object of this research is the Aedes aegypti mosquito egg. This research was conducted with 3 treatments with 6 repetitions. By using 20 Aedes aegypti mosquitoes for each treatment. The length of the study was 1 month, and observations were made every day. Once a week the number of mosquito eggs was calculated for each attractant. Methods of conducting research: a. Prepare observation cages of 3 cages containing 15 females Aedes aegypti mosquitoes and 5 males. b. After that, prepare the straw as a source of food for the male mosquitoes and put it in each observation cage. c. After everything is finished, prepare 3 pieces of attractants / ovitrap (used bottles that have been wrapped with black powder). e. Then enter mineral water, rainwater, and dug well water into the attractant/ovitrap. Observed each observation cage and recorded the number of mosquito larvae trapped in the ovitrap once a week. Data analysis to determine the differences in the types of straw-soaked water with mineral water, rainwater, and dug well water on the number of trapped Aedes aegypti eggs. And the Mann Whitney test because the data are not normally distributed, with alpha 5% and CI 95%. If p≤ alpha 0.05 it means, there

is a difference.

Results and Discussion

The research was conducted at the Central Science Laboratory of the University of Fort De Kock. The extract was made from 22 July to 5 August 2022. The straw-soaked extract. The mosquitoes used for research were male and female mosquitoes. Male mosquitoes aim to fertilize female mosquitoes, female mosquitoes lay eggs after sucking blood from mice in the cage. Measurement of air temperature during the study, which was measured using a thermometer, the air temperature during the study was 27°C. Measurement of air humidity during the study was measured using the air humidity hygrometer when the study was 70% to 71%. The usefulness of different types of traps on the number of trapped Aedes aegypti mosquito eggs shows different numbers. This figure is obtained from observations that are repeated 9 times.

The average number of mosquito eggs that are mostly trapped in the straw immersion with 97.56 rainwater value of 1.13, the lowest number of eggs is 96 and the highest is as many as 99 Aedes aegypti mosquito eggs. The lowest mosquito eggs are trapped in the straw using mineral water, a value of 1,900 SD with the lowest eggs of 21 and the highest eggs being 27 pieces. The decrease in rainfall and rainy days reduces the number of natural and artificial clean water reservoirs (TPA) scattered around settlements. This condition is a natural process of controlling the mosquito population. On the other hand, the existing Aedes mosquito population cannot continue the regeneration process optimally because of the presence of deadly egg traps (Barrera et al., 2023).

In obtaining Aedes spp eggs, mineral water has a higher number of eggs than pool water. This indicates that Aedes spp mosquitoes like to lay their eggs in mineral water. As is known, mosquito eggs hatch and turn into larvae which need a medium to grow and develop to the next stage, namely pupa. The mineral water content can be used by larvae as a medium for growth (Jaffal et al., 2023). Furthermore, the tendency of the Ae.aegypti mosquito to lay eggs in groundwater is the second option. Ae. Aegypti mosquito tendencies in choosing a place to lay eggs in a combination of groundwater media is believed to be because the organic matter content in groundwater media is the second highest after straw-soaking water (Boekoesoe & Ahmad, 2022).

Based on the table of data normality analysis results, where the value is taken in the Shapiro Wilk box, because the number of samples is small and obtained by all p-values > α (0.05), meaning that all data is normally distributed. So that the next analysis is used

Table 1. The Average Number of Aedes Aegypti Eggs on Water Variation

No	Water variation	Mean	SD	Min – Max	N
1	Rainwater	97.56	1.130	96 – 99	9
2	Mineral Water	23.11	1.900	21 – 27	9
3	Well water	24.71	3.592	21 – 29	7

Table 2. Test of Normality Data

Type of water Statistic		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		df	Sig.	Statistic	df	Sig.	
Number of mosquito eggs	Rainwater	0.208	9	0.200*	0.899	9	0.248
	Well Water	0.204	7	0.200*	0.850	7	0.124
	Mineral water	0.276	9	0.046	0.864	9	0.106

**This is a lower bound of the true significance*

a. Lilliefors Significance Correction

Table 3 Test the Difference in Water in Ovitrap

Number of mosquito egg						
			df	**Mean Square**	**F**	**Sig.**
Between Groups	(Combined)		2	15666.610	2957.494	0.000
	Linear Term	Unweighted	1	24938.889	4707.886	0.000
		Weighted	1	24938.889	4707.886	0.000
		Deviation	1	6394.331	1207.102	0.000
Within Groups			22	5.297		
Total			24			

Table 4 Test the Variation of Ovitrap Water with a Trapped Number of Eggs

Multiple Comparisons

Dependent Variable: Number of mosquito eggs

Bonferroni

(I) Type of water	(J) Jenis Air	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Rainwater	Well water	72.841*	1.160	0.000	69.84	75.85
	Mineral water	74.444*	1.085	0.000	71.63	77.26
Well water	Rainwater	-72.841*	1.160	0.000	-75.85	-69.84
	Mineral water	1.603	1.160	0.542	-1.40	4.61
Mineral water	Well water	-74.444*	1.085	0.000	-77.26	-71.63
	Well water	-1.603	1.160	0.542	-4.61	1.40

*. The mean difference is significant at the 0.05 level.

by the parametric test with the One-Way Anova test to analyze the differences in water variations used in the straw immersion.

Based on the table above, after the Anova test obtained a value of p 0,000 <α (0.05) which indicates that there is a significant difference between the number of mosquito eggs trapped in the straw immersion with the type of well water, mineral water, and rainwater. Further variations can be seen by multiple comparison tests with Bonferroni tests. Straw extract soaked in rainwater is more effective because it contains a compound that has been proven to influence the olfactory nerves of the Aedes aegypti mosquito to lay its eggs on the attractant.

Based on the above table, it is known that the use of rainwater and well water is obtained by the Mean Difference 72 and P Value 0.000 <α (0.05) means that it has been proven effectively used as a straw soaking water for the Aedes aegypti mosquito eggs. As for rainwater with mineral water, it gets a P value 0.000 <α (0.05), meaning that the two water are also proven effective to be used as straw soaking water, where the average difference is 74. Furthermore, for well water with water with water with water with water with water with water with water Rain obtained a p-value of 0,000 <α (0.05) means that the two water is also good to be used as a straw marinade water, the average difference is 72. For well water with mineral water with a p-value obtained 0.542> α 0.05 means that well water with mineral water cannot effectively be used as a straw marinade water. Test Variations in Mineral Water with Rainwater Obtained by p-value 0.000 <α 0.05, meaning that the water is also effective for use as a shedding water in the straw immersion. Finally, the variation of mineral water variations with well water obtained a p-value of 0.542 > α 0.05, meaning that the water immersion is not effective to be used as a straw water soaking water.

Straw soaking extract with rainwater is more effective as an attractant for Aedes Aegypti mosquitoes compared to straw soaking extract with well water and straw soaking extract with mineral water because well water is relatively

close to surface soil, so it can be contaminated through seepage. The most common contamination is due to water depletion from human and animal waste disposal facilities which can affect larval survival (Liu et al., 2023). The survival of the larvae also depends on the presence of plankton and anthrax soaking in straw with mineral water is less popular with mosquitoes because minerals have the property of being degraded by bacteria (Zhu et al., 2019). Rainwater is more dominant in discussing the differences in water types because rainwater is statistically more significant. Rain is one of the factors that causes mosquitoes to lay eggs more often and of course, more individual mosquitoes will be produced (Hemme et al., 2022). High rainfall will cause many puddles which can become breeding places for mosquitoes (Mastrangelo et al., 2018). Rainfall in the range of 310 mm, while rainfall of 575 mm does not support the life of Ae larvae. Aegypti (Barrera et al., 2023). The increase in Aedes aegypti oviposition is known to originate from the non-volatile chemical content contained on the surface of the straw-soaking water. Rain is one of the factors that causes mosquitoes to lay eggs more often and of course, more individual mosquitoes will be produced (Leppla & De Clercq, 2019). The presence of high rainfall will cause many puddles which can become breeding places for mosquitoes. When touched by the mosquito's chemotactile sensory organ, this chemical content further stimulates the mosquito to speak. So that it produces the most eggs in the fifth repetition.

Conclusion

The results of this study are expected to be useful for the community as one of the vector controls, especially to reduce the development of the Aedes aegypti mosquito cycle naturally by using straw quantities using rainwater so that the eggs do not develop into mosquitoes so that they can reduce the incidence of DHF.

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The Nexus of Cancer Patient Experiential Satisfaction on the Intention to Recommend

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Abstract

This research aims to test and analyze the relationship of antecedents of patient experience measured by the CPEQ (The Cancer Patient Experience Questionnaire) instrument, which consists of service by ward nurse, service by specialist, service by ward doctor, information, and hospital staff coordination. Further, its impact on the intention to recommend the respective private hospital. This research was accomplished with a quantitative survey and a cross-sectional approach. Respondents were those treated at a private special cancer hospital in Jakarta and were taken by purposive sampling. A total of 192 respondents met the requirements and were analyzed using PLS-SEM. The results showed that the six antecedents have a significant and positive relationship with cancer patient's experiential satisfaction and encouraging patient intention to recommend the hospital. The most relevant relation was in the service by specialist doctors followed by hospital standards, service by nurse wards, and information. The findings in this study establish the positive relation between cancer experiential satisfaction and the intention to recommend the hospital.

Introduction

Health services are one of the vital factors of sustainable development in emerging countries, according to WHO (World Health Organization, 2020). The intended health services should be accessed by every citizen and follow the quality of health services for every disease, including cancer. These health services must also be able to reduce mortality rates and improve cancer patients' quality of life. Cancer is a main burden of disease worldwide. Each year, tens of millions of people are diagnosed with cancer worldwide, and more than half of these patients die (Bray *et al*., 2018; Berlin *et al*., 2021). In many countries, cancer is the second leading cause of death after cardiovascular disease, as the elderly are the most vulnerable group to cancer and population aging continues in many countries, cancer will remain a main health problem worldwide (Ma, 2006; van de Haar *et al*., 2020). According to data from The Global Cancer Observatory (GCO) in 2020, the increase in new cases in Indonesia was 141.1 per 100,000 population, with 85.1 deaths per 100,000 population.

There have been many discoveries in the field of diagnosis and therapy in cancer patients, as well as the development of palliative science to assist cancer patients since the diagnosis. A care was intended so that the quality of life of cancer patients is still maintained. Higher patient satisfaction with service quality is associated with favorable survival outcomes in various cancers (Gupta *et al*., 2013; Pinder *et al*., 2016). The opening of new horizons in the field of cancer treatment goes along with the development of the hospital industry. Many private hospitals have

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begun to prepare strategies to expand their scope to serve cancer patients. The existence of a comprehensive cancer hospital that has adequate facilities and medical staffs plays an important role in improving the quality of care for cancer patients (Berlin *et al*., 2021; Pinder *et al*., 2016). Factors that influence services in cancer specialty hospitals are not only medical personnel and facilities but also work culture, hospital environment, and systems that support services (Tremblay *et al*., 2015; van de Haar *et al*., 2020). Apart from government hospitals, private cancer hospitals face the challenge of growing through the quality of their services. The hospital management has the responsibility to utilize the resources owned to provide a good experience for patients and their families as well (Prakash & Srivastava, 2019). Excellent quality of health services is well known as the outcome of the process of various factors, especially human factors and resource governance (Donabedian, 2002).

The implementation of the health policy in Indonesia involves the private sector in health services and consequently increases the number of hospitals managed by the private sector. Unfortunately, the number of private hospitals specializing in treating and serving cancer patients is still very limited in Indonesia. It is related to limited financial resources and the scarcity of human resources such as cancer specialists or oncologists. Currently, in Indonesia, only four specialized cancer hospitals have adequate facilities to treat cancer cases (Indonesian Ministry of Health, 2021). Siloam Cancer Hospital, also known as (MRCCC) Mochtar Riady Comprehensive Cancer Centre in Jakarta, is one of the four cancer specialty hospitals operated by the private party.

Apart from accepting private patients at their own expense or private insurance, the Siloam Cancer Special Hospital also accepts referral patients from the Social Security Organizing Agency (JKN: Jaminan Kesehatan Nasional). As an accredited private hospital, this hospital has been developing and becoming a preference. However, managing cancer patients is not easy. Treatment of cancer disease is complex, and in many cases, the survival rate is low (Gupta *et al*., 2015). Cancer patients usually put their hope in a total cure that is difficult to be fulfilled. Besides, most cancer patients suffer from the side effects of chemotherapy (van de Haar *et al*., 2020). In that regard, measuring the quality of care delivered by the hospital from the patient's perspective remains challenging. Further study is needed to gain feedback to improve the quality of care, especially in cancer hospitals. That kind of study is also crucial for hospital performance since patients who have a satisfying experience tend to provide positive recommendations to their relatives or friends, resulting in an increase in new patients and a more positive hospital reputation.

The increasing number of patients is a determining factor for hospitals to survive in the fierce competition (Arici & Gucer, 2018). From previous research, hospital performance is closely related to patient experience (Rapport, 2019, Wolf, 2015; 2021), and it is also applied to cancer patients (Gualandi *et al*., 2021). Patients who perceive a service experience that matches their expectations tend to recommend the hospital to others as potential prospective patients (Sadeh, 2017; Wu *et al*., 2011). It is also shown in a study by Park *et al*. (2022), and further Kasena and Antonio (2023), where the cancer patient's level of satisfaction with the services he or she receives affects the desire to recommend the hospital. This study aims to analyze the nexus of the element of cancer patient experience with the hospital outcome. To that end, this study focuses on the intention of the patient to recommend the hospital based on his subjective assessment of the overall interaction he received while being treated at the hospital. Thus, the intention to recommend variable was deployed as the dependent variable in this research.

To address the scarcity of research on cancer patient experience in private hospitals in Indonesia, this research proposes a modified model where the Intention to Recommend the private hospital is the dependent variable. In this research model, seven directional hypotheses were tested, as depicted in Figure 1. Cancer Patient Experiential Satisfaction serves as an intervening variable, measured by the patient's overall satisfaction with the experience. The six independent variables obtained from the CPEQ instrument developed by Iversen *et al.* (2012) act as antecedents. Namely, Service

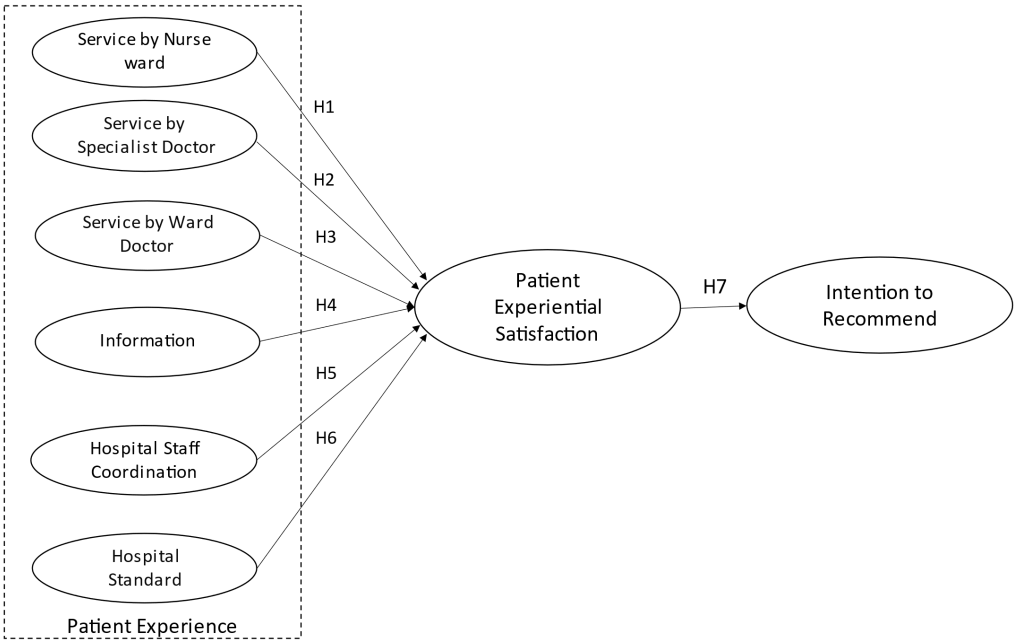

Figure 1. Conceptual Framework

by Nurse Ward, Service by Specialist Doctor, Service by Ward Doctor, Information, Hospital Staff Coordination, and Hospital Standard. This research model will be tested empirically on cancer hospitalized patients who have received services at Siloam Cancer Specialty Hospital in 2023 with cancer staging from 1 to 4.

METHOD

This research underpinned the Donabedian theory of systems, processes, and outcomes (SPO) integrated with the theory of customer satisfaction and loyalty (Oliver, 2014). This theoretical background was also extended through the customer experiential concept (Schmitt, 1999). From the customer experience perspective, customers assess the services they receive and the interactions that occur with service providers through cognitive and emotional approaches. This approach is more comprehensive than the concept of customer satisfaction which mainly uses a cognitive approach. The customer experience concept is adopted into the patient experience concept which is defined as the total sum of all interactions felt by the patient in response to the services received (Wolf, 2014; 2021). This study uses patient experience to explain and predict patient intentions and behavior after receiving services from Siloam Cancer Hospital in Central Jakarta.

It is a quantitative study with cross-sectional data obtained with a questionnaire instrument in the form of online and printouts. The data in this study were taken by purposive sampling with certain criteria. Data collection was carried out from May to June 2023. In PLS-SEM studies, the minimum sample was calculated by power analysis according to recommendations (Hair *et al.*, 2022; Sarstedt *et al.*, 2022a). The calculation uses G*Power 3.1 software, where f^2 was determined to be 0.15, alpha 0.05, power was 90 percent, and 7 predictors, resulting in a minimum sample size of 153. Respondents who filled out the questionnaire were cancer patients treated at the Siloam Semanggi Cancer Specialty Hospital inpatient room. From the distribution of questionnaires, 192 respondents met the specified criteria. Data were analyzed using the Partial Least Square - Structural Equation Modeling (PLS-SEM) approach due to the complexity of the research model and explanatory orientation. The sample size in PLS-SEM was calculated according to recommendations (Hair *et al.*, 2022; Sarstedt *et al.*, 2022b). Priorly, informed consent was collected from patients following the

research ethics protocol. This study underwent assessment by the ethics committee and received approval from Siloam Cancer Hospitals (2183/SS/Dir/X/2022).

Various types of instruments specifically measure patient experience in cancer patients such as SCAPE (The Swiss Cancer Patient Experiences) from Switzerland (Arditi *et al*., 2022), SCPES (Scottish Cancer Patient Experience Survey) from Scotland (Cunningham & Wells, 2017), and The Cancer Patient Experiences Questionnaire (CPEQ) from Norway (Iversen *et al.*, 2012) and several other specialized instruments. These specialized instruments are important to identify issues specific to cancer patient care. It will be more useful than using a general instrument to measure cancer patients. The SCAPE instrument consists of 14 dimensions with 47 questions. Although this instrument has proven its validity, the relatively large number of questions make it difficult to implement in cancer patients. On the other side, the SCPES instrument only consists of 7 questions which narrows the ability to describe the complexity of the cancer patient's care. The CPEQ Instrument has 7 domains with 37 questions. Due to the complexity of cancer patient care and its relevance, this study chose the CPEQ instrument to measure customer experience. The Cancer Patient Experiences Questionnaire (CPEQ) instrument is a self-report instrument that covers various aspects of cancer patients' experience of hospitalization. This instrument has been tested through a national survey in Norway involving 7,212 patients and has proven its reliability and validity.

Patient experiential satisfaction measurement was adapted from Kao *et al*. (2007) and Wang *et al*. (2019) while intention to recommend adapted from Kim *et al*. (2017) and Li *et al*. (2021). This study deployed a structured questionnaire modified from previous studies, which translated the national language by an expert translator. Respondents were asked to rate their level of agreement with the items on a scale that ranged from 1 (strongly disagree) to 5 on a Likert scale that ranged from 1 to 5 (strongly agree). This scale is considered effective for measuring perception (Bougie & Sekaran, 2020). Priorly, all the items in the questionnaire were through a face validity process done by a panel of academic experts. Some sentences in the questionnaire were corrected based on the feedback to ensure the questionnaire was easier to understand.

In the data analysis with a multivariate PLS-SEM method, the first stage is to assess the external model (measurement model). This study deploys SmartPLS® 3.2.9 as recommended by Memon *et al*. (2021). In the PLS-SEM stage, indicator reliability and construct reliability should be established before continuing to the next step in the inner model analysis (structural model). At the inner model, the quality of the model is assessed in predicting the dependent variable by calculating the Variance Inflation Factor (VIF), R-square, f-square, and Q-square. Hypotheses are assessed based on the coefficient and significance of the relationship between model variables (Hair *et al*., 2022). In addition, IPMA analysis was conducted to provide managerial implications (Hair *et al*., 2022) and PLS-POS to analyze data heterogeneity (Ringle *et al*., 2022: Hair *et al*., 2022).

RESULTS AND DISCUSSION

From the data collection process, 192 respondents fulfilled the requirements. From Table 1, most patients were above 50 years old (51.4 percent), followed by 41-50 at 29.69 percent. Most respondents are women, as many as 77.6 percent, with the majority having a bachelor's degree and are housewives. The type of cancer patients consists of female reproductive cancer which occupies 39.58 percent, followed by gastrointestinal cancer. Table 1. also shows that the minimum time between the discovery of cancer and the patient seeking treatment is above 5 years, which is considered to be five years of survival for cancer patients.

In the outer model analysis, Table 2 shows all outer loading values exceeded the specified threshold of 0.708, confirming the indicators in the model are reliable for measuring the construct (Hair *et al*., 2019; Hair *et al*., 2022). The construct reliability was established by Cronbach's alpha and composite reliability, which indicates all constructs were reliable. No

Table 1. Demographic Profile of Respondents (n=192)

Descriptions	Categories	Total	Percentage (%)
Age	21-30 Years	19	9.89
	31-40 Years	18	9.38
	41-50 Years	57	29.69
	Over 50 Years	98	51.04
Gender	Men	43	22.40
	Women	149	77.60
Last Education	Junior high school	52	27.08
	Senior high school	56	29.17
	Bachelor's degree	74	38.95
	Master's degree	10	5.21
Occupation	Teacher	2	1.04
	Housewife	98	51.04
	Private employee	35	18.23
	Retired	6	3.13
	Civil Servant	13	6.77
	Professional	8	4.17
	Self-employed	24	12.5
	Not Employed	6	3.13

composite reliability value was found 0.950 as the upper limit, so there was no redundancy among indicators (Hair *et al*., 2022). Construct validity also called convergent validity in the reflective model assessed by Average Variance Extracted (AVE). Constructs or latent variables with an AVE value greater than 0.50 are considered valid (Hair *et al*., 2019; Sarstedt *et al*., 2022a). Table 2 shows all variables have an AVE value greater than 0.50. Thus, it can explain more than 50 percent of the variance. Based on those parameters, it can be concluded that the measurement model has proven valid.

The next step in analyzing the measurement model is to evaluate discriminant validity using the Heterotrait-Monotrait (HTMT) Ratio (Henseler *et al*., 2015). According to Hair *et al*. (2019; 2020), this approach has a high accuracy value that stipulates each indicator is different. The acceptable HTMT ratio value is lower than 0.9. Table 3 shows that all HTMT values are below 0.9, which means that all indicators used in this research model have sufficient differences to measure respective variables. To evaluate the model fit, the Standardized Root Mean Square (SRMR) was assessed. The result obtained was found 0.07, less than 0.8 as the threshold, which means avoided model misfit (Sarstedt *et al*., 2022b).

Multicollinearity issues and common method bias were investigated using the inner Variance Inflation Factor (VIF). Based on the results, each construct has a VIF score below 3, as recommended. (Hair *et al*., 2019) confirming that the model does not have multicollinearity problems. The model's predictive ability was evaluated by using cross-validated Q^2 and the coefficient of determination or R^2. As shown in Figure 2, Patient Experiential Satisfaction (PES) has strong explanatory power with an R^2 value of 0.787 and Q^2 found above 0.5 (Hair *et al*., 2019). The PLS-SEM feature is used to apply out-of-sample redundancy values as developed by Shmueli *et al*. (2019). In this model, PES has Q^2_predict = 0.587, classified as a large relevance (>0.5), and ITR has a Q^2_predict of 0.351, which is sufficient in terms of cross-validated relevance. The R^2 for Intention to Recommend (ITR) was 0,484. However, his model could be said, capable of estimating the dependent variable with an effect size or f^2 value

TABLE 2. Construct Reliability and Validity

Variables	Indicators	Outer Loading			AVE
Service by Nurse Ward (SNW)	I received information from the inpatient nurse about the treatment I was undergoing	0.732	0.872	0.914	0.727
	The inpatient nurse asked about my complaint	0.905			
	The inpatient nurse cared and was quick to treat me	0.860			
	I saw that the inpatient nurse looked skilled	0.902			
Service by Specialist (SSD)	I received clear information from the Specialist Doctor about the treatment I was undergoing	0.749	0.785	0.858	0.602
	The Specialist Doctor took time to answer my questions	0.807			
	The specialist asked about my complaint	0.804			
	I saw a specialist doctor who looked skilled	0.741			
Service by Ward Doctor (SWD)	I received clear information from the doctor on duty about the treatment I was undergoing	0.808	0.856	0.913	0.779
	The doctor on duty asked about my complaint	0.932			
	The doctor on duty gave me time to answer my questions	0.903			
Information (INF)	I got clear information about my disease	0.907	0.847	0.928	0.865
	I received clear information about the side effects of treating my disease	0.952			
Hospital Staff Coordination (HSC)	I feel that the coordination between the registration staff and the ward nurses is going well	0.935	0.845	0.909	0.770
	I feel that the coordination between the support staff and the ward nurses is going well	0.940			
	I feel that the coordination between the cashier staff and the ward nurses is going well	0.743			
Hospital Standard (HS)	I think the ward is comfortable for resting	0.842	0.828	0.897	0.743
	I think hospital food really supports my treatment	0.861			
	In my opinion, the examination support facilities (laboratory / radiology / nuclear medicine / radiotherapy / blood bank) really support my treatment	0.883			

AVE: Average Variance Extracted

of 0.938, higher than 0,35 as the threshold.

In the inner model analysis, Table 4 shows the seven hypotheses have p-values < 0.05, indicating that each hypothesis is significant. All the hypotheses have positive coefficient valence, as expected. Hence, all the hypotheses are supported and confirm the positive relation between the variables in the structural model. The standardized coefficient of SSD for estimating PES was higher than the others at β=0.264. It was followed by HS (β = 0.221), while INF (β = 0.190) and SNW (β = 0.190) have equally strong correlations with PES. Based on the hypothesis result, PES was strongly related to ITR (β = 0.696). All four elements of cancer patients (SSD, HS, INF, and SNW) were meaningful in shape PES. With the increase in PES, the ITR will also increase. Furthermore, the result shows evidence of the intervening function of PES from the four elements of experience. Thus, PES has a beneficial mediating effect in the model.

TABLE 3. Discriminant Validity (HTMT Ratio)

Var	PES	HSC	HS	INF	ITR	SNW	SSD
PES							
HSC	0.693 C I						
HS	0.863	0.474					
INF	0.826	0.530 C I	0.677 CI(0,590; 0.756)				
ITR	0.817	0.860	0.760	0.657			
SNW	0.850 CI(0.789; 0.910)	0.672	0.598	0.731	0.668		
SSD	0.902	0.475	0.831	0.696	0.688	0.734	
SWD	0.777	0.469	0.743	0.618	0.657	0.640	0.758

HS: Hospital Standard; HSC: Hospital Staff Coordination; INF: Information; ITR: Intention to Recommend the Hospital; PES: Cancer Patient Experiential Satisfaction; SNW: Service by Nurse Ward; SSD: Service by Specialist; SWD: Service by Ward Doctor

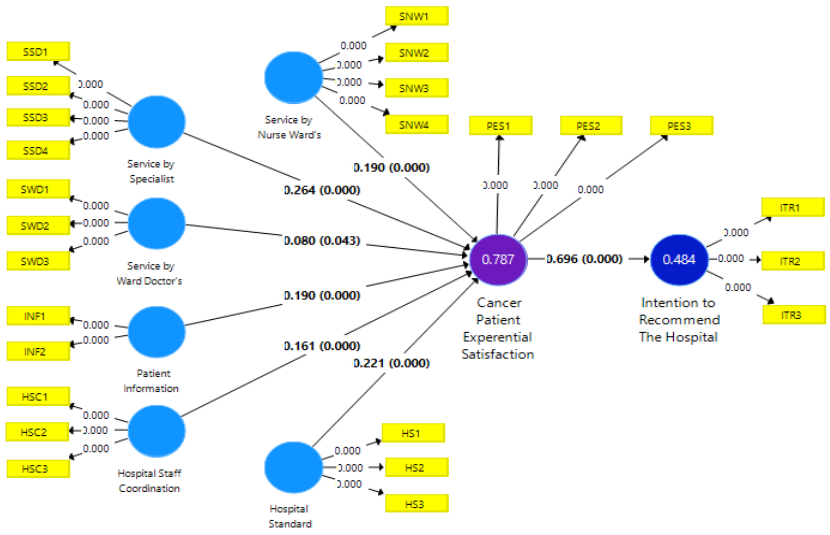

FIGURE 2. Inner Model Results

Hypothesis test results as in Table 4 above show that the CPEQ instrument with its four elements is reliable and valid for measuring cancer patient experience in privately managed cancer hospitals in Indonesia. Therefore, this instrument is recommended based on the evidence for measuring the quality of service based on the patient's perspective. The results of this hypothesis test also show that these four elements need attention because cancer patients' perceptions of these service elements may influence their overall satisfaction with their experience of being treated in the hospital. Patient satisfaction is necessary because it will also be related to patient outcomes. This study aims to analyze the influence of patient experience on cancer patient experiential satisfaction and its impact on the intention to recommend a hospital. The respondents were cancer patients who had been treated at Siloam Cancer Hospital. The proposed research model has empirically tested the seven hypotheses that were found to be supported. The research findings show that the four independent variables from the domain of the CPEQ can positively influence Cancer Patient Experiential

TABLE 4. Hypothesis Test Result

Hypotheses		Standardized Coefficient		Confidence Interval		f2	Result
H1	SNW -> PES	0.190	0.000**	0.114	0.266	0.070	Hypothesis Supported
H2	SSD -> PES	0.264	0.000**	0.181	0.353	0.126	Hypothesis Supported
H3	SWD ->PES	0.080	0.043*	0.001	0.154	0.015	Hypothesis Supported
H4	INF -> PES	0.190	0.000**	0.111	0.269	0.083	Hypothesis Supported
H5	HSC -> PES	0.161	0.000**	0.094	0.222	0.078	Hypothesis Supported
H6	HS -> PES	0.221	0.000**	0.128	0.305	0.099	Hypothesis Supported
H7	PES -> ITR	0.696	0.000**	0.637	0.742	0.938	Hypothesis Supported

*Significant at <0,05, **Significant < 0,001 HS: Hospital Standard; HSC: Hospital Staff Coordination; INF: Information; ITR: Intention to Recommend the Hospital; PES: Cancer Patient Experiential Satisfaction; SNW: Service by Nurse Ward; SSD: Service by Specialist; SWD: Service by Ward Doctor

Satisfaction. The most relevant influence was found in services by specialist doctors, followed by standard hospitals, while the weakest was inward doctor services. The result of this study provides evidence that the Experiential Satisfaction of Cancer Patients has a significant and positive influence on the Intention to Recommend the hospital. The more satisfied the patient is with hospital services, the more the patient will intend to recommend the hospital. These findings confirm the SPO theory (Donabedian, 2002) that with proper structures and processes in health care, patient outcomes and hospital outcomes will improve. This research supports what Berry (2019) stated in health services, namely the existence of highly emotional factors in services that are perceived subjectively by each patient.

The results of this research provide several new contributions, namely by using the CPEQ instrument specifically for cancer patients (Iversen *et al*., 2012). The results of this research show the reliability and validity of the CPEQ instrument when implemented in Indonesia. This finding is relevant so that management can choose relevant instruments to measure satisfaction with patient experience and not use ones that are too general because treatment for cancer patients has different characteristics. The four CPEQ elements tested patient satisfaction. The most relevant influence was found in services by specialist doctors, followed by standard hospitals, while the weakest was inward doctor services. This finding aligns with the previous research (Arditi *et al*., 2022), which shows that the relationship between specialists and patients was the most important factor in patient satisfaction. This finding is not surprising because of the central role of specialist doctors as doctors responsible for patients. This specialist determines the therapy and procedures needed.

This research model shows evidence that patient experience needs to be seen specifically through its elements. All of these elements of the patient experience are related to overall patient satisfaction. Furthermore, satisfaction with the experience will have an impact on patient outcomes and also on the hospital. It is relevant to the performance of private cancer hospitals, which must manage their resources effectively. This study underlined that patient experiential satisfaction is more assessed by the emotional aspect. This result aligns with the previous one, indicating hospitals must pay attention to the emotional aspects of their patient's care during the treatment (Kasena & Antonio, 2023; Park *et al*., 2022). This study also aligns with the study stated that communication with a cancer patient is pivotal (Bakker *et al*., 2001; Black *et al*., 2021; Lumentut & Antonio, 2022). Cancer patients need clear information regarding their current disease progress. The results of this study are in line with previous research conducted in various countries and different types of hospitals (Ricca & Antonio, 2021; Liu *et al*., 2021; Tan *et al*., 2019; Fatima *et al*., 2018), which found that a positive evaluation of patient satisfaction at a hospital become a marker of the level of delivery of care

and further will encourage their intention to recommend the hospital. This study contributes to understanding patient care specifically from the perspective of cancer patients.

From this empirical research, managerial implications can be drawn for cancer hospitals and other types of hospitals serving cancer patients. Namely continuously assessing and measuring patient satisfaction, especially from their experiences while receiving treatment. It can be used as a reference for developing service programs that are more effective and meet patient expectations. As is known, patient expectations for quality health services have also changed over time (Berry, 2019). This research has a different approach, emphasizing the aspect of satisfaction not only from the fulfillment of hopes or expectations but also from satisfaction with the experience of cancer patients when interacting and receiving inpatient service encounters. The finding of this study emphasizes that hospitals must pay attention to the hospital standards as stated in a previous study (Kasena & Antonio, 2023, MacAllister *et al*., 2018). The result of the analysis revealed that Hospital standards, such as room facilities and cleanliness, affect cancer patient experience satisfaction. This finding is in line with previous research, which states that hospital standards have a significant and positive effect on patient satisfaction levels (Addo *et al*., 2021; Park *et al*., 2022; Shen *et al*., 2023; Talantikite *et al*., 2021)

Apart from the role of Service by Specialist doctors and hospital standards, this research also proves the significant influence of other independent variables Service by Nurse Ward, Service by Ward Doctor, Information, and Hospital Staff Coordination. This study's results follow previous research that notified those variables play a significant and positive role in patient satisfaction (Cunningham & Wells., 2017 Johnson & Russell, 2015; Lumentut & Antonio 2022; Park *et al*., 2022; Shen *et al*., 2023). Thus, to provide better service, the cancer hospital should also consider a holistic approach involving many people, ranging from doctors, nurses, and staff who have direct contact with patients. Cancer patient therapy is complex and therefore requires adequate care coordination between units or departments in the cancer hospital (Iversen *et al*., 2012).

The result of this study suggests hospital management to increase patient experiential satisfaction, which subsequently could increase patient willingness to recommend the hospital. This research shows that the experience of cancer patients is positively and significantly influenced by the services provided by specialist doctors and hospital standards. Additionally, this research can help hospitals identify and prioritize areas that need improvement. Hospital management must pay more attention to improving service point diagnostic and therapeutic processes as well as inpatient room facilities. This study also indicates it is important to maintain the quality of the information provided to patients and the quality of doctors (the ability, benevolence, and integrity) to create a positive patient experience. The results of this study add new insight that CPEQ can be useful as a tool for measuring patient satisfaction, so it can be beneficial to hospital management. Furthermore, management needs to periodically conduct patient experience surveys to improve their care delivery. Lastly, if the cancer patients have a good experience, the hospital will also have the advantage of these patients' willingness to recommend the hospital.

Several limitations can be identified in this research. First, the research model was only tested at one cancer hospital with a limited number of respondents. Therefore, there are limitations in generalizing the findings of this study to the other hospitals. It is recommended that future research include more cancer hospitals with more respondents. The second limitation was this study did not separate specific types and stages of cancer, which may affect the model estimate. Patients who are at different stages of cancer may have different perceptions. Therefore, further research respondents should be separated by the type of cancer and the stage and then conducting subgroup analysis. The next limitation is that this study did not include variables related to the patient's personality. The previous study revealed that the differences between patients with extroverted and introverted personalities are different in responding to the disease they suffer. In further research, we recommend

including patient personality and psychological status in the patient perception measurements.

CONCLUSION

This study concludes that the Cancer Patient Experiences Questionnaire (CPEQ) instrument, with its six elements, is reliable and valid for measuring cancer patient experience in privately managed cancer hospitals in Indonesia. Therefore, this instrument can be recommended based on the evidence for use in measuring the quality of care based on the patient's perspective. The most prominent elements are shown from Service by Specialists and followed by Hospital Standards that need to be deliberate in the hospital service plan. Furthermore, the study results demonstrated that the cancer patient experience is associated with their willingness to recommend the hospital. In that regard, the effort to provide experiential satisfaction must be well considered, especially by the private hospital management providing cancer treatment. Hospitals that receive more positive recommendations from their patients will gain long-term benefits. This study result supports the notion that cancer patient satisfaction is necessary since it's also related to patient outcomes such as quality of life. Therefore, patient experiential satisfaction needs to be studied further by listening to input from patients

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The Neurotoxic Impact of Lead on The Appearance of Antisocial Behavior In Batik Dye Workers

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Abstract

Batik home industry waste not managed with standardized WWTP can lead to environmental pollution. It is caused by the remaining synthetic batik dyes containing heavy metal lead. The remaining dyeing waste is disposed of into the river, a water source in the surrounding environment. Waste containing heavy metals causes a neurotoxic effect on the human body. Furthermore, exposure to heavy metals due to synthetic batik dyes is more at risk for workers who do coloring since they do not use personal protective equipment while working and do not live a clean and healthy lifestyle. One of the behavioral disorders associated with the effects of accumulated lead exposure is antisocial personality disorder. In this study, blood lead levels were checked for batik dye workers by taking blood samples using a 3 ml purple vacuum tube and placing them in an ice box to be sent to the Yogyakarta Health Laboratory Center (BLK). The blood sample was then wet destroyed, and the Pb levels were read using an AAS tool. Antisocial tendency scale data was measured using STAB (Subtypes of Antisocial Behavior), where the validity test had previously been carried out with the Pearson product-moment of 0.327-0.786 and the reliability test with the Cronbach alpha technique of 0.936. The results of the data analysis showed a correlation between blood lead levels and antisocial disorder tendencies of 0.690, but no correlation was found between blood lead levels and body mass index (BMI)

Introduction

Lead is a heavy metal that has long been a concern. Lead (Pb), widely found in the environment, is a heavy metal element with a neurotoxic effect. Different from elements like iron and zinc, lead does not provide any benefit to the human body(Wani et al., 2021; Shilpa et al., 2021). The key aspect underlying Pb-induced neurotoxicity is oxidative stress, which is caused by increased activity of oxidative parameters such as lipid peroxidation or alteration of protein chains by reactive oxygen species (ROS) or reactive nitrogen species (RNS). The increase in ROS is caused by the rise in pro-oxidation factors, which support the formation of radicals through the Fenton reaction as a form of metal redox activity and a decrease in antioxidant ability. This process causes changes in membrane biophysics, disruption of cell signaling and neurotransmitters, and substitution for other polyvalent cations(Wang et al., 2020; Narayanan et al., 2020)

Oxidative stress will impact chronic psychological stress, which plays a vital role as a factor associated with the development of depression, which is shown by behavioral, neurochemical, and biological changes(Kiarash et al., 2020). Changes in behavior are influenced by serotonin, where serotonin plays a vital role in regulating aggressiveness and impulsivity, especially in individuals with behavioral disorders. Most of the data shows an inverse relationship between serotonin levels and levels of aggressiveness and impulsivity, where serotonin deficiency is caused by aggressive and impulsive behavior and vice versa(Yagishita,

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2020; da Cunha-Bang & Knudsen, 2021; Leshem & Weisburd, 2019). Besides affecting impulsivity, serotonin levels also lead to compulsive behavior and addiction(Leshem & Weisburd, 2019)

Research on the harmful effects of accumulated exposure to lead in the blood has been developed abroad. The study was conducted on some pregnant women in locations with high lead exposure. Examinations were carried out periodically from the age of newborns until they were 18 years old. The results showed that increased exposure to lead in the blood correlates with high crime rates in the region. The study results stated that every 5 mg/dl increase in exposure to lead in the blood of children aged six years increases the risk of antisocial behavior in adolescence by 50%(Fruh et al., 2019; Rodríguez-Carrillo, et al., 2022; Desrochers-Couture et al., 2019a; Desrochers-Couture et al., 2019b)

Lead is one of the chemicals that can disrupt the endocrine, which is related to the function of the hypothalamic-pituitary-adrenal (HPA), thyroid hormone, and bone metabolism(Fan et al., 2023; Wu et al., 2023; Bjørklund et al., 2020). A study on adults conducted by Wang *et al.* (2018) showed that blood lead levels would increase body weight based on NHANES 2003–2014. The study results showed a correlation significantly associated with other obesity measures, including BMI, skinfold thickness, and total body fat, as well as obesity-related chronic conditions, hypertension, and T2DM, independent of other important risk factors(Wang et al., 2018). In a prospective study conducted in the United States that examined nail metal alloys in relation to body mass index (BMI), findings showed that all non-essential metals had quartile increases linked to a higher BMI, while all essential metals had quartile increases linked to a lower BMI (Niehoff et al., 2020)

One industry that uses lead compounds in the production process is the batik industry, where lead is used as a dye mixture in the coloring process. In the textile industry, Lead (Pb) is used as a dye mixture, which produces a yellow color by adding chromium or PbCrO4, a white color from white lead [$Pb(OH)_2.2PbCO_3$] and a red color from red lead (Pb_3O_4) (Deliza et al., 2021; Putri et al., 2022). One area in Surakarta that has been producing batik for a long time and marketing it abroad is the batik village. Based on the background above, a study was conducted on the correlation between blood lead levels and the appearance of antisocial behavior in batik dye workers. The results of this study are expected to increase public awareness of the negative impact of lead on the environment.

Methods

This study uses a correlational quantitative research design. The research took place in the Batik village by taking a sample of 72 workers through purposive non-random sampling. The sample criteria were taken from workers in the batik coloring division. This research has obtained an Ethical Clearance certificate with the number KEPK/UMP/12/XI/2023 issued by the Health Research Ethics Commission at Universitas Muhamadiyah Purwokerto. Secondary data is in the form of records obtained from questionnaires as a research control to find out personal data related to research, activity, and history of illness of research sample workers. Blood lead levels were checked by taking a blood sample using a 3 ml purple vacuum tube and placing it in an ice box to be sent to the Yogyakarta Health Laboratory Center (BLK). Then, the blood sample was wet destroyed, and the Pb level was read using a graphite furnace atomic absorption spectrometry tool. The appearance of antisocial behavior data was measured using STAB (Subtypes of Antisocial Behavior), where the validity test had previously been carried out with the Pearson product-moment of 0.327-0.786 and the reliability test with the Cronbach alpha technique of 0.936. Normal lead levels in the blood, according to the Centers for Disease Control and Prevention or the CDC (2012) are Adults: < 10 g/dL and children: < 5 g/dL. Data analysis techniques for blood lead (Pb) levels and the appearance of antisocial behavior were analyzed using a correlation test using SPSS 26.

Result and Discussion

This study involved 72 batik workers consisting of 57 (79,17%) male workers and 15 (20,83%) female workers. Heavy metals

exist in nature but will increase along with human activities in industry. An industry that is vulnerable to high heavy metals from the dye sources used is the batik industry. The heavy metals in the batik industry act as a color binder to be absorbed into the fabric or present as a dyeing impurity (Juliani, 2021; Birgani et al., 2016). Previous analysis detected heavy metal types Cd, Pb, Fe, Cu, Zn, Al, Mn, Mg, Ca, Cr, and Si in batik waste samples in Malaysia and Indonesia (Sungur & Gülmez, 2015; Juliani, 2021). It is essential to note that the concentration of each heavy metal element varies significantly based on the stage of production.

The batik industry in Indonesia is produced on a small and medium scale, including in the category of household industry, with limited capacity like occupational safety and environmental management. Batik workers will be at risk of exposure to chemicals used in production due to the minimum use of personal protective equipment supported by the habits of workers who feel that using personal protective equipment will slow down their work. On the other hand, batik waste from most factories is released into the environment without proper treatment. While many batik factories are located around residential areas, improper handling of this wastewater can release pollutants into the soil and groundwater (Juliani, 2021). It would pose a health risk to humans from direct use and exposure to contaminated soil, water bodies, and groundwater.

In humans, heavy metals enter the body in various ways, such as contaminated food, water, skin, and inhalation. These metals are absorbed through the intestines, mainly soluble in water, and transmitted to several organs through the circulatory system. However, at low concentrations, heavy metals affect the respiratory tract and many cells such as endothelium, epithelium, and so on (Kiran et al., 2022). The measurement of blood lead (Pb) levels in batik dye workers showed normal results for the 72 (100%) respondents. 15 (20.83%) had below-normal body mass index, 35 (48.61%) had normal body mass index, 17 (23.61%) had above-normal body mass index, and 5 (6.94%) had obesity. 14(19.44%) had a low appearance of antisocial behavior, 39 (54.17%) had a moderate appearance of antisocial behavior, 16 (22.22%) had an upper appearance of antisocial behavior, and 3 (4.17%) had a very high of appearance of antisocial behavior (Tabel 1)

The average value for Blood lead (Pb) levels is 11.770 ± 1.376 µg/L. Blood lead levels of workers are still within normal thresholds because batik workers are not permanent workers and only work when there is demand from consumers. The average value appearance of antisocial behavior is 42.38 ± 0.90; while their average Body Mass Index is 22.802 ±

Tabel 1. Frequency Distribution of Body Mass Index and Blood Lead (Pb) Levels Values in Batik Dye Workers

Categories	Frequency	Percentage
Body Mass Index (Kg/m^2)		
Below Normal (≤ 18.5)	15	20.83%
Normal (18.5–24.9)	35	48.61%
Above Normal (25–29.9)	17	23.61%
Obesity (≥ 30)	5	6.94%
Blood lead (Pb) levels (µg/dL)		
Normal (<10)	72	100 %
Abnormal (≥10)	0	0 %
Appearance of Antisocial Behavior		
Very low (<25)	0	0.00%
Low (25-35)	14	19.44%
Moderate (36-46)	39	54.17%
Upper (47-57)	16	22.22%
Verry high (58-70)	3	4.17%

0.531% (Table 2).

The analysis results did not show a significant correlation between blood lead levels and BMI, with a proportional correlation coefficient. This directly proportional correlation coefficient indicates that an increase in blood lead levels will impact an increase in BMI. Research conducted by Firoozichahak *et al.* (2022) also shows no significant relationship (P> 0.01) between workers exposed to lead and those not exposed to lead. The results showed that BLL and the levels of bilirubin, lactate dehydrogenase, aspartate transaminase, alkaline phosphatase, and alanine transaminase were positively and significantly correlated (P<0.01). Additionally, a substantial and negative connection (P<0.01) was seen between BLL and levels of total protein, albumin, globulin, triglycerides, and globulins (Firoozichahak et al., 2022). Research in China shows that women in rural areas with increasing economies have higher lead pollution from industry. Lead sourced from drinking water or rice contaminated with lead shows high levels of lead in the blood, positively related to BMI and a tendency to obesity (Ningjian et al., 2015).

Lead exposure early in life is at risk of affecting intelligence and increasing the risk of ADHD. Exposure in adolescence is at risk of showing symptoms of delinquent behavior (juvenile delinquency), while exposure in adulthood indicates criminal behavior (breaking the law. The existence of a causal relationship between lead exposure and behavioral disorders in children, adolescents, and adults is evidenced in cross-sectional epidemiological studies of criminal behavior in prisoners. The association between lead exposure and behavior was observed in populations with mean blood lead levels (BLL) of 7–14 µg/dL; association with

Table 2. Distribution of Descriptive Statistics of Lead Levels, Appearance of Antisocial Behavior, and BMI

Variables	Mean	Median	SD	Min	Max	95% Confidence Interval		Significance
						Lower Bound	Upper Bound	
Blood lead (Pb) levels (µg/L)	11.770	9.646	11.675	0.019	48.965	9.027	14.514	-
Appearance of Antisocial Behavior	42.38	40.00	7.642	32	63	40.58	44.17	0.032
Body Mass Index	22.802	21.675	4.509	15.94	32.96	21.742	23.862	0.731

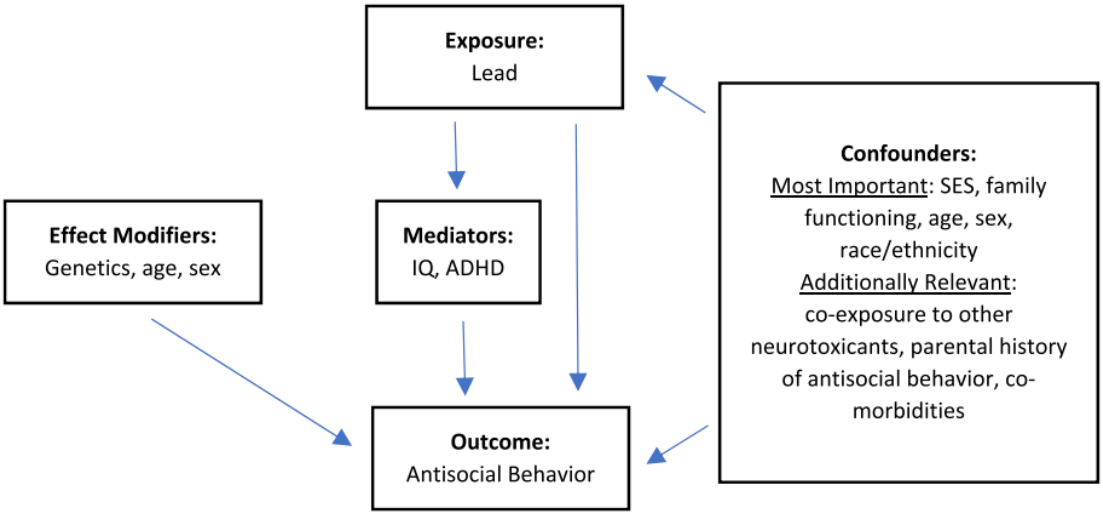

Figure 1. Logic Model for the Link Between Lead Exposure and Antisocial Behavior, IQ = Intelligence Quotient; ADHD = Attention-Deficit Hyperactivity Disorder; SES = Socioeconomic Status (Shaffer *et al.*, 2022)

lower BLL was also observed in cross-sectional studies. Behavioral disorders tend to be affected by higher levels of lead exposure early in life (Shaffer et al., 2022)

Environmental pollution can damage the central nervous system. Environmental pollution can be caused by air pollution from motor vehicle fumes, soil pollution by adding chemical pesticides in agriculture, and water pollution from industrial area waste, e.g., the batik industry, which produces synthetic dye waste discharged into rivers. The social environment is the primary concern for the emergence of problematic behavior so far. It includes parenting patterns and social environment. However, it turns out that a broader understanding is needed regarding the environment. The environment that influences behavior is the social environment and the physical environment. Internally, the physical environment that becomes an important concern is the impact of lead toxicology, i.e., lead exposure, which causes damage to the brain and nerves, resulting in behavioral changes. Lead is a heavy metal that can be a source of free radicals when it enters the body. Lead can enter the body through the digestive tract, respiratory tract, or skin (Budi et al., 2024; Patel et al., 2021). The toxicology of lead becomes harmful to the body due to the ionic mechanism with lead's ability to replace other bivalent cations such as Ca^{2+}, Mg^{2+}, and Fe^{2+} and monovalent cation ions such as Na^{+}. It will affect the fundamental biological processes in the human body(Massa & Siaka, 2022; Fu & Xi, 2020). The accumulation of lead exposure in the body significantly impacts various processes, including disruption of signal transmission between cells, causing cell adhesion, protein folding and maturation, apoptosis, ionic transport, enzyme regulation, the release of neurotransmitter amounts and types, and so on (Briffa et al., 2020; Singh et al., 2024)

Particularly, the ionic mechanism contributes to the depletion of the neurotransmitter by displacing calcium ions and their ability to cross the blood-brain barrier (BBB). After passing BBB, the lead will accumulate in astroglial cells (protein lead bonds). Then, the lead will damage immature astroglia cells and inhibit the formation of myelin sheaths. Even in small amounts, lead can replace calcium, affecting key neurotransmitters such as protein kinase C. This protein plays a role in regulating nerve excitation and memory storage. Lead also influences the concentration of sodium ions responsible for vital biological activities, such as responses to actions in excitatory tissues for intercellular communication, uptake of neurotransmitters (choline, dopamine, and GABA), and regulation of calcium use and retention by synaptosomes. The interaction between lead and sodium then impairs the normal function of sodium (de Souza et al., 2018; Rocha & Trujillo, 2019). Compared to the effect of lead on organs, the nervous system is the main target and is more sensitive to inducing lead toxicology(Singh et al., 2018). Both the central and peripheral nerve systems will be impacted by lead exposure. Adults are more likely to notice effects on their peripheral nervous system, whereas children are more likely to notice effects on their central nervous system.(Boskabady et al., 2018; Tshala-Katumbay et al., 2015)

Lead poisoning in children can decrease intelligence, growth, hearing, and anemia, and can lead to attention disorders and behavioral lapses(Agudelo et al., 2024). High exposure can result in severe brain damage, even death. Children are susceptible to lead poisoning because they can absorb more lead from the environment than adults. Besides that, the central nervous system in children is still in the developmental stage, so it can disrupt development. Lead can also poison the reproductive system, resulting in disruption of the formation of red blood cells. High blood lead levels are associated with delayed puberty in girls. It is because lead poisoning suppresses the production of hormones in the ovaries that function to prepare a woman's body to ovulate and release an egg. Exposure to lead throughout pregnancy, stored in bones and blood, eventually leads to across the placenta and causes fetal death. Short-term exposure to high lead levels can cause brain damage, movement disorders, anemia, and gastrointestinal symptoms. Long-term exposure can cause damage to the kidneys, reproductive system, immune system, and nervous system. The impact of low-level lead exposure on the nervous system is related

to intellectual development in early childhood. The same analogy as mercury, lead crosses the placenta and accumulates in the fetus. Short-term and low-level lead exposure in children affects neurobehavioral disorders (Musfirah & Rangkuti, 2019).

The accumulation of lead in the central nervous system leads to the emergence of structural and functional disorders. Lead poisoning is known to affect different parts of the brain, namely the cerebral cortex, cerebellum, and hippocampus. Lead exposure in adult mice and growing mice showed increased oxidative stress in the cortex, hippocampus, cerebellum, and medulla. This increase in oxidative stress is characterized by a decrease in the activity of the enzymes Superoxide Dismutase (SOD), Xanthine Oxidase (XO), and Catalase (CAT), as well as increasing levels of lipid peroxidase (LP) enzymes. The area in the brain most early affected by lead exposure is the gray matter of the prefrontal. The reduction of gray matter in the prefrontal is related to the appearance of criminal behavior in individuals and antisocial personality disorder. Elevated levels of lead in the blood affect the process of delivering neurotransmitters at the synapse. It leads to inhibition of neurotransmitter release, including at serotonergic synapses, which are synapses that have the neurotransmitter serotonin. Serotonin is one of the neurotransmitters that is also responsible for influencing individual behavior. Serotonin, in normal levels, maintains emotional stability. Disturbances in the serotonin can lead to increased aggressive and impulsive behavior. Decreased serotonin levels were found to occur in people with antisocial behavior disorder. Although it is recognized that antisocial behavior is due to the interaction of various socio-hereditary variables, there is increasing research evidence that exposure to the heavy metal lead plays a role in its epigenesis, namely as a trigger for stimulus. Increased blood lead levels will have implications for the structure, enzyme system, and neurotransmitters of the nervous system, which implicates the emergence of behavioral changes (Marianti et al., 2015).

Lead exposure directly causes encephalopathy or the progressive degradation of specific brain regions. Symptoms include headaches, tremors in the muscles, dull skin, irritability, poor focus, memory loss, and hallucinations. Seizures, ataxia, psychosis, lack of coordination, paralysis, and coma are examples of more severe symptoms (Reuben, 2018; Eid & Zawia, 2016; Bakulski et al., 2020). The importance of the research topic on the link between lead exposure and antisocial behavior has several reasons. First, there has been a lot of relationship between the two variables, but there has not been a concern related to policy. Second, there are no documents that specifically address delinquency and criminality (part of the symptoms of antisocial disorder). It needs to be included in theories of human development. This perspective is vital, given that the trajectory of the results achieved can have an impact. Third, a recent evaluation of the evidence for the role of lead etiology in antisocial behavior can inform an updated quantitative assessment of the effect of the global burden of lead and evidence-based policy interventions aimed at reducing exposure worldwide, particularly early in life and reducing the harmful effects of lead and other neurotoxicants in achieving the sustainable development goals.

Conclusion

The industry of batik produces waste from dyeing residue, which causes environmental pollution if it is not managed properly. Environmental pollution contains the heavy metal lead neurotoxic to the human body. Accumulated exposure to lead in the blood of dye workers in the batik industry has a positive and significant correlation with the appearance of antisocial behavior, yet does not correlate with body mass index.

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A.galanga (L.)-Willd Rhizome and O.sanctum L. Leave Essential Oils as Culex sp. Larvicide

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Abstract

Culex sp. can transmit diseases such as encephalitis and filariasis which is a public health problem because of elephantiasis, disability, and a neglected tropical disease. To prevent these diseases, the mosquitoes need to be eradicated and larvicides are considered to control them at their early stage. Temephos, a synthetic larvicide, could cause several disadvantage, such as potential toxicity against non-target organisms and easier-to-develop mosquito resistance. Botanical sources from Indonesian spices i.e. galangal (Alpinia galanga (L.) Willd.) and basil (Ocimum sanctum L.) are potentially used as larvicide. This study aimed to explore the larvicidal effect of their essential oils compared against temephos against Culex sp. A true experimental study was done using several concentrations and replications of these essential oils in each container, consisting of 25 third instar of Culex sp larvae for 24 hours at room temperature according to WHO procedure. The percentage of dead larvae was analyzed by ANOVA/ Kruskal Wallis. The study showed that Alpinia galanga (L.) Willd. and Ocimum sanctum L. essential oils had larvicide activity and their activity starting from 140 ppm and 400 ppm consecutively was the same as temephos 1 ppm.

Introduction

Many diseases are vector-borne diseases which are usually transmitted by bloodsucking arthropods. Mosquitoes are the best-known vectors besides other vectors. Three genera of them i.e.: Culex, Aedes, and Anopheles are the most important vector of many diseases (Osanloo *et al.,* 2019). Mosquitoes are the most dangerous animal in the world (Breedlove, 2022). *Culex sp.* besides causing itching, can transmit several fatal diseases, such as encephalitis, and also can decrease productivity by disability because of filariasis. Filariasis, especially lymphatic filariasis, is one of the important neglected tropical diseases and it becomes a problem because of the elephantiasis (WHO, 2020). Indonesia is endemic for several neglected tropical diseases including filariasis, one of the public health problems (Santoso *et al.,* 2020), and there is a target time for filariasis elimination in Indonesia (Meliyanie & Andiarsa, 2017). Elephantiasis itself could not be cured by administering medication. So, it is vital to prevent these diseases by reducing the mosquito population and this effort might support the filariasis elimination program.

Larvicide is preferred for this purpose because it reduces the population earlier by killing the larvae, and it is easier because the larvae are concentrated in breeding places and accessible before the mosquitoes become adult stadia (Osanloo *et al.,* 2019). The effectivity of temephos as a chemical/synthetic larvicide of the organophosphate group is still good, cost-effective, and recommended by WHO. However, a recent study reported detrimental

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effects on male fertility of mice in vitro which showed that temephos caused disturbance of the sperm functions by several mechanisms which significantly decreased the fertilization rate and further early embryonic development (Kim *et al.,* 2020). According to clinical studies, temephos had no significant negative effect on general human health. However, it has been proven that temephos might have mild genotoxic/teratogenic effects and could cause detrimental effects on fetal development specifically against the central nervous system to inhibit acetylcholine esterase as well as inhibition in fetal growth (Satriawan *et al.,* 2019) and has been reported the impact of exposure to pesticide, organophosphate/ carbamate, against pregnant women who worked as shallot farmers in the Middle of Java province especially at first trimester of pregnancy resulted a generation with lower IQ (Suwondo et al. 2016). Also, another study reported that there was population resistance of mosquitoes (*Aedes sp*) against temephos which reduced the impact on developmental and reproduction potential of mosquitoes (Rahim *et al.,* 2017). Resistance of mosquitoes against synthetic larvicides might be caused by several factors: it is a tendency of persistence of the synthetic larvicide for a long time in the environment causing adaptation of the mosquitoes against it. The single compound in it also causes resistance. Targeting the non-target organism in the indiscriminate use of the synthetic larvicide also becomes another risk because of the toxic residue of the synthetic larvicide (Antonio-Nkondjio *et al.,* 2018, Osanloo *et al.,* 2019). Therefore, it is wise to find another effective larvicide that is safe for non-target organisms and spared from resistant mosquitoes.

Spices such as galangal (*Alpinia galanga* (L.) Willd.) rhizome extract which flavonoid is one of the dominant compositions has been reported as a larvicide against *Aedes sp.* (Boesri *et al.,* 2015) and other spices i.e. basil (*Ocimum sp.*) leaves essential oil also has been reported about its larvicide effect which had different one according to mosquito genus and the species of Ocimum (Sneha *et al.,* 2022). These kinds of herbal are very familial especially in Indonesia because they are consumed in so many Indonesian foods. Less cloudiness usually found in essential oils applications than extracts might be another benefit. This study aimed to explore the larvicidal effect of the *Alpinia galanga* (L.) Willd rhizome and the *Ocimum sanctum* L. leaves essential oils against the third instar of *Culex sp.* larvae to be developed in further study.

METHOD

The *Culex sp.* larvae were obtained from The School of Life Science and Technology, Bandung Institute of Technology (ITB), while *Alpinia galanga* (L.) Willd. rhizome and *Ocimum sanctum* L. leaves and their essential oils were from The Taman Kebun Percobaan Manoko, Lembang, Kabupaten Bandung Barat, Indonesia, and the essential oils were made using the distillation method by the company. Temephos to be used in this experiment was Abate from BASF. Before making essential oils, these simplicia were identified by Pusat Studi Biofarmaka Tropika (*Trop BRC*), Institute for Research and Community Service, Institut Pertanian Bogor, Bogor, Indonesia. The study was done after ethical approval by The Ethical Committee of the Faculty of Medicine, Maranatha Christian University. It was a true experimental study with a completely randomized design preceded by the pre-experimental research to identify the variation of concentrations to be used. This study was done according to WHO Guidelines for Laboratory Testing of Mosquito Larvicides (WHO Communicable Disease Control, 2005). According to pre-experimental research, the range of concentrations of *Alpinia galanga* (L.) Willd rhizome essential oil (AgEO) to be used in this experiment were between 60-160 ppm: 60, 80, 100, 120, 140, and 160 ppm, while the concentrations of *Ocimum sanctum* L. leaves essential oil (OsEO) were used in concentrations 100, 200, 400, 800, and 1.600 ppm. Aquadest was used as a negative control while temephos 1 ppm was a positive control. AgEO study was done with 4 replications for 8 treatments while OsEO with 5 replications for 7 treatments. All these treatments with each replication were done in glass containers containing 100 mL treatment solutions at room temperature. Then 25 live third instar larvae of *Culex sp* were added into each container. These treatments were done for 24 hours and

thereafter the percentages of dead larvae in each container were counted and analyzed using ANOVA or Kruskal Wallis according to homogeneity/ normality of the data.

RESULT AND DISCUSSION

The study of AgEO was done with 4 replications for 8 treatments: 60, 80, 100, 120, 140, and 160 ppm, with aquadest as a negative control, and temephos 1 ppm as a positive control. The result showed the percentage of dead larvae for each replication in each treatment. Because the data were not normal, it was analyzed with Kruskal Wallis and continued with Mann-Whitney.

According to probit analysis, the LC_{50} of AgEO as larvicide against *Culex sp* was 83 ppm = 0.0083% and LC_{90} was 126 ppm=0.0126%. This LC50 was less than 100 ppm. Because of this LC50, AgEO could be classified as an active larvicide against Culex sp (Gomes *et al.,* 2021, Diaz *et al.,* 2023). As shown in Table 1 below, this essential oil has a larvicidal effect starting from 60 ppm and starting from 140 ppm the effect was the same as temephos to kill the larvae. AgEO rhizome consisted of so many compounds, either major or minor, and there was synergistic interaction between them in insecticidal effect. The AgEO from Yunnan Province-China consisted of 5 major components (alpha-pinene, beta-pinene, eucalyptol, L-borneol, and alpha-terpineol) and eucalyptol and alpha-terpineol were the most active as larvicide among the major components. The major components of AgEO from Indonesia were 1,8-cineole and pinenes, while these compounds were less active than alpha-terpineol and eucalyptol. Therefore the larvicidal activity of the AgEO between these different countries might be different because of different rates of each active ingredient and the difference might depend on their geography, season, and time of harvesting (Wu *et al.,* 2014).

Another study reported that *Alpinia galanga* rhizome extract from the same country (Indonesia) showed larvicidal activity against *Aedes sp* which LC_{90} was 8.2% (Boesri *et al.,* 2015), while in this study its essential oil could kill all the *Culex sp* larvae in concentration starting from 140 ppm (=0.014%) and the LC_{90} was 0.0126%. The smaller LC_{90} of the essential oil might probably be caused by the more active compounds obtained from this preparation. The significantly less cloudy solution of the essential oil was another benefit of its application.

Essential oils are mixtures of active compounds such as alkaloids, monoterpenes, and flavonoids. Flavonoids kill the larvae by targetting the mosquito's acetylcholine esterase enzymes, while monoterpenes and alkaloids by targetting N-K-ATP-ase or K+ and Na+ channels. Using a single active compound as

TABLE 1. The Percentage of the Dead Larvae for Each Replication in Each Treatment of Various Concentrations of AgEO Compared to Aquadest (as a Negative Control) and Temephos 1 ppm (as a Positive Control)

	Percentage of The Dead Larvae from Each Treatment Group							
	I	II	III	IV	V	VI	VII	VIII
1	24	40	60	84	100	100	4	100
2	24	56	88	68	100	100	12	100
3	24	24	80	68	100	100	4	100
4	36	44	68	76	100	100	4	100
Mean ±SD	27 ± 6^{b}	41 ± 13^{b}	68 ± 12^{c}	74 ± 8^{c}	100 ± 0^{d}	100 ± 0^{d}	6 ± 4^{a}	100 ± 0^{d}

Notes: I= group treated with AgEO 60 ppm, while II, III, IV, V, VI were treated with AgEO 80. 100, 120, 140, 160 ppm consecutively. VII= group treated with aquadest only, VIII= group treated with temephos 1 ppm as a positive control. The same superscript letter means no significant difference ($p > 0,05$).

larvicide might give rise to more larvicide-resistant mosquitoes while using multiple active compounds such as compounds in essential oil that have different targets causes less resistant ones, and it might be another benefit of using essential oil as larvicide (Kim and Ahn 2017, Osanloo et al. 2019). The biodegradability of the botanical larvicide also reduces the resistance process. Essential oils are biodegradable while synthetic larvicide such as temephos tends to remain in the environment for a long time, and the larvae might adapt against this condition and then potentially become resistant to the larvicide (Osanloo *et al.,* 2019).

Larvicidal effect against *Culex sp* larvae of *Alpina galanga* rhizome dichloromethane extract continued with further bioassay-guided gradually graded fractionation of the extract also showed high effectivity and could kill 100% larvae (Abutaha & Al-Mekhlafi, 2020). So the larvicidal activity of the botanical larvicide also depends on its preparation beside its plant origin. It could be concluded that AgEO is potentially to be used as mosquito larvicide although the possibility of negative effects of this preparation should be studied further. Considering the result of our study, It is wise to do further research using concentrations between 120-140 ppm to find out the smallest concentration which still has the same effect as temephos as a standard larvicide.

Larvicidal study of OsEO was done with 5 replications for 7 treatments: 100, 200, 400, 800, and 1.600 ppm, with aquadest as negative control, and temephos 1 ppm as positive control. The result showed the percentage of dead larvae for each replication in each treatment. Because the data were not normal, it was also analyzed with Kruskal Wallis and continued with Mann-Whitney.

According to probit analysis, the LC_{90} of OsEO as *Culex sp* larvicide was 353 ppm. According to this LC, OsEO could be classified minimally as an effective larvicide. If the LC_{50} is less than 100 ppm, it could be classified as an active larvicide (Kim & Ahn, 2017). As shown in Table 2 below, this essential oil had a larvicidal effect against *Culex sp* and this effect at ≥ 400 ppm was the same as temephos larvicidal effect as a standard control which killed 100% of the larvae. This result supported the previous preliminary study which showed the potential larvicide effect of *Ocimum sanctum* leaf crude extract against *Culex sp* and *Aedes sp* larvae. Still, this last study indicated low and moderate results (Anees, 2008). Contrary to the larvicide study using ultrasound-assisted hydrodistillation essential oil of several species of Ocimum plants (*O.basilicum*, *O.canum*, *O.tenuiflorum*, *O.gratissimum*) against *Culex sp*, it was shown that all of these plants had a low LC_{50} i.e. 50-75 ppm (Sneha *et al.,* 2022). A study in India also showed that essential oil of *Ocimum sp* including *Ocimum sanctum* aerial parts as

TABLE 2. The Percentage of the Dead Larvae for Each Replication in Each Treatment of Various Concentrations of OsEO Compared to Aquadest and Temephos 1 ppm (as a Positive Control).

	Percentage of The Dead Larvae from Each Treatment Group						
	I	II	III	IV	V	VI	VII
1	50	56	100	100	100	20	100
2	76	50	100	100	100	4	100
3	56	84	100	100	100	12	100
4	56	48	100	100	100	4	100
5	40	60	80	100	100	4	100
Mean± SD	55.6±13.1[a]	59.6±14.4[a]	96±8.9[b]	100±0[b]	100±0[b]	8.8±7.2[c]	100±0[b]

Notes: I= group treated with OsEO 100 ppm, while II, III, IV, V, were treated with OsEO 200, 400, 800, and 1600 ppm consecutively. VI= group treated with aquadest only, VII= group treated with temephos 1 ppm as a positive control. The same superscript letter means no significant difference ($p > 0,05$).

well as their petroleum ether extracts had a lower LC_{50} against *Culex sp* which meant that they had a stronger effect as larvicide compared to our study. LC_{90} OsEO in the previous study in India was 106.66 ppm and 223.6 ppm for laboratory and field-reared *Culex sp* larvae (Rajamma *et al.,* 2011), while in our study it was 353 ppm. This might also be caused by the different geography, climate, and time to harvest (Wu *et al.,* 2014). Different extractor solutions could influence in obtaining the amount of active compounds. The major compounds that had insecticidal activity were *t*-methyl cinnamate, linalool, and estragole; *t*-methyl cinnamate was more potent than linalool while linalool was potentially better than estragole. The target of insecticidal/ larvicidal effect of these 3 compounds is the central nervous system of the insects by inhibiting acetylcholine esterase and influencing gamma-aminobutyric acid (GABA) and the result against this enzyme as well as against GABA receptor resulted in synergistic effect as an insecticide/ larvicide. Fortunately, the morphology and molecule of the GABA receptor and the molecule of the acetylcholine esterase of the insects are different against vertebrates/humans, therefore it is safe for them (Savigny *et al.,* 2021). In Brazil, OsEO could act as an insecticide against all the stadia of *Musca domestica* (Chil-Núñez *et al.,* 2020).

Because in 400 ppm the AsEO could kill 100% Culex larvae and have the same effect as temephos as a standard larvicide drug, it is also wise to consider further study using the range of concentration between 200 and 400 ppm to find out the least concentration that could still have the same larvicidal effect as temephos. Further study on whether there is any negative effect against non-target organisms also needs to be explored. All of these need to be considered before its application in the community. It showed a different LC50 than our study because of different plants origin, different preparations, different larvae stadiums, and different mosquito genera.Another spice, familiar in Indonesia, red ginger (*Zingiber Officinale* Rosc), also had been studied as a larvicide for Aedes aegyti (Boekoesoe & Ahmad, 2022). Also, other botanical sources such as Srigading (*Nyctanthes arbor*-tristis) a decorating plant easily found in Indonesia had been studied as larvicide against 4th instar Aedes aegypti (Fakhriadi *et al.,* 2023). Its leaf extract was used. Besides other factors, different active compounds obtained by different preparations i.e. juice, extract, and essential oil, could be one of the reasons for different effects. These evidences might be put in our consideration to investigate many studies ahead about natural larvicides especially using substances which are familiar to human.

CONCLUSION

AgEO and OsEO had larvicidal properties against Culex sp. and, within proper concentration, could have the same larvicidal activity as temephos, a standard synthetic larvicide, which could kill all the larvae. As we know, prevention is preferred to therapy, and the application of these essential oils might be considered to support the filariasis program to prevent the disease by killing the vector at an early stage. These essential oils need further study to determine the lowest concentration with the same effect as temephos. Although these essential oils are botanical sources, they need to be studied further also to explore any possible harm to the environment/non target organism.

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Health Belief Model in The Prevention of Type-2 Diabetes Mellitus in Fertile Age Couples

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Abstract

Sufferers with diabetes want to well recognize the threat of diabetic headaches and the shape of the Health Belief Model (HBM) recognition to construct suitable interventions. This study aims to determine the effect of the health belief model on the prevention of type 2 diabetes mellitus in fertile-age couples. The research design was cross-sectional. The research sample was a fertile age couple who are in the area of Depok City, West Java as many as 399 respondents. Data analysis used a structural equation modeling approach with the partial least squares method. The results showed that there was a perceived effect on the prevention of type-2 diabetes mellitus with a t-statistic of 13.331880, there was an effect of self-efficacy on the prevention of type-2 diabetes mellitus with a t-statistic of 2.221879, there was an effect of cues to action on the prevention of type-2 diabetes mellitus with a t-statistic of 2.482949, and the perceived indicator that has the most influence on the prevention of type-2 diabetes mellitus was barriers with a t-statistic of 180.528565. Based on the value of R2, the magnitude of the effect of perceived, self-efficacy, and cues to action on the prevention of type-2 diabetes mellitus was 89.52%. From the Q2 value, the model in this study has a relevant predictive value, where the model used can explain the information contained in the research data by 89.52%. There was an effect of the health belief model on the prevention of type 2 diabetes mellitus in fertile-age couples. Another dominant variable that influences the prevention of type 2 diabetes mellitus in fertile-age couples is perceived and the indicators of barriers.

Introduction

Diabetes mellitus (DM) is a significant global public health concern due to its increasing prevalence and associated health risks (Purwanti, Nursalam & Pandin 2024). The International Diabetes Federation (IDF) estimates that approximately 537 million individuals globally are affected by diabetes, with this number projected to rise to 783 million by 2045 (Duan *et al*., 2022). The prevalence of DM is particularly high in low- and middle-income countries (LMICs), where nearly 80% of the diabetic population resides (Jiang *et al*., 2021). Diabetes mellitus, a chronic medical condition, is rapidly spreading globally, posing a significant public health challenge. Type 2 diabetes, a common form of the disease, primarily affects individuals who are overweight, lead a sedentary lifestyle, and have a genetic predisposition to the condition. It is crucial to recognize that several risk factors contribute to the development of type 2 diabetes (Shooka *et al*., 2018).

Between 2010 and 2030, the prevalence of type 2 diabetes was expected to increase by 70% in developing countries and 20% in developed countries. The International Diabetes Federation (IDF) predicts that the global population of people with diabetes will reach 415 million in 2015 and increase to 642 million by 2040 (Balgis *et al*., 2023). There are almost 4.6 million people with diabetes. Diabetes in Iran

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accounts for 8.5% of the country's population (Roglic 2016). The prevalence is 7.3% to 7.7% in people over 30 years of age. More than 90% of people with diabetes have some form of type 2 diabetes. The World Health Organization WHO has estimated that the number of people with diabetes will increase from 135 million in 1995 to 300 million people by 2030 (Prasetyowati, Tamtomo & Murti 2018).

Diabetes mellitus (DM) is a common degenerative disease. This is indicated by an increase in blood sugar levels. Indonesia ranks second only to India in the number of diabetics in Southeast Asia. Diabetic complications in fertile-age couples with gestational diabetes can affect mothers and babies. DM in fertile-age couples is an important problem because of the high proportion of new cases and the impact is also dangerous because married fertile-age couples have a chance to get pregnant (Tawfik 2017). DM during pregnancy affects the condition of the baby, namely, the baby is more at risk for stillbirth, premature birth, high birth weight, low Apgar score, high level of resuscitation, hospitalization in intensive care, and requires a longer stay in hospital than babies born from mothers without DM. In addition, if a woman with DM becomes pregnant, her unborn child also has a high risk of developing DM as an adult (Shabibi *et al*., 2017).

Prevention of type 2 diabetes mellitus is very important, especially among couples of childbearing age, because it can prevent chronic complications and improve quality of life. One effective way to prevent type 2 diabetes mellitus is to change daily behavior, such as reducing sugar and fat consumption, increasing physical activity, and controlling body weight (Khosravizadeh *et al*., 2021). To lessen the headaches of diabetes, a few research emphasize that healthcare employees ought to now no longer simply offer expertise to humans, however, do not forget the belief of the threat as a vital idea for knowledge of healthful behaviors and making adjustments in conduct (Esquives, Ramos & Stoutenberg 2021). So, sufferers with diabetes want to well recognize the threat of diabetic headaches and the shape of the Health Belief Model (HBM) recognition to construct suitable interventions (Shabibi *et al*., 2017). HBM as a theoretical framework for this research, is one of the handiest fashions of fitness education, particularly targeted on prevention of sicknesses and adoption of behaviors to keep away from infection and disorder chains and it's by far one of the essential particular fashions that is used to decide the connection among fitness ideals and behaviors (Ong *et al*., 2023).

The Health Belief Model was used as a theoretical framework to understand people's behavior in preventing and managing type 2 diabetes. Various factors such as risk perception, severity perception, and self-efficacy are analyzed to understand how individuals understand and apply diabetes prevention behavior (Duan *et al*., 2022). The results show that the Health Belief Model can be an effective tool in increasing awareness and diabetes prevention behavior among type 2 diabetes patients, as well as in encouraging changes in community behavior to reduce the risk of diabetes (Jones *et al*., 2015). HBM is a theoretical framework used to understand people's behavior in preventing and managing disease. The HBM focuses on four main components: risk perception, severity perception, self-efficacy, and behavior. By using HBM, researchers can understand how individuals perceive the risk of type 2 diabetes mellitus, how they assess the severity of the disease, and how confident they are in changing behavior to prevent type 2 diabetes mellitus (Afrasiabi *et al*., 2022). In the context of couples of childbearing age, HBM can be used to understand how they perceive the risk of type 2 diabetes mellitus, how they assess the severity of the disease, and how confident they are in changing behavior to prevent type 2 diabetes mellitus. Thus, HBM can be an effective tool in increasing awareness and diabetes prevention behavior among couples of childbearing age (Jiang *et al*., 2021).

The HBM posits that humans would take motion to save you infection if they regard themselves as liable to a condition (perceived susceptibility) if they trust it'd have doubtlessly extreme consequences (perceived severity) if they trust that a selected path of motion to be had to them could lessen the susceptibility or severity or result in different fine outcomes (perceived benefits), and if they understand few bad attributes associated with the fitness

motion (perceived barriers) (Melkamu, Berhe & Handebo 2021). Additionally, HBM pupils later cautioned that cues to the action-self-efficacy perception that you may efficiently entire the conduct of a hobby regardless of taking into consideration barriers introduced to the versión (Pipatpiboon *et al*., 2024). It was hoped that this research could contribute to the development of more effective prevention strategies for type 2 diabetes mellitus among couples of childbearing age. It was also hoped that the results of this research would help increase public awareness about the risks of type 2 diabetes mellitus and the importance of changing daily behavior to prevent this disease. Fertile-age couples who contracted diabetes mellitus, their offspring have risk factors for developing diabetes later in life. The purpose of this study was to determine the effect of the health belief model on the prevention of type 2 diabetes mellitus in fertile-age couples.

Method

The research design was cross-sectional, namely a type of research that emphasizes measuring/observing independent and dependent variable data only once at a time (Sugiyono 2019), that aims to determine the effect of the health belief model on the prevention of type 2 diabetes mellitus in fertile age couples. The study population was all fertile age couples aged 15-49 years in Depok City totaling 213.716 couples. The minimum sample size needed was determined by the Slovin formula. A total of 399 samples were collected in sub-districts around Depok City using the multistage sampling method. There were eleven sub-districts included in this study, namely Bojongsari, Sawangan, Limo, Cinere, Cipayung, Pancoran Mas, Beji, Cilodong, Sukmajaya, Cimanggis, and Tapos. Several variables and indicators were included in the Structure Equation Modeling (SEM) analysis to see the Health Belief Model in the Prevention of Type 2 Diabetes Mellitus. Exogenous variables consist of Cues to Action, Self Efficacy, and Perceived with indicators of Barriers, Benefits, and Severity. Endogenous variables were Prevention of Type-2 Diabetes Mellitus.

Data was collected by researchers using a questionnaire. The questionnaire on the perceived variable consists of 20 questions, while the self-efficacy, cues to action, and prevention variables each consist of 15 questions. Instrument validation was tested with the Pearson product-moment correlation technique. The reliability of the instrument was tested using Alpha Cronbach. Researchers apply research ethics based on the statement letter from the Indonesian Advanced University Health Research Ethics Commission No. Number: 1650/Sket/Ka-Dept/RE/UIMA/VIII/2022 to protect the rights and obligations of respondents and researchers. Data were analyzed multivariately using Structural Equation Modeling analysis with statistical software applications using Smart Partial Least Squares (PLS).

Result and Discussion

The results of this research contain images of the research concept before it becomes a research model. Next contains the results of the calculate algorithm to evaluate whether the model is valid and reliable. After that, display the results of calculating bootstrapping to see the significance of the influence between variables. Once it is known that the model is valid, reliable, and significant, the magnitude of the influence between variables is presented and a mathematical equation is formed from the model and the validity of the model is seen in measuring the prevention of type 2 diabetes mellitus. The structural model in this study was described as follows:

The measurement model or outer model with reflexive indicators was evaluated with convergent and discriminant validity of the indicators, composite reliability for indicator blocks, and AVE, as well as composite reliability values. The outer model with formative indicators was evaluated based on its substantive content, namely by comparing the relative magnitude of the weight and seeing the significance of the weight measure. The results of the loading indicator factor for each variable can be seen in Figure 1 below. The following was the output of the initial run:

Based on Figure 1, it could be seen that the loading factor value of Barriers was 0.940, Benefits was 0.939, Severity was 0.854, and Susceptibility was 0.840 which met the

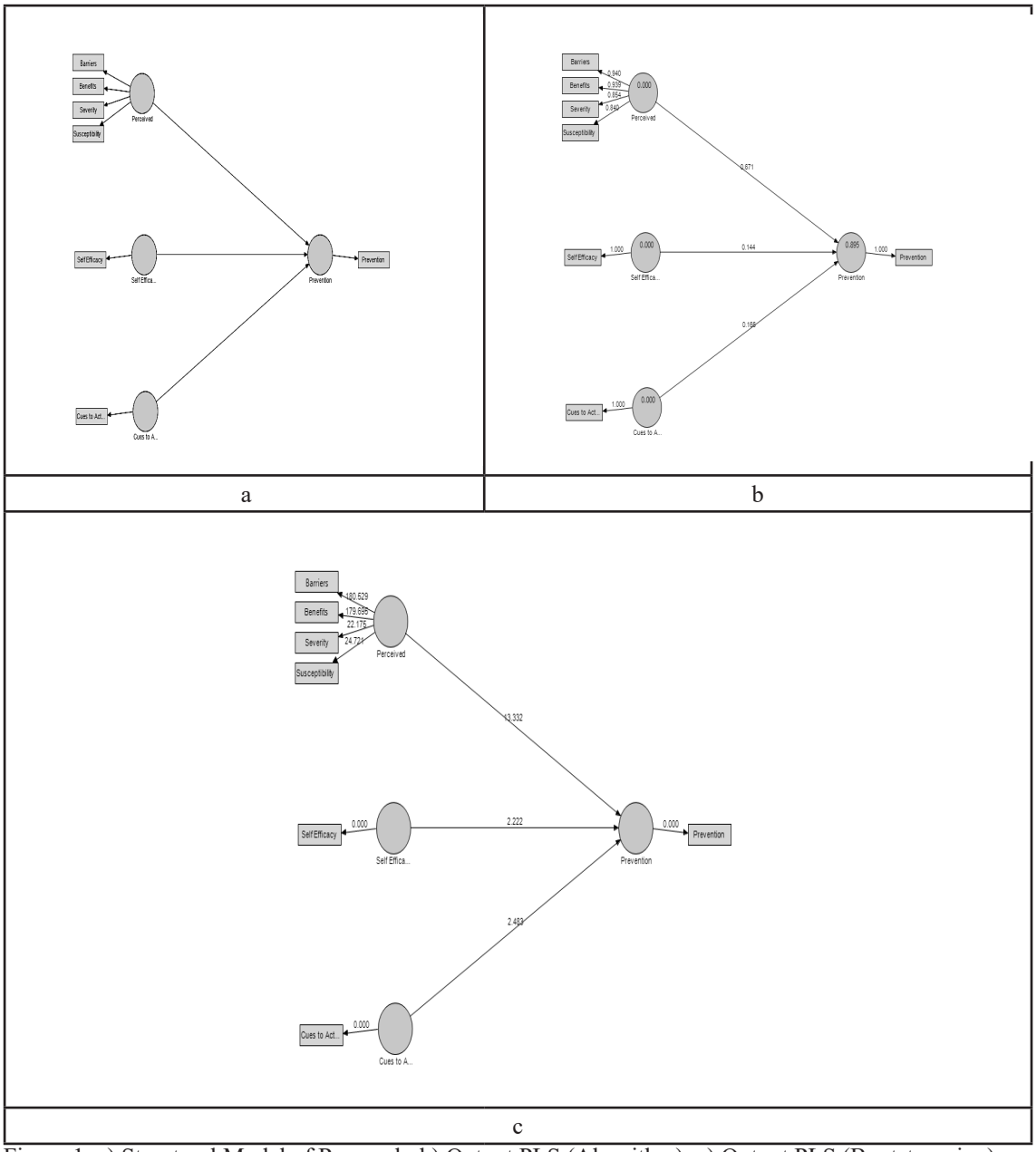

Figure 1. a) Structural Model of Research; b) Output PLS (Algorithm); c) Output PLS (Bootstrapping)

requirements, namely the loading factors value was greater than 0.5. A reflective indicator was declared valid if it had a loading factor above 0.5 for the intended variable based on its substantive content. Based on Figure 1 shows that all variables have a loading factor value greater than 0.5 so the test criteria for the measuring indicators were declared to be all valid. The purpose of cross-loading was to find out whether the variable can predict a higher factor loading indicator than predictions for other indicators by looking at the value of cross-loading. In addition, seeing the validity of the indicators used in the study could be done by evaluating the results of the cross-loading of all indicators, the table of results was as follows:

An indicator was declared valid if it had the highest factor loading to the intended variable compared to factor loading to other variables. Based on Table 1 above, the correlation variable was greater than the other variable sizes. This shows that the latent variable predicts the size of the block better than the size of the other blocks. The way to see discriminant

validity was by looking at the value of the square root of the Average Variance Extracted (AVE). The expected value was above 0.50. After being tested for validity and it was stated that the variables and indicators were valid, then the reliability test was carried out. The results of the outer model reliability evaluation are set out in the table below by evaluating Cronbach's Alpha and Composite Reliability values. The measurement results in this research model were as follows:

Based on the output results in Table 2, it could be seen that all variables were declared valid because they provide an AVE value above 0.50, so it could be concluded that the evaluation of the measurement model has good discriminant validity. Based on Table 2, both composite reliability and Cronbach's alpha, each variable has a value greater than 0.70, so all variables in the estimated model meet the variable reliability requirements. The results of the significant evaluation of the outer model are

Table 1. Cross-Loading Evaluation of Research Variables

Indikator	Variabel				Evaluation of Model
	Cues to Action	Perceived	Prevention	Self Efficacy	
Barriers	0.801931	0.940230	0.930299	0.827692	Valid
Benefits	0.799768	0.939314	0.929589	0.826447	Valid
Cues to Action	1.000000	0.829027	0.847655	0.872885	Valid
Prevention	0.847655	0.935617	1.000000	0.881878	Valid
Self Efficacy	0.872885	0.884101	0.881878	1.000000	Valid
Severity	0.653477	0.854203	0.688782	0.748309	Valid
Susceptibility	0.690266	0.840030	0.667920	0.760656	Valid

Source: Primary Data, 2023

Table 2. AVE Measurement Results and Reliability Evaluation of Research Variables

Variable	AVE	Cronbach's Alpha	Composite Reliability	Evaluation of Model	
Cues to Action	1.000000	1.000000	1.000000	Valid	Reliable
Perceived	0.800414	0.918355	0.941170	Valid	Reliable
Prevention	1.000000	1.000000	1.000000	Valid	Reliable
Self Efficacy	1.000000	1.000000	1.000000	Valid	Reliable

Source: Primary Data, 2023

Table 3. Results of Measurement on the Effect Between Research Variables

Effect Between Variables	Path Coefficients	T-Statistic (>1,96)	Hypothesis Null	Conclusion
Perceived → Prevention	0.670681	13.331880	Rejected	Positive and Significant Effects
Self Efficacy → Prevention	0.144320	2.221879	Rejected	Positive and Significant Effects
Cues to Action → Prevention	0.165668	2.482949	Rejected	Positive and Significant Effects

Source: Primary Data, 2023

arranged in the PLS output below by evaluating the reflection of the T-statistical indicator value on the variable. The evaluation of the significance of the outer model was carried out to assess the significance of the latent variable with its variable, namely by comparing the T-Statistic value of each latent variable with a value of = 0.05 (1.96). To measure the T-Statistic value, bootstrapping was carried out on the model with the following results:

After bootstrapping was done to measure the T-Statistic value of each latent variable to its variable, the T-Statistic value was compared with the value of = 0.05 (1.96). The stipulation was that if the T-Statistic value was greater than the value of = 0.05 (1.96), then the latent variable was significant to the variable. Figure 1. The results of measuring the T-Statistic value from each indicator to the variable were greater than 1.96 with a 95% confidence level (α = 0.05), Barriers of 180.529, Benefits of 179.695, Severity of 22.175, and Susceptibility of 24.721. That means all indicators had a significant effect on the variables studied. To test the hypothesis between variables could be seen in Table 3.

Based on Table 3, perceived has a positive effect on the prevention of Type-2 Diabetes Mellitus, the test results show that there was a positive effect of 0.670681, while the T-Statistic value was 13.331880 and was significant at =5% (1.96). Self-efficacy has a positive effect on the prevention of Type-2 Diabetes Mellitus, the test results show a positive effect of 0.144320, while the T-Statistic value was 2.221879 and was significant at =5% (1.96). Cues to Action has a positive effect on the prevention of Type-2 Diabetes Mellitus, the test results show a positive effect of 0.165668, while the T-Statistic value was 2.482949 and was significant at =5% (1.96). After the T-Statistic was known, then measurements were carried out to determine the magnitude of the direct and indirect influence between variables with the following results:

Table 4 states that a perceived has a direct effect on the prevention of Type-2 Diabetes Mellitus by 62.75%. Self-efficacy has a direct effect on the prevention of Type-2 Diabetes Mellitus by 12.73%. Cues to action directly affect the prevention of Type-2 Diabetes Mellitus by 14.04%. If together they show conformity with the R Square value or in other words, this states that the perceived, self-efficacy and cues to action variables were able to explain the prevention of Type-2 Diabetes Mellitus variable (62.75% + 12.73% + 14.04%) = 89.52%. Mathematically, the form of the structural equation of this research model is as follows:

Prevention of Type-2 Diabetes Mellitus = 0.670681 x Perceived + 0.144320 x Self Efficacy + 0.165668 x Cues to Action + 0,104798

Prevention of Type-2 Diabetes Mellitus was influenced by the perceived 0.670681, self-efficacy of 0.144320, cues to action of 0.165668, and influenced by other factors of 0.104798 meaning that there was a positive influence of perceived, self-efficacy and cues to action on the prevention of Type 2 Diabetes Mellitus. The better than perceived, self-efficacy and cues to action, the better than to the prevention of Type-2 Diabetes Mellitus. The Q-Square (Q^2) test aims to assess the amount of data diversity or variation in research data on the phenomenon being studied. The formula used to measure Q^2 was as follows:

Table 4. Percentage of Effect Between Variables

Effect Between Variables	Latent Variable Correlation	Path Coefficients	Direct Path	Direct %
Perceived → Prevention	0.935617	0.670681	0.6275	62.75
Self Efficacy → Prevention	0.881878	0.144320	0.1273	12.73
Cues to Action → Prevention	0.847655	0.165668	0.1404	14.04
Total			0.8952	89.52

Source: Primary Data, 2023

$Q^2 = 1-(1-R_1^2)$

$Q^2 = 1-((1-0.895202)$

$Q^2 = 0.895202 \Rightarrow 89{,}52\%$

Based on the results of these calculations, it could be concluded that the model was able to explain the data variability of 89.52%, while 10.48% was explained by other variables not examined in this study. Perceived has a positive effect on the prevention of Type-2 Diabetes Mellitus, the test results show that there was a positive effect of 0.670681, while the T-Statistic value was 13.331880 and was significant at =5% (1.96). Perceived has a direct effect on the prevention of Type-2 Diabetes Mellitus by 62.75%. The results of measuring the T-Statistic value from each indicator to the variable were greater than 1.96 with a 95% confidence level (α = 0.05), Barriers of 180.529, Benefits of 179.695, Severity of 22.175, and Susceptibility of 24.721. That means all indicators had a significant effect on the variables studied. The construct of perceived susceptibility (perceived risk) also affects the emergence of healthy behavior. When a person knows that it was at risk for a disease, then a belief is formed that it was indeed at risk. Therefore, it will try to do things it deems able to reduce the potential risk (Rossen *et al*., 2015). The higher the risk a person believes, the higher the tendency to behave healthily in the hope of reducing the risk. Unfortunately, this also applies the other way around. When a person feels that he/she is not at risk of disease, it was also more likely to behave unhealthily. However, the statement was not absolute law. Sometimes beliefs about the risk of disease do not have implications for healthy or unhealthy behavior (Afrasiabi *et al*., 2022).

Perceived susceptibility is a person's perception of the risk of contracting a disease. Someone will take preventive and treatment measures because there is a perception that there is a vulnerability to the disease. Individual health beliefs depend on the individual's perception of the disease (Oktora & Butar Butar 2022). The perception of susceptibility obtained from the study followed what was revealed by the participants, namely the perception of the belief that DM is a disease that is passed on to other family members. Where someone who has a family history of suffering from DM has a greater chance. Unhealthy lifestyle factors also cause a person to be vulnerable to DM, especially on the wrong or unhealthy diet that causes an increase in blood sugar levels in pre-DM patients (Githinji & Murimi 2022).

Perception of severity is a perception or opinion about the seriousness, risks, and impacts of diabetes mellitus. The results of the interview, Participant One, Participant Two, Participant Three, and Participant Five explained that the seriousness of DM can cause a person to experience amputation (Li *et al*., 2022). Someone with DM has difficulty maintaining a diet because it should not be careless and must be considered. In addition, participants revealed that they were afraid of DM because of the experience of a family member who died of DM (Ağralı & Akyar 2022). Then the construct of perceived benefit, means that the individual behaves healthily because it believes that something it does will provide benefits, especially in reducing the potential for getting a disease. Healthy behavior carried out by individuals because of beliefs about the benefits of a new activity usually was to prevent disease (Joiner *et al*., 2022).

Perceived benefits are the positive impact that a person feels from carrying out disease prevention behaviors such as a sugar diet, exercise, and consumption of herbal medicines. Participants revealed that having a sugar diet can reduce the risk of diabetes mellitus and become healthier. Participants said that exercise can improve physical health because the body is healthier, and fitter (Chowdhury *et al*., 2023; Chowdhury *et al*., 2024). Consumption of both medical and traditional medicines was felt to provide benefits for participants. Participants said that medical and traditional medicines have various benefits such as making the body feel better (Jones *et al*., 2015). Another construct in the Health Belief Model was the perceived barrier. This construct explains that changing behavior and undergoing a new activity to become, maintain, or improve health is not easy because there are obstacles. The obstacle was the personal evaluation itself. The four constructs, alone or together, could be used to explain healthy behavior (Khodaveisi *et al*., 2021).

Perception of obstacles is an obstacle experienced by a person in taking diabetes mellitus prevention measures such as doing a sugar diet and exercising. The results showed that participants knew what to do to control their blood sugar levels, namely with sugar diet and exercise behavior, but on the other hand, there were obstacles to exercise because participants were busy working, taking care of children, and doing household chores (Bowen *et al*., 2018). Self-efficacy has a positive effect on the prevention of Type-2 Diabetes Mellitus, the test results show a positive effect of 0.144320, while the T-Statistic value was 2.221879 and was significant at =5% (1.96). Self-efficacy has a direct effect on the prevention of Type-2 Diabetes Mellitus by 12.73%. Self-efficacy (individual's perception of their abilities) was considered to affect their healthy behavior. If the individual feels that it was able to do new things that would make him/her live a healthier life, then this belief is most likely to be true in his behavior. However, if the individual wants a change by living a healthier life but feels unable to carry out these activities, then the possibility of this belief in inability makes the individual discouraged, then the targeted healthy behavior does not appear (Ong *et al*., 2023).

Low self-efficacy and negative perceptions of the health belief dimension are some of the reasons behind the discordant prevention of diabetes. Controlled levels of anxiety help patients make better decisions about their diabetes and increase treatment adherence and health beliefs. It was used as a lever to help improve patient beliefs and adherence to treatment and medication, diet, and diabetes management(Gregory *et al*., 2022). Cues to Action has a positive effect on the prevention of Type-2 Diabetes Mellitus, the test results show a positive effect of 0.165668, while the T-Statistic value was 2.482949 and was significant at =5% (1.96). Cues to action directly affect the prevention of Type-2 Diabetes Mellitus by 14.04%. HBM was also influenced by the presence of cues to action. Cues to action are events, people, or objects that make someone change their behavior such as sick family members, health advertisements, and advice from others (Cho *et al*., 2018). Constructs or components in the HBM are also influenced by other factors (motivating factors) in supporting Cues to Action such as culture, education level, experience, expertise, and motivation. These factors are personal characteristics that differ from one individual to another (Deylami *et al*., 2018).

Cues to action is an action that makes someone feel the need to take real action to carry out healthy behavior. Cues to action also mean support or encouragement from the environment for individuals to carry out healthy behavior (Handayani, Kurnia & Fathonah 2021). The results of the study stated that participants showed efforts to behave healthily by following a sugar diet to regulate sugar intake from food and drink, exercising, and taking traditional medicine to reduce the risk of DM (Melkamu *et al*., 2021). The limitation of this research was that the research instrument uses a questionnaire, so there may be subjectivity in filling out the questionnaire. The weakness of this research was that it did not include analyzing how HBM could be used to understand type 2 diabetes mellitus prevention behavior among couples of childbearing age. Further research is needed which aims to find out how risk perception, perceived severity, self-efficacy, and behavior of couples of childbearing age towards type 2 diabetes mellitus, as well as how HBM can be used to increase awareness and diabetes prevention behavior among couples of childbearing age, for example through mobile applications.

Conclusion

There was an effect of the health belief model (perceived, self-efficacy, and cues to action) on the prevention of type 2 diabetes mellitus in fertile-age couples. Another dominant variable that influences the prevention of type 2 diabetes mellitus in fertile-age couples is perceived and the indicators of barriers. It was hoped that fertile age couple would manage their time and make time to exercise in between busy work, taking care of children, and doing household chores.

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Bloso Fish *(Glossogobius giuris sp.)* Biscuit in Increasing Albumin Levels in Tuberculosis Patients

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Abstract

Tuberculosis is a major global health threat. Tuberculosis patients frequently suffer hypoalbuminemia. Protein-rich foods like Bloso fish (Glossogobius giuris sp.) can improve patient outcomes by elevating albumin levels and nutritional status. This study aims to evaluate the impact of Bloso biscuit on albumin levels in Tuberculosis patients. This study used a cross-over randomized controlled trial design. Sixty participants were divided into two groups: the treatment group consuming Bloso biscuits and the control group consuming non-Bloso biscuits. Each group was monitored for four weeks, and albumin levels were checked before and after biscuit administration. The formula consists of 15% bloso fish flour, 35% low protein flour, 20% margarine, 7% butter, 10% cheese, 8% egg yolk, 3% cornstarch, and 1% sugar. The study statistically analyzed the albumin level in Tuberculosis patients. This study found that most patients were female (55%) and aged 26-35 (41.7%). The baseline albumin levels in both groups were 4.5 g/dL. The average albumin level in the treatment group increased to 5.07 mg/dL. Based on statistical tests, Bloso fish biscuits significantly increased albumin levels in the treatment group ($p<0.05$). We concluded that giving Bloso biscuits can increase albumin levels in Tuberculosis patients.

Introduction

The disease known as tuberculosis is preventable and typically treatable. Mycobacterium tuberculosis, the bacterium causing tuberculosis, spreads when a patient coughs or otherwise releases the infection into the air. After coronavirus disease (COVID-19), tuberculosis will be the second most common infectious agent-related cause of death worldwide by 2022, accounting for nearly twice as many fatalities as HIV/AIDS. In 2022, there will be 1.3 million Tuberculosis-related fatalities and 7.5 million new tuberculosis diagnoses worldwide. Since WHO started monitoring tuberculosis worldwide in 1995, this new morbidity rate has been the highest. About 90% of all instances of tuberculosis that occur each year are in adults and more males than women get the disease. Although it can affect other regions, pulmonary tuberculosis is a disease that typically affects the lungs. With 10% of all tuberculosis cases, Indonesia has the second-highest tuberculosis burden after India. The World Health Organization (WHO) and United Nations (UN) Member States have agreed that immediate action is required to stop the tuberculosis epidemic worldwide by 2030 (World Health Organization, 2023).

Tuberculosis is often marked by low albumin levels or hypoalbuminemia (Guo *et al.*, 2022; Xiao *et al.*, 2022). Previous studies in Indonesia indicate that hypoalbuminemia is common among many tuberculosis patients (Assagaf & Kusumawardhani, 2022; Maranatha *et al.,* 2021; Sari *et al.*, 2019). Tuberculosis patients can experience a significant drop in

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albumin levels, with albumin being the main protein in blood plasma. During infection, blood plasma levels tend to decrease, and the reduction in total protein and albumin is often due to loss of appetite, which can lead to anorexia, malnutrition, and malabsorption, potentially worsening the treatment process (Maaz *et al*., 2024; Sinha *et al*., 2019; Xu *et al*., 2022). Hypoalbuminemia is also closely associated with the severity of clinical symptoms of tuberculosis and is a predictor of mortality in hospitalized tuberculosis patients (Assagaf & Kusumawardhani, 2022; Guo *et al*., 2022; Maranatha *et al*., 2021).

Nutritional improvement can help enhance the nutritional status of tuberculosis patients, both in terms of weight gain and disease recovery. Providing additional oral nutrition to tuberculosis patients can be done through primary meals or protein-containing supplements (Jahnavi & Sudha, 2010; Martins *et al*., 2009; Paton *et al*., 2004; Praygod *et al*., 2012; Singh *et al.,* 2021). Bloso fish (*Glossogobius giuris sp.*), also known as tank goby, is widely found in Indonesian waters and inhabits brackish water areas. This fish is rich in protein, vitamins, amino acids, minerals, and water content, while having a low percentage of carbohydrates and lipids, making it suitable for human consumption (Dana *et al*., 2019; Ghosh *et al*., 2021; Islam & Joadder, 2005; Zhuang *et al*., 2010). The protein content in Bloso fish potentially increases albumin, hemoglobin, hematocrit, and platelet levels (Anwar *et al*., 2023). Bloso fish can also be processed into fish flour or fish oil, which can then be used in snacks or supplements to improve the nutritional status of tuberculosis patients. This nutritional and dietary management has the potential to reduce the incidence and mortality rates of tuberculosis.

Previous research related to biscuits as a source of protein based on fishmeal has been conducted, such as biscuits containing hydrolyzed tilapia protein (*Oreochromis* sp.), snakehead fish flour (*Ophiocephalus striatus*) with pumpkin porridge (*Cucurbita moschata* durch) and also catfish flour enriched with moringa leaf flour. The formula for bloso fish flour biscuits (*Glossobius giuris* sp.) consists of 15% bloso fish flour (*Glossobius giuris* sp.), 35% low protein flour, 20% margarine, 7% butter, 10% cheese, 8% egg yolk, 3% cornstarch, and 1% sugar. These biscuits contain 20% fat, 21% protein, 50% carbohydrates, 29% unsaturated fatty acids, 26,4% omega 3 and 110.5 µg/100g vitamin A. This study aims to determine how albumin levels in tuberculosis patients improve following the provision of Bloso fish cake (*Glossogobius giuris sp.*) as an additional protein source. The additional food nutrition as a protein source plays a role in improving the nutritional status of tuberculosis patients.

METHOD

This type of research used the cross-over randomized controlled trial method. Sixty participants were divided into two groups: a treatment group and a control group. The treatment group received biscuits that contained Bloso fish flour, while the second group, namely the control group, was given biscuits without Bloso fish flour. The formula of biscuits for the treatment and control group appeared in Table 1.

The nutritional value should match the

Table 1. Formula of Bloso Biscuit in Treatment and Control Group

Ingredients	Quantity (%)	
	Treatment Group	Control Group
Bloso fish flour (*Glossobius giuris* sp.)	15	-
Low protein flour	35	50
Margarine	20	20
Butter	7	7
Cheese	10	10
Egg yolk	8	8
Cornstarch	3	3
Sugar	1	1

Table 2. Characteristic of Research Sample

Characteristics	Treatment		Control	
	Quantity (N=30)	Percentage (%)	**Quantity (N=30)**	**Percentage (%)**
Age (years)				
17-25	12	40	5	16.7
26-35	13	43.3	12	40
36-45	5	16.7	9	30
46-55	0	0	4	13.3
Gender				
Male	12	40	15	50
Female	18	60	15	50

daily calorie intake of 400-500 mg. The Bloso fish powder manufacturing process uses a freeze dryer, ensuring high-quality preservation of its nutritional components. Participants in both groups received their assigned biscuits every two days for four weeks. Throughout the study period, researchers monitored participant adherence to the biscuit consumption. Albumin levels were measured in all participants before the intervention began and again at the end of the four-week period. This two-phase measurement allowed for a comparison of albumin levels within each group and between the groups, enabling researchers to assess the impact of Bloso fish flour biscuits on albumin levels.

This research was conducted at the Laboratory of Food Technology Soegijapranata Catholic University, Nutrition Laboratory of Universitas Negeri Semarang, and Semarang City Health Centre. The population in this study was all tuberculosis patients at the Semarang City Health Center. The sample size for this study was determined by calculating the mean difference formula and adding this number to account for a 10% dropout rate, resulting in 60 respondents. The inclusion criteria for this study were as follows: (1) Tuberculosis patients over 17 years of age, (2) currently undergoing tuberculosis treatment, (3) signed a consent form, and (4) willing to participate for four weeks. Patients with chronic diseases were included in the exclusion criteria. The recommendation of the research feasibility letter has been carried out at Universitas Negeri Semarang No. 473/KEPK/FK/KLE/2024, and written informed consent was obtained from all participants before enrollment. Parametric paired t-tests and independent t-tests will be used for data analysis if the data has a normal distribution.

RESULT AND DISCUSSION

This study was conducted on adult tuberculosis patients (>17 years) in 2 Health Centers in Semarang City. The sample that met the inclusion and exclusion criteria was 60 patients. Patient characteristics data are in Table 2 below:

Based on Table 2 above, most tuberculosis patients in this study are aged 26-35 years, which is 41.7%. This observation underscores the significant impact of tuberculosis on the productive age, as all participants in this study fell within the productive age range of 16 to 55 years. Based on WHO data, tuberculosis generally affects individuals of productive age. However, all age groups are susceptible to this disease. More than 80% of cases and deaths from tuberculosis are concentrated in low and middle-income countries (World Health Organization, 2023, 2024). It is in accordance with previous studies which found that > 50% of tuberculosis patients are patients of productive age (Fadhilah & Sari, 2021; R. Liu *et al*., 2020; Pratiwi *et al*., 2020; Sari *et al*., 2019). Previous studies show that the productive age group most often experiences tuberculosis, especially pulmonary tuberculosis. Several risk factors that contribute to the high number of tuberculosis cases in this age group include Mycobacterium tuberculosis infection, close contact with tuberculosis sufferers, and low socioeconomic conditions, especially as measured by income

below the Upah Minimum Regional (UMR) or Regional Minimum Wage. Low socioeconomic levels are often associated with lifestyles and social environments that are less supportive of the treatment process. Although tuberculosis treatment programs are available, efforts to identify and reduce risk factors associated with this disease remain important (Basra *et al.*, 2024; Pratiwi *et al.*, 2020; Senanayake *et al.*, 2018).

Patients in this study were mostly female, as many as 55%. The role of gender in the prevalence of tuberculosis is still not fully understood. Previous research in Semarang City also found that the majority of tuberculosis patients were women (65%) (Rahayu *et al.*, 2017). The gender distribution of tuberculosis cases was nearly even in certain countries, with roughly equal numbers of male and female patients (Ratnasari *et al.*, 2024). A study in Pakistan found that 50.4% of tuberculosis patients were male and 49.6% were female (Khan *et al.*, 2016). Studies indicate gender differences in the clinical manifestations of tuberculosis, where pulmonary tuberculosis is more dominant in men and extrapulmonary tuberculosis is more common in women. Female patients with tuberculosis are more likely to experience extrapulmonary manifestations than male patients. It may be related to the role of endocrine factors in the body (Eddabra & Neffa, 2020; Liu *et al.*, 2020). The albumin levels of respondents in both the treatment and control groups in this study are shown in Table 3 below.

Based on the data in Table 3 above, the average albumin levels for both the control and treatment groups were the same, namely 4.5 g/dL. After conducting the study, it was found that both in the advanced treatment group and the control group, respondents experienced a decrease and increase in albumin levels. However, on average in the treatment group, albumin levels increased to 5.07 mg/dL. Albumin is an important protein in the blood that can indicate a person's nutritional status, both at the beginning of the onset of malnutrition and during improvement. The normal range of serum albumin values is between 3.5-4.5 g/dL, with a total body content of 300-500 g. Serum albumin levels, an important indicator of nutritional status, may be relevant to tuberculosis monitoring because strong evidence supports an inverse relationship between serum albumin levels and mortality in tuberculosis patients. In patients with tuberculosis, albumin levels often decrease due to several factors, such as malnutrition, loss of appetite, enteropathy, and acute phase protein reactions. This decrease in albumin levels indicates malnutrition. The decrease in total protein and albumin is often caused by decreased appetite, malnutrition, and malabsorption in tuberculosis patients (Guo *et al.*, 2022; Memon & Naz, 2014; Prastowo *et al.*, 2014; Simbolon *et al.*, 2016).

Based on statistical tests, this study found a p-value in the treatment group before and after treatment of 0.000 ($p<0.05$), which means that the treatment of giving biscuits made from Bloso fish flour (*Glossogobius giuris* sp.) resulted in a different increase in albumin levels in the treatment group. A study by Shingdang *et al* showed that the serum albumin/globulin ratio correlated significantly between tuberculosis patients and controls. Previous research by Liu *et al* showed that tuberculosis patients undergoing effective treatment would experience a significant increase in albumin levels. However, in tuberculosis patients with less successful treatment, albumin levels tended not to experience significant changes (Liu *et al.*,

Tabel 3. Differences in albumin levels (g/dL) in the treatment and control group

Groups	Before	After	p-value
	Mean ± SD	Mean ± SD	
Control	4.5 ± 0.56	4.39 ± 0.52	0.115[a]
Treatment	4.5 ± 0.54	5.07 ± 0.48	0.000[b]
p-value	0.914[c]	0.000[d]	

Note: statistically differences between: a. control before vs after, b. treatment before vs after, c. control before vs treatment before, d. control after vs treatment after.

2020). Based on research by Aslam *et al* (2024), Bloso Fish (*Glossogobius giuris* sp.) was proven to contain much higher protein. However, its lipid content is lower than other fish used as research objects. The results also clearly revealed that the *Glossogobius giuris* fish species is rich in macronutrients (Khan *et al*., 2024). Research by Sarmin *et al* (2012) showed that bloso fish has a maximum protein content of 73.32%, while the maximum water content is 14.28% with every kilogram of fresh bloso fish processed, 11.72% fish powder obtained (Akther, 2012). These results show that bloso fish is a splendid source of protein and can be an alternative source of healthy animal protein. Previous studies have also found that the addition of nutrients can improve the nutritional status of tuberculosis patients and produce good effects on the weight of tuberculosis patients and have a good effect on the healing of tuberculosis patients (Jahnavi & Sudha, 2010; Martins *et al*., 2009; Paton *et al*., 2004; Praygod *et al*., 2012; Singh *et al*., 2021).

Conclusion

From this study, we concluded that bloso fish (Glossobius giuris sp.) biscuits snacks formulated with 15% bloso fish flour (Glossobius giuris sp.), 35% low protein flour, 20% margarine, 7% butter, 10% cheese, 8% egg yolk, 3% cornstarch, and 1% sugar, can significantly elevate albumin levels in tuberculosis patients from baseline albumin levels in 4.5 g/dL increased to 5.07 mg/dL. Bloso fish is a rich source of protein, providing a healthy animal protein option. Bloso fish biscuits as a nutritional supplementation can enhance the nutritional status of tuberculosis patients, leading to albumin levels, improved weight, and faster recovery. The tuberculosis program management team is advised to consider giving at least four bloso fish biscuits a day to tuberculosis patients to support therapy during the treatment period.

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Prevalence of Hypertension in Indonesia: 2018 Basic Health Research

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Abstract

Hypertension is one of the main factors contributing to premature death. The nationwide prevalence rate of hypertension in Indonesia is relatively high. Understanding the factors contributing to hypertension is essential to reduce the prevalence of hypertension. This paper investigates the risk factors associated with hypertension based on the survey data of Riskesdas 2018. The risk factors related to behaviors or lifestyle include smoking every day, being less active, eating fatty or salty foods once a day, drinking caffeine once a day, and overweight status. Using multiple linear regression, this study finds that being overweight with a body mass index in range 25-27 and having a daily coffee intake habit of one cup are the most significant risk factors to the prevalence of hypertension. These findings should be used as a reference for preventative and promotional actions to reduce the prevalence of hypertension in Indonesia.

Introduction

The Many people experience non-communicable diseases (NCDs) that affect the heart and blood arteries, the main cause of health issues worldwide. According to the American Academy of Pediatrics most recent release of revised pediatric clinical practice recommendations, adults older than 13 years old are considered to have hypertension if their systolic and/or diastolic blood pressure is greater than 130 mmHg and 80 mmHg, respectively (Flynn *et al.*, 2017). There are two types of hypertension: primary hypertension, which has an unknown exact cause, and secondary hypertension, which is a complication condition that might elevate blood pressure, such as kidney illness, an endocrine disorder, etc. When left untreated, hypertension frequently goes undetected and can develop into difficulties if it persists for an extended period. This can also cause complications in other diseases, such as obesity and hypertension prevalences positively impact the prevalence of diabetes mellitus (Oktora & Butar Butar, 2022). To identify hypertension early, it is crucial to check blood pressure periodically (Sola *et al.*, 2022). In general, there are two categories of risk factors for hypertension. The first factors that cannot be modified are age, heredity, and gender. Meanwhile, the second factors can be controlled, such as following a nutritious diet, regular physical activity, maintaining one's weight, stress management, and healthy sleep habits (Valenzuela *et al.*, 2021). Only when a person experiences multiple instances of these risk factors may hypertension develop (Charchar *et al.*, 2024).

Hypertension is one of the major causes of premature death worldwide. Africa has the highest prevalence of hypertension (27%), whereas Asia has the lowest rate (18%) (WHO, 2023). The number of adults with hypertension

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rose from 594 million in 1975 to 1.13 billion in 2015. These rising hypertension risk factors may affect 1.6 billion people by the year 2025 (Sackou *et al.*, 2020). The overall estimated prevalence of hypertension for the urban population in Southeast Asia is 33.82%. Among them, the community reported 33.98% of hypertension, while teenagers in schools reported 32.45% of it (Mohammed *et al.*, 2021). In Indonesia, hypertension is a serious health issue (Merita *et al.*, 2019). the Bangka Belitung Islands Province had the highest prevalence at the national level (30.9%), while Papua Province had the lowest prevalence (16.8%), according to the results of 2013 Indonesia Basic Health Research (Riskesdas) (Kemenkes RI, 2013). The 2018 Basic Health Research findings showed that, in comparison to 2013, North Sulawesi had the greatest prevalence of hypertension (13.2%) and Papua had the lowest (4.4%) (Kemenkes RI, 2018).

The rising trend of hypertension prevalence has been a concern globally as it is thought to be the most common cause of death worldwide and one of the triggers for cardiovascular disease (Mills *et al.,* 2020). Studies about hypertension prevalence in various regions have been conducted worldwide (Carlsson *et al.*, 2009; Larkins, Teixeira-Pinto & Craig, 2018; Mills *et al.,* 2020). An analysis of the prevalence and associated factors for hypertension was conducted among the 4228 population in Sweden study using univariate and multivariate logistic regression (Carlsson *et al.*, 2009). They conducted a medical, lifestyle, and socioeconomic questionnaire. They discovered that waist circumference of more than 97 cm, cardiovascular disease, lack of access to healthcare due to finances, and regular fruit consumption were separately linked to men's uncontrolled hypertension. While, living in an apartment, having a waist circumference greater than 78 cm, and having coronary heart disease continued to be independently associated factors. Another study in Australia related to hypertension is conducted to assess the Australian kids population aged 5-17 years old using Australian Health Survey data using selected predictor variables (age, sex, remoteness, socioeconomic status, body mass index) using linear regression and multiple linear regression (Larkins *et al.,* 2018). Their study revealed that low socioeconomic class is the second most significant predictor of blood pressure, after BMI. This indicates that a wide range of factors affect the estimation of the prevalence of hypertension and multiple linear regression is a prominent tool to estimate the prevalence of hypertension.

One of the promising strategies to reduce the prevalence of hypertension is to comprehend and control the risk factors for the condition, the majority of which are influenced by behavior and lifestyle. However, not so many studies about the risk factors affecting hypertension have been conducted in Indonesia. Therefore, this study proposes to investigate the hypertension risk factors in Indonesia, particularly those that are closely related to the population's lifestyle and the prevalence of hypertension, using multiple linear regression. Understanding the hypertension risk factors will guide preventative and promotional actions to lower the prevalence of hypertension in Indonesia.

METHOD

The data used in this study were taken from the 2018 report of Indonesia Basic Health Research, a national survey with many goals to assess Indonesia's health state. The survey data involved 34 provinces, 416 districts, and 98 cities in Indonesia. Riskesdas is a cross-sectional, non-interventional national scale survey run by the Ministry of Health in the Republic of Indonesia, which began gathering the data in March 2018. A representative sample of 658,201 people of all ages, including 327,150 men and 331,051 women, were questioned for the 2018 Indonesia Basic Health Research to assess their hypertension status. This study examines the risk variables that affect the prevalence of hypertension in Indonesia, which includes individual behaviors endangering health at risk. The prevalence of hypertension is a measure of the proportion number of hypertension cases in a given area at a given period. It is commonly reported as a percentage value. According to Riskesdas 2018, the prevalence of hypertension value based on a doctor's diagnosis in Indonesia is 8.36, within the range of 4.39 - 13.21 on the province scale. This number estimates that

more than 8% of people in Indonesia have hypertension in general.

Six behaviors will be measured in this study. First is smoking activity, whether the respondent smokes every day or not. Of course, the smoking behavior and tobacco consumption were asked for the respondent aged older than 10 years. The second behavior will be measured from physical activities, whether the respondent is doing exercises or less active. The third and fourth behaviors correspond to eating habits, whether they eat fatty or salty foods at least once a day. Salty food is defined as food that contains a strong salty flavor or a lot of salt. In contrast, fatty foods are those that have a high-fat content, particularly saturated fat and cholesterol. The fifth behavior is about caffeine consumption, whether the respondent drinks caffeine once a day. The last behavior is about the respondent's overweight status, which is determined by the BMI metric. The Body Mass Index (BMI) is used to determine the nutritional status of persons over the age of 18 (adult nutritional status). To determine whether a person is overweight or not. Overweight is defined when the BMI value is ≥ 25.0 to < 27.0 by calculating body weight (kg) divided by the square of height (m2). To investigate the relation between the prevalence of hypertension and the six risk factors, we applied a multiple linear regression method, a statistical technique to predict an outcome based on multi-independent variables. In this study, the outcome would be the prevalence of hypertension and the six risk factors would be the independent variables. From this regression, we expect to find the important factors affecting the prevalence of hypertension.

RESULT AND DISCUSSION

According to the 2018 Basic Health Research (Riskesdas) report, the prevalence of hypertension based on a doctor's diagnosis varied substantially by province in Indonesia. The highest prevalence is 12.3 in North Sulawesi, while the lowest prevalence is 4.4 in Papua. The average prevalence of hypertension across all of Indonesia is 8.4. The hypertension prevalence in some provinces is illustrated in Figure 1. Six variables of the risk factors associated with the prevalence of hypertension have been chosen: physical activity, eating fatty food at least once per day, eating salty at least once per day, consuming caffeine at least once per day, and smoking every day. A brief overview of how many residents in a province face the risk factor of hypertension is described in Figure 2. Meanwhile, the statistics descriptive of the data are presented in Table 1.

Before implementing the multiple linear regression method to predict the prevalence of hypertension, we assess the multicollinearity of the predictor variables and a significant

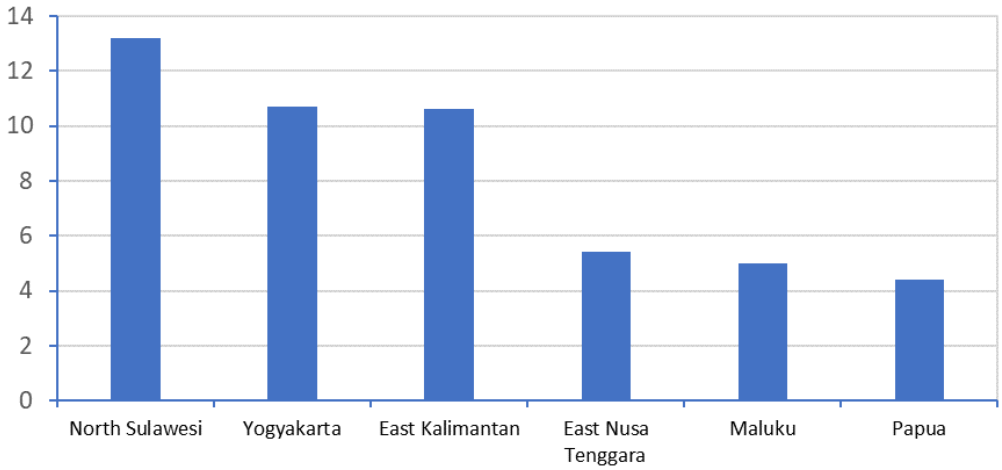

Figure 1. The Prevalence of Hypertension in Some Indonesian Provinces

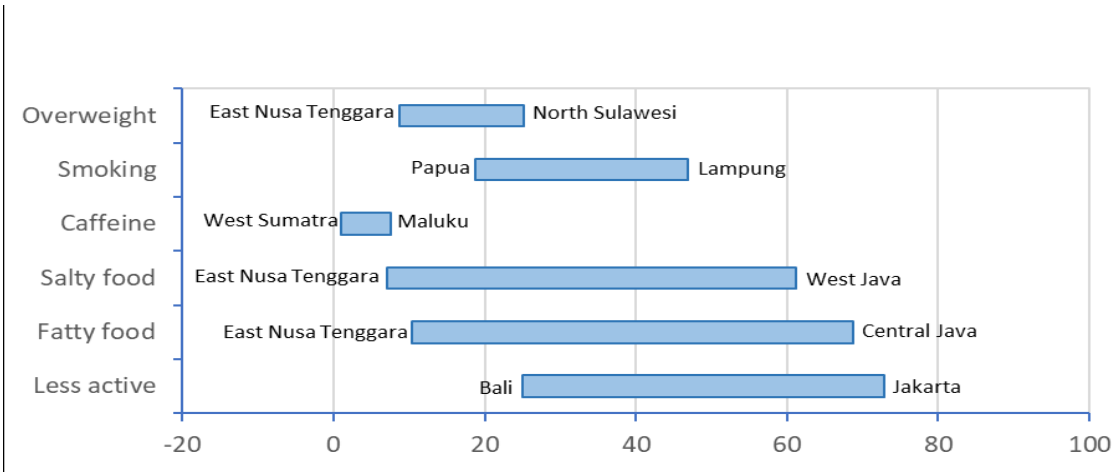

Figure 2. Percentage of Residents in Each Indonesian Province with the Risk Factor

Table 1. Statistic Descriptive of Variables and VIF

Variable	Mean	SD	Min	Max	VIF
Hypertension prevalence	8.2	1.9	4.4	13.2	-
Less active	34.9	5.8	25.2	47.8	1.29
Eat fatty ≥1x per day	33.3	11.1	10.3	58.4	1.69
Eat salty ≥1x per day	20.9	10.0	7	54.1	1.51
Consume caffeine ≥ 1x per day	2.3	1.4	1	6.5	1.21
Smoking every day	23.5	2.6	18.8	28.1	1.22
Overweight	13.6	1.3	8.8	16.3	1.3

Table 2. Results of Multiple Linear Regression Using Six and Three Variables

Variable	Coefficient (CI 95%)	P value	Coefficient (CI 95%)	P value
Less active	0.03213	0.48923*		
Eat fatty ≥1x per day	0.06729	0.02012	0.05308	0.017442
Eat salty ≥1x per day	-0.02588	0.37419*		
Consume caffeine ≥ 1x per day	-0.61595	0.00233	-0.54363	0.002210
Smoking every day	-0.01563	0.87598*		
Overweight	0.58929	0.00772	0.66896	0.000836

*Variables that do not meet p value < 0.25 are not continued for the next multiple regression mode

correlation between independent variables. The linear regression would give a more robust prediction when there are no multicollinear variables. Therefore, a variance inflation factor (VIF) value is used to determine whether the multicollinearity exists among the variables. VIF of variable j is formulated by 1 / (1-R2), with R2 as the coefficient of determination calculated by multiple regression of variable j with other variables as the predictors. If the value of VIF is 1, then multicollinearity does not exist. The value of VIF above 4 indicates a chance of multicollinearity, and further investigation is required. If a VIF value of more than 10 is attained, multicollinearity is present. In this study, all VIF values presented in Table 1 are less than 10, so there is no multicollinearity between the variables used in this study. The first multiple linear regression is conducted using six variables, and the result is described in Table 2, see the second and third columns. With a criterion of p-value less than 0.25 for pre-filter variables, the result reveals that three variables, less active, eating salty ≥1x

per day, and smoking every day have p-values larger than 0.25. As a result, these variables are eliminated for the next regression model, which will only consider three variables, eating fatty ≥1x per day, Consuming caffeine 1x per day, and being Overweight.

The result of the second multiple linear regression remains three variables with p value less than 0.05. Then, this regression model was the final model occupying three variables associated with the prevalence of hypertension. Even though the p-value of all variables is small enough, the variable related to salty food has a very small coefficient regression. So, eating salty food habits only contributes a little to the prevalence of hypertension. In contrast, the largest value of the regression coefficient is the overweight variable with the value of 0.66896, indicating that this variable has a significant influence on the prevalence of hypertension in Indonesia. The heavier a person is, the higher their risk of developing hypertension. The variable Consume caffeine ≥ 1x per day has a coefficient value of -0.54363, indicating that it has a negative relationship with the prevalence of hypertension. As this study does not consider how much caffeine is consumed by the respondents, we cannot summarize that the more frequently you consume caffeinated beverages, the lower your risk of developing hypertension.

There are many factors, categorized into two conditions that can trigger hypertension. The first condition which cannot be controlled is the physics such as gender, age, and heredity. While, the second condition that still can be controlled is the individual life's behavior such as nutritional status, stress, food, physical activity, and so on. This study investigates the second condition. Based on the multiple regression results, we found that there are three important factors related to daily behaviors influencing the prevalence of hypertension, namely caffeine consumption, eating fatty food habits, and overweight status. The coffee substances help boost energy, reduce exhaustion, and keep people awake because the polyphenols and caffeine in coffee can change blood pressure, either decreasing it or raising it (Barrea *et al.*, 2023). These advantages would drive the habit of consuming caffeine every day. Different from the studies (Steffen *et al.*, 2012; Surma & Oparil, 2021), that consuming habits do not significantly affect blood pressure or hypertension, our study reveals that according to Table 2, the consumption of caffeinated beverages once per day is already associated with the prevalence of hypertension. This finding agrees with the previous study by Palatini *et al.*, (2007) which also found a relationship between coffee consumption and blood pressure in hypertension sufferers (Palatini *et al.*, 2007). The study by Miranda *et al.*, (2021) also showed that there is a strong relationship between coffee consumption habits and hypertension levels (Miranda *et al.*, 2021).

Fatty diets (whether they are high in fat, saturated fat, or cholesterol) can raise blood pressure and increase the risk of cardiovascular system disorders (Guasch-Ferré *et al.*, 2015). Based on the results, consumption of fatty foods at least once per day was related to the prevalence of hypertension. This is in line with the study of Wang et al. (2010) that the risk factor for consuming fatty meals is connected to a high prevalence of hypertension (Wang *et al.*, 2010). This finding is further supported by (Qin *et al.*, 2022), which demonstrated a link between fatty food consumption and the prevalence of hypertension. Other research also demonstrates this link to be positive, demonstrating that individuals who regularly consume fatty foods are more likely to develop hypertension (Reddy & Katan, 2004).

Being overweight is more frequently linked to a higher risk of cardiovascular illness, including hypertension. Our research finds that being overweight may increase the prevalence of hypertension. This is in line with a study by (Jayedi *et al.*, 2018), which shows that the risk of developing hypertension increases continuously followed by increasing anthropometric measurements including weight gain. Compared to their body weight, obese and overweight people are twice as likely to develop hypertension (Mohammed *et al.*, 2021). According to another study, the risk of high blood pressure can rise significantly as BMI approaches 25.0 and waist circumference approaches 88 cm. Since the blood flow in the body must work harder to carry nutrients and oxygen to all parts of the body, the risk

of developing hypertension or elevated blood pressure is higher in those with high BMIs (Gelber *et al.*, 2007). This is because the blood volume in the blood vessels also rises.

CONCLUSION

This paper studies six life behaviors from the survey data of Riskesdas 2018 that are believed to be associated with the prevalence of hypertension, namely smoking every day, being less active, eating fatty or salty foods once a day, drinking caffeine once a day, and overweight status. Based on the variance inflation factors, these six factors are independent variables that are not correlated with each other. Thus, we applied a multiple linear regression method to analyze which variable dominantly contributes to the prevalence of hypertension. Our study reveals that three life behaviors, drinking caffeine, eating fatty food, and being overweight, were associated with the prevalence of hypertension. Quantitatively, eating fatty food once a day only slightly contributes to the prevalence. Meanwhile, being overweight and having a daily one cup of coffee mainly contribute to the risk of hypertension. Therefore, preventative and promotional actions to reduce the prevalence of hypertension should consider this study's findings. Except for the BMI to measure the overweight status, the intensity of each factor in this study still needs to be measurable clearly. Further study should consider how much activity/ smoke/ caffeine/ fatty food/ salty food is consumed that would be associated with hypertension prevalence.

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Intestinal Parasitic Infections and their Relationship with Healthy Living Behavior and Nutritional Status in Children

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Abstract

Intestinal parasitic infection is an infectious disease still found in tropical countries with inadequate implementation of Clean and Healthy Living Behavior (PHBS). Parasites that generally infect the intestines are soil-borne worms and protozoa. The worms that infect a lot are Soil Transmitted Helminths (STH), namely Ascaris lumbricoides, Trichuris trichiura, and Hookworm. Cryptosporidiosis is an infectious disease caused by infection with the protozoan Cryptosporidium sp. that causes watery diarrhea. Nutritional status is an important factor in the immune system. The purpose of this study was to identify STH and Cryptosporidium sp infections and link them with the application of PHBS and nutritional status in elementary school students in Wori District, North Minahasa Regency. This type of research is descriptive-analytic with a cross-sectional design. The sample amounted to 160 respondents from six elementary schools taken by purposive sampling. STH examination using the native method and Cryptosporidium sp examination using Zn modification staining, nutritional status measurement was carried out based on BMI / U. This study concluded that 100% of respondents were not infected with cryptosporidium sp parasites, 8% of respondents were infected with Soil-Transmitted Helminth and there was no relationship with nutritional status respondents where 87% of respondents have normal nutritional status, 5% undernourished, 6% well-nourished and 2% obese.

INTRODUCTION

Intestinal parasitic infection is an infectious disease still found in tropical countries with inadequate application of clean-living behavior. Parasites that generally infect the intestines are soil-borne worms and protozoa. The worms that infect a lot are Soil Transmitted Helminths (STH), namely *Ascaris lumbricoides, Trichuris trichiura,* and *Hookworm*. Cryptosporidiosis is an infectious disease caused by infection with the protozoan *Cryptosporidium sp* that causes watery diarrhea. This parasite infection is usually found through contamination of water, food, soil, or on dirty hand surfaces; because it is contaminated by human and animal feces containing infectious agents, it is classified as a waterborne and soil-transmitted disease. These parasites spread evenly throughout the world. During 2001-2010 it became the leading cause of *waterborne outbreak* in the United States. Information on *Cryptosporidium sp* infection in Indonesia is very limited because there have not been many research publications on this infection (Wijayanti, 2017).

Anyone can be infected with STH and *Cryptosporidium sp* but people with low immune status will show more severe symptoms than those with good immune status. Immunity status is related to nutritional status, and sensitive nutrition and specific nutrition interventions are related to nutritional status (Migang *et al*., 2020). Nutritional status is an important factor in the immune system; If a person's nutrition decreases, it will experience a decrease in immune function due to a lack of

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energy intake, and macro and micronutrients (Fast & Sudargo, 2021). Publications on the nutritional status of school children in North Sulawesi were not found, but data from the North Sulawesi Provincial Health Office in 2016 there were 21 cases of malnourished toddlers with a percentage of malnutrition of 1.4%. The nutritional status of toddlers in the North Minahasa Health Office, based on data from the annual report of the nutrition program in 2016, is known that the nutritional status of toddlers who are well nourished as many as 11364 children, malnourished as many as 227 children and malnourished as many as 3 children (Latta *et al*., 2017).

Elementary school children are an age group that is susceptible to parasitic infections, this is because they have the habit of playing or contact with the soil by not paying attention to personal and environmental hygiene, where this can be a risk factor for worm infections. The government's mass treatment program has been implemented to reduce the incidence of worm infections in school children, but it will not have an impact if it is not followed by the implementation of clean and healthy behavior (Dc *et al*., 2019). Research conducted by Lalangpuling *et al*. (2019) at SD GMIM Wori which is one of the schools in the Wori sub-district area shows that 60% of students still have the habit of playing dirt (Lalangpuling *et al*., 2021).

Based on initial observations that have been made at SD Inpres Tiwoho which is one of the elementary schools in Tiwoho Village, Wori District, North Minahasa Regency. Where it was found that these children still have habits that do not pay attention to cleanliness such as playing barefoot, some children are also seen playing in the gutter, and on the coast, there are even found children who when defecating not in the latrine but on the beach, besides that when making observations there are houses around the garbage dump. So that these conditions can be a risk factor for infection. Based on the above background, the author is interested in researching the description of intestinal parasite infection examination and its relationship with nutritional status and clean and healthy living behavior (PHBS) in elementary school students in Wori District, North Minahasa Regency.

METHOD

This type of research is descriptive-analytic. The study was conducted from February to May 2022. Specimen collection was carried out in six elementary schools in Wori District, North Minahasa Regency, namely GMIM Budo Elementary School, Pontoh Small Elementary School, Lansa Elementary School, Talawaan Bajo Elementary School, Lantung Elementary School and Kima Bajo Elementary School. The research began by coordinating with the school and Community Health Center of Wori District. The involvement of the school includes permission, and coordinating parents in their children's willingness as research respondents; Health workers from the Wori Community Health Centre coordinate to accompany research activities and are responsible for measuring students' height and weight to determine nutritional status. The respondents' parents were socialized with the purpose of the study and provided informed consent to be signed as a form of approval, then explained how to collect fecal specimens for examination. Specimen collection is carried out for five days. The respondents involved in this study were 160 students with a sampling technique, namely purposive sampling with the criteria of respondents not taking antihelminth drugs in the last 3 months, fecal specimens not mixed with water and urine, and sufficient sample volume for examination. Examination of intestinal parasite infection using the native method for STH examination and Ziehl-Neelsen (Zn) staining modification for *Cryptosporidium sp* examination, sample examination was carried out in the Parasitology laboratory Department of Technology Medical Laboratory Poltekkes Kemenkes Manado. Determination of nutritional status is obtained by measuring height and weight then determined nutritional status using an application based on the Z score value. Data on Clean and Healthy Living Behavior was obtained from interviews with students and parents of respondents. This research has been approved by the Manado Health Polytechnic Ministry of Health Research Ethics Committee No. KEPK.01/09/181/2023.

RESULT AND DISCUSSION

Wori District is one of the sub-districts

in North Minahasa Regency. The research was conducted in six (6) elementary schools located in Wori District, namely GMIM Budo Elementary School, Pontoh Small Elementary School, Lansa Elementary School, Talawaan Bajo Elementary School, Lantung Elementary

Table 1. Characteristics and Clean and Healthy Living Behavior (PHBS) of Elementary School Children in Wori District in 2023

Respondents' Characteristics	Total (n)	Percentage (%)
Gender		
Man	93	58
Woman	67	42
Total	160	100
Age (years old)		
6	6	4
7	18	11
8	20	13
9	35	22
10	34	21
11	36	23
12	11	7
Total	160	100
Parents' Work		
Laborer	14	9
Farmer	71	44
Fishermen	32	20
Unpaid Workers	5	3
Private	37	23
Government employee	1	1
Hand Washing		
Yes	136	85
No	24	15
Total	160	100
Sucking Fingers		
Yes	75	47
No	85	53
Total	160	100
Eating Food Dropped on the Ground		
Yes	51	32
No	109	68
Total	**160**	**100**
Playing the Soil		
Yes	64	40
No	96	60
Total	**160**	**100**

School and Kima Bajo Elementary School. The total sample size of the six elementary schools was 160 respondents with the characteristics of respondents and the application of clean and healthy living behaviors seen in Table 1.

The majority of respondents are male at 58% with the highest age being 11 years old at 23%. The majority of respondents' parents' jobs were as farmers at 44%. Respondents aged six (6) to twelve (12) years, where this age is an age that actively play in the environment and often ignores cleanliness so that it can be classified as a risk group for infection with *Cryptosporidium sp* parasites. Table 1. shows the application of respondents' Clean and Healthy Living Behavior. 15% of respondents do not have the habit of washing hands and 47% of respondents have the habit of sucking fingers. The habit of eating fallen food again was carried out by 32% of respondents. 40% of respondents have the habit of playing with soil. From the table, there are still many respondents who have not implemented PHBS properly. Meanwhile, one of the risk factors for infection is unclean and unhealthy behavior.

The results of microscopic examination of intestinal parasite infection showed that 8% of respondents were infected with STH intestinal worms and all respondents did not have *Cryptosporidium sp* protozoan infection. STH torture uses a native method with eosin and lugol dyes while *Cryptosporidium sp* examination uses ZN-modified staining. The presentation of this infection follows government requirements, namely 10%, this may be caused by the geographical location of Wori Village which is in a coastal area. Examination of STH infections in children living in highland areas shows higher positive results compared to those living in lowland areas (Ni Made Nuryanti, 2018). Correct and sensitive laboratory examination will help in the diagnosis of infection, treatment, and prevention of transmission of helminth infections. Currently, available examinations use conventional and molecular methods, but these two methods have disadvantages and advantages. Conventional examination is easy to do with simple equipment but has a low sensitivity value, whereas molecular examination has high sensitivity but costs more. So a fast and accurate inspection method is needed for the STH examination (Khurana & Sethi, 2017). The conventional Kato Katz method is the method most widely used in studies in the Southeast Asia region for examining STH infections (Dunn *et al*., 2016).

Cryptosporidiosis is an infectious disease caused by infection with the parasite *Cryptosporidium sp*. *Cryptosporidium sp* infection is a major factor in the occurrence of diarrhea in malnourished children and AIDS sufferers in developing countries. In 2009 – 2010 in the United States, there was an extraordinary occurrence of cryptosporidiosis caused by water pollution (water-born disease) (Ludington & Ward, 2015). Cryptosporidiosis occurs with the entry of parasite oocysts through the mouth or breathing (inhalation). The excitation process occurs with the release of sporozoites which then enter the intestinal epithelial cells, then develop asexually and

Table 2. Results of *Soil-Transmitted Helminths* (STH) and *Cryptosporidium sp* Examination of Elementary School Children in Wori District in 2023

Examination Results	Total (n)	Percentage (%)
Soil-Transmitted Helminths		
Positive	13	8
Negative	147	92
Total	**160**	**100**
Cryptosporidium, sp		
Positive	0	0
Negative	160	100
Total	**160**	**100**

form microgametes and macrogametes will be followed by the formation of thick-walled oocysts capable of sporulating in the host's body. After that, thick-walled oocysts will be removed with the patient's stool or can also cause autoinfection because it takes place in the host's body (Ludington & Ward, 2015). In its development, *Cryptosporidium* examination uses several types of dyes. Giemsa's dye and Jenner's stain were the earliest dyes that could be used to identify oocysts, but these dyes had the disadvantage that "ghost" cells could be found that interfered with the examination process. The development of the Ziehl-Neelsen (ZN) dye in 1981 also identified oocysts better, and until recently its use was more widespread for screening for *Cryptosporidium* infections. Identification is usually done to pediatric patients who have diarrhea but those who have decreased immune status can also be examined. Examination samples commonly used are feces but can be used for small intestine aspiration, tissue samples, or biopsy if available (Khurana & Chaudhary, 2018).

Cryptosporidiosis can be examined by several methods, namely microscopic methods, immunological methods, antigen detection methods, histology, and molecular methods. Microscopically it can be examined through wet preparations or staining and electron microscopy. The sample used in this examination can use samples preserved with 10% formalin (Khurana & Chaudhary, 2018). Table 3 shows the results of sample examination with Zn and PCR modification methods showing 100% negative samples of *Cryptosporidium sp*. infection. The samples used for Zn modification method examination are fecal samples using Zn modification preservatives and samples for PCR method examination are samples with potassium dichromate preservatives. The use of preservatives in fecal specimens is adjusted to the laboratory examination method.

Microscopic examination is widely used but has several disadvantages, including low sensitivity so that re-examination must be done (*duplo*), the examination time for each specimen is approximately ten minutes so it is not efficient for examination in large quantities and the difficulties encountered if the stool sample used in the examination contains a lot of fiber (Destura *et al*., 2015). In addition, another disadvantage is that it requires specially trained personnel and the sample used should be fresh because preserved samples can result in non-optimal examination (Mergen *et al*., 2020). *Cryptosporidium sp* becomes a protozoan that causes diarrhea. The immune status of the patient determines the prognosis of the disease. Transmission of this parasite occurs through the fecal-oral route of either infection to humans or animals. Innate immunity and acquired immunity play a role in cryptosporidiosis infection. Sporozoites that enter intestinal epithelial cells will cause damage or death to intestinal epithelial cells. As a result of the occurrence of inflammatory processes in the intestine and the occurrence of cryptic hyperplasia and liquid diarrhea may occur. Patients who have good endurance generally do not cause clinical symptoms or real complaints, but patients with low immunity or immune system disorders such as HIV/AIDS will experience severe clinical symptoms (Borad & Ward, 2010).

Natural immune responses suggest dendritic cells, natural killer (NK) cells, and mast cells play a role in clearing parasite infections but the exact mechanism for *cryptosporidium* infection is unknown. The adaptive immune response involving T cells has been studied in many AIDS cryptosporidiosis patients, but it is also unclear (Ludington & Ward, 2015). Dendritic cells play a role in the immune response to *cryptosporidium sp* infection. Dendritic cells recognize parasites and initiate natural immune responses and adaptive immune responses. Dendritic cells stimulate *Tool-Like Receptors (TLRs) and Pattern Recognition Receptors (PRRs)* producing proinflammatory cytokines and chemokines. Dendritic cells also present *cryptosporidium sp* antigens to T cells thereby activating adaptive immune responses (Saraav & Sibley, 2023). Until now there is no specific vaccine to protect children and immunocompromised patients against *cryptosporidium sp* infection (Zaph *et al*., 2014). *Cryptosporidium sp* infection, malnutrition, and immune deficiency are related to one another. Malnutrition can weaken the immune system so that it is more susceptible to *cryptosporidium sp* infection, and

result in prolonged diarrhea (Mahdavi Poor *et al*., 2022).

The results of statistical testing did not show a significant relationship between clean and healthy living behavior with the incidence of STH infection but of the 13 respondents infected with STH, 8 respondents had the habit of playing soil. The application of clean and healthy living behaviors is a risk factor for helminthic infections because the life cycle of STH worm species is related to soil being infective. STH worm eggs in the soil will develop into a stage of infection and if accidentally entered the body through food or live behavior, it will develop in the intestine. Elementary school children generally do not have awareness about cleanliness and hygiene, so they still have the habit of playing in the dirt, eating back food that has fallen, sucking their fingers, and not washing their hands. Accidentally, worm eggs or infective larvae found in soil or unclean hands can enter the patient's body, develop, and then the patient can be a source of transmission for others. The results of the STH examination found that 6% of respondents were infected with *Ascaris lumbricoides*, 1% of respondents were infected with *Hookworm, 1% of* respondents were infected with *Trichuris trichiura* and 1% had mixed infections of *Ascaris lumbricoides* and *Hookworm*. This STH species is a species that commonly infects elementary school children because its transmission is related to the application of clean and healthy living behaviors because there is a relationship between the incidence and poor hygiene behavior (Widiarti *et al*., 2020).

Access to clean water, standardized sanitation facilities, and the implementation of clean living behavior are generally associated with a reduction in soil-borne worm infections. The use of water treated by filtering or boiling shows a relationship with a lower incidence of STH infection, whereas using piped water does not show this relationship (Strunz *et al*., 2014). Support for water availability, sanitation, and environmental cleanliness supports reducing the incidence of STH infections in addition to mass treatment programs (Garn *et al*., 2022); access to water, sanitation, and the implementation of clean and healthy living behavior are also related to children's growth and development (Cumming & Cairncross, 2016). However, several studies conducted show that the use of toilets for defecation for children does not have a direct effect, but children are still expected to be directed to carry out defecation activities in the toilet (Majorin *et al*., 2019).

The results of measuring the nutritional status of respondents, 86% of respondents have normal nutritional status, 5% of respondents are united in malnutrition, 6% of respondents are well nourished and 2% of respondents are obese. In patients with cryptosporidiosis

Table 3. The Relationship between PHBS and STH Infection of Elementary School Children in Wori District in 2023

PHBS	Inspection Results (n)		Total	R
	Positive	Negative		
Hand washing				
Yes	10	126	136	0,416
No	3	21	24	
Sucking Fingers				
Yes	8	67	75	0,386
No	5	80	85	
Eating Food Dropped on the Ground				
Yes	5	46	51	0,757
No	8	101	109	
Playing Land				
Yes	8	56	64	0,139
No	5	91	96	

Table 4. Cross-Table of Nutritional Status and STH Infection of Elementary School Children in Wori Sub-district in 2023

Status Gizi	Examination Results					
	Negative	*Ascaris lumbricoides*	Hookworm	*Mix infection* (*Ascaris lumbricoides* + Hookworm)	*Trichuris trichiura*	Total
Normal	129	7	1	0	1	138
Malnutrition	7	1	0	1	0	9
Nourished	9	1	0	0	0	10
Obese	2	1	0	0	0	3
Total	**147**	**10**	**1**	**1**	**1**	**160**

infection can lead to dehydration, malnutrition, and weight loss. Children with low immune status and malnutrition may develop more severe conditions and prolonged infections (Destura *et al*., 2015). Children with cryptosporidiosis are 2.7 times more likely to be malnourished resulting in chronic diarrhea and malabsorption (Quihui-Cota *et al*., 2015). Research conducted by Al-Ani and Al-Warid on 43 children diagnosed with *Cryptosporidium sp* infection showed no association between infection and nutritional status (Al-Ani & Al-Warid, 2023). Table 4. shows that most respondents who experience STH infection are respondents who have normal nutritional status. This shows that STH infection is not related to nutritional status but it is necessary to implement clean and healthy living behaviors to prevent the incidence of STH infection because STH infections that are not treated properly will affect the child's health (Djuardi *et al*., 2021). Research conducted by Bia (2022) shows that nail hygiene is at five times the risk of being infected with STH worms (Bia *et al*., 2022).

STH infection and nutritional status are related to each other, where STH infection can cause a decrease in nutritional status or poor nutrition can make it easier to become infected with STH (Muslim *et al*., 2021). Several other studies statistically do not show a weak relationship between STH infection and the incidence of stunting, but prevention and control strategies need to be carried out to prevent ongoing impacts (Campbell *et al*., 2017).

Fulfilling children's nutrition starts from their nutrition in the womb, the nutritional intake of pregnant women before and during pregnancy is one of the factors determining the nutritional status of children born (Aguayo & Menon, 2016). Children's growth, immune function, and cognitive development are also influenced by nutritional adequacy (Davies-Kershaw *et al*., 2024). One of the stunting prevention programs is monitoring the development of nutritional status in the first 1000 days of birth, known as 1000 HPK; Currently, an application is being developed to facilitate monitoring that can be accessed by parents, midwives, and other health workers (Hijrawati *et al*., 2021). The cleanliness of the house as a place to live and the cleanliness of the food consumed are also factors in the incidence of stunting in children (Dominguez-Salas *et al*., 2024).

CONCLUSION

From the results of the study, it was concluded that 100% of respondents were not infected with *cryptosporidium sp* parasites, 8% of respondents were infected with Soil-Transmitted Helminth with no relationship to the nutritional status of respondents where 87% of respondents had normal nutritional status, 5% of respondents were united in malnutrition, 6% of respondents were well nourished and 2% of respondents were obese.

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Stunting Prevention and First 1,000 Days of Life Optimisation Programme in Gunungkidul

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Abstract

Stunting is a significant public health issue and the prevalence of stunting in Indonesia was reported at 21.6% in 2022. This study used a mixed-methods approach. The qualitative component employed a single-case embedded study design, data were collected through semi-structured interviews involving 15 participants and analyzed by using a thematic approach using NVivo-12. Meanwhile, the quantitative component utilized a one-group pre-test post-test design involving 155 respondents, data were gathered using questionnaires and were analyzed using paired t-tests with SPSS-26.Participants had a lack of knowledge about stunting. However, they acknowledged various healthy nutrition and health programs for stunting prevention. There were also various programs managed by local government involving multisector bodies, and communities focusing on reducing stunting prevalence. However, there were expectations to strengthen the program strategies by providing home visits, online educational media, adequate facilities, and infrastructure within Integrated Community Services (ICS (Posyandu)). The paired t-test revealed a significant average difference between pre-test and post-test values, with a mean difference of 1.167 and a p-value of <0.008. The ongoing stunting alleviation program demonstrates the government's commitment to multi-sectoral collaboration and the use of educational media, such as videos, significantly enhances respondents' knowledge about stunting.

Introduction

The second goal of the Sustainable Development Goals (SDGs) is to eliminate all forms of hunger by 2030 and achieve food security, aiming to reduce stunting by 40% by 2025 (United Nations, 2023). Stunting remains a significant nutritional health issue globally, particularly in developing countries. In 2020, the prevalence of stunting in Indonesia was alarmingly high at 149.2 million cases, surpassing other nutritional issues such as wasting (45.4 million) and overweight (38.9 million) (WHO, 2021). By 2022, the prevalence of stunting in Indonesia had decreased to 21.6%, yet it still exceeded the WHO standard of less than 20% (Miranda *et al*., 2023). Stunting is characterized by a failure to thrive due to chronic malnutrition during the first 1,000 days of life (de Onis & Branca, 2016). Children are considered stunted if their height-for-age Z-score (HAZ) is less than -2 standard deviations (SD), and severely stunted if the Z-score is less than -3 SD (Suratri *et al*., 2023). The impact of stunting on human resources

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is profound, affecting not only individual physical and cognitive development but also the country's economic potential (Soliman *et al*., 2021). Short-term effects include impaired physical growth and cognitive development, potentially leading to reduced intelligence, lower educational outcomes, and increased poverty (Annisa & Sulistyaningsih, 2022). Long-term consequences include a higher risk of chronic diseases such as heart disease, diabetes, obesity, and stroke (Soliman *et al*., 2021)

The multifaceted causes of stunting include economic disparities, inadequate education, infectious diseases, insufficient nutrition during the first 1,000 days of life, and poor health services and sanitation (Nafisah & Astuti, 2023; Utami & Laila, 2022). Additionally, maternal nutritional status during pregnancy and suboptimal maternal care contribute significantly to the problem (Hanifah & Astuti, 2023). Addressing stunting requires raising awareness among families, particularly women, about the importance of proper nutrition from a young age and during adolescence (Titaley *et al*., 2013). The first 1,000 days of life are critical for a child's growth and development, often referred to as the "window of opportunity" by the World Bank (Titaley *et al*., 2014). The Indonesian government has implemented a nutrition program to protect pregnant women from deficiencies in iron, folic acid, and protein, and to ensure adequate nutrition for children under two years old (Agustina *et al*., 2023). The government also has Presidential Regulation Number 72 of 2021 on the Acceleration of Stunting Reduction mandates and the National Population and Family Planning Board as a lead to implement this program, involving various sectors and creating provincial and local Stunting Reduction Acceleration Teams (TPPS) (Sari, 2023). Gunungkidul is a municipality within Yogyakarta province with a stunting prevalence of 16.4% in 2022, which is considered the highest prevalence among other municipalities in Yogyakarta province (Dinkes-Gunungkidul, 2023). To address this, the Indonesian Family Planning Board has initiated the establishment of *Kampung Keluarga Berkualitas* (Quality Family Village), aimed at improving human resource quality through integrated and convergent strategies. Given the persistently high prevalence of stunting in Gunungkidul and the establishment of Quality Family Villages, this study aimed to understand the implementation of stunting prevention programs and the optimization of the first 1,000 days of life in Gunungkidul.

Methods

This study employed a mixed methods approach with an embedded design (Shorten & Smith, 2017). The first phase of this research applied qualitative methods, with data collection and analysis adhering to standard qualitative research practices. Concurrently, quantitative data were also collected and analyzed, to augment and develop findings derived from the qualitative methods. The results were subsequently interpreted in an integrated manner. The qualitative component of the research adopted a single embedded case study approach, selected due to the singular nature of the case, which encompassed multiple units of analysis necessitating in-depth understanding. In the quantitative component, a one-group pre-test post-test approach was utilized. This method aimed to assess research activities by administering an initial test (pre-test) before delivering an intervention. Following the intervention, a final test (post-test) was conducted. The quantitative research aimed to determine the effect of video media on participants' knowledge regarding the optimization of the first 1,000 days of life in the context of stunting. By integrating these qualitative and quantitative approaches, the study provides a comprehensive analysis of the stunting reduction program and the critical period of the first 1,000 days of life.

This study was conducted in 4 villages within Gunungkidul Municipality, the population was 260 including 34 future parents, 73 women in pregnancy, 20 in the postnatal period, and 133 mothers of children under five. The qualitative phase used purposive sampling based on inclusion criteria set before, and data collection was conducted through semi-structured interviews. The qualitative sample size was 15, involving several groups of stakeholders, including 2 Family Planning Field Officers (PLKB), 2 midwives, 2 Secretaries

of the Family Welfare Movement (PKK), 2 PKK members, 2 cadres, 2 future parents, and 3 women during their maternal period. Additionally, the number of quantitative sample sizes was 155, including prospective parents, pregnant women, and mothers of children under five years old. The sample size of the quantitative component was calculated by using the sample size for a population of 260 with a 95% confidence level, a 5% margin of error, and a population proportion of 0.5 (Creswell & Creswell, 2018).

The qualitative research instruments utilized semi-structured guidelines, employing individual interview techniques. Interview guideline was piloted before interviews were conducted to ensure that it worked properly and aligned with the research objectives. Additionally, an observation list form was also used for qualitative secondary data. As for the quantitative research, questionnaires were employed to assess respondents' knowledge regarding the impact of video media on mothers' understanding of the optimization of the first 1,000 days of life in stunting prevention. The questionnaire was adapted from previous research, which had previously undergone validity and reliability testing. The validity of the questionnaire was confirmed at 100%, and its reliability, measured using Cronbach's Alpha, was 0.809, surpassing the threshold of 0.50. Consequently, it can be concluded that the questions in the questionnaire are reliable.

All the participants in the qualitative and quantitative components were provided with participants' information sheets, informed consent forms, and information on the right to withdraw from this study. Only those who signed the informed consent form were eligible to participate in this study. In this study, qualitative data were collected through one-to-one semi-structured interviews, audio recorded, and supplemented by secondary data obtained from documentation studies. Interviews were conducted in a private room within the office of stakeholders, which was set previously to maintain privacy. These secondary data sources were utilized to support and enrich the existing research data. The recruitment of informants was facilitated by two midwives who work at Community Health Centres, acting as guides. For the quantitative component, primary data were collected through online questionnaires completed by the respondents. The online questionnaires used Google Forms and were distributed to the respondents by using the WhatsApp application with a guideline involving steps for fulfilling the form.

Qualitative research in this study employed analytical techniques, utilizing thematic analysis (Braun & Clarke, 2006). The steps in the data analysis process included data familiarisation, coding qualitative data, building themes, reviewing themes, defining and naming emerging themes, and reporting the analysis results, facilitated by the NVivo 12 software tool. For quantitative research, data analysis was conducted using the paired sample t-test. Before determining the appropriate test, tests for data normality and homogeneity were performed to assess whether the data were normally distributed. This process was supported by computer software using the SPSS 26 application.

This study adhered to rigorous qualitative research standards to ensure the validity and trustworthiness of the data (Johnson *et al.*, 2020), employing multiple strategies to maintain high data quality throughout the research process. Data validity in qualitative research is assessed through trustworthiness, which includes various aspects such as transferability, confirmability, dependability, and credibility. Transferability in this research was ensured by considering the characteristics of the research setting, the methods employed, the interview process, data analysis, and the documentation of findings. Discussions with the research team also contributed to strengthening the assessment of the research process. Confirmability was achieved by adhering to the research design, ensuring accurate language translation in interview transcripts, taking comprehensive notes during data collection, including direct quotes from informants to substantiate findings, and holding discussions with supervisors. Dependability was enhanced by incorporating direct quotes from informants and involving other researchers in reading the transcriptions, thus improving data quality. Repeated checks and transcript reviews by other researchers further ensured dependability, with NVivo 12

being used for data storage and organization. Data coding facilitated the analysis process. Credibility was established through the use of recording devices during interviews to ensure accurate recordings, verbatim transcription of interview data, and repeated checks to verify the accuracy of information provided by informants. Discussions with other research team members were conducted to assess data validity. Reflexivity was maintained by the researchers using reflexive notes to complement the data analyzed, as suggested by Morse (2015). This reflexive practice helped ensure comprehensive and accurate data analysis. The research was conducted after obtaining approval from the Health Research Ethics Committee of Universitas Aisyiyah Yogyakarta on May 22, 2023, with reference number No.1644/ KEP-UNISA/V/2023.

Results and Discussion

This research was conducted in Gunungkidul Regency. Gunungkidul Regency is one of the regencies in the Special Region of Yogyakarta. The area of Gunungkidul Regency is 1,485.36 km2 or about 46.63% of the site of the Special Region of Yogyakarta. Gunungkidul Regency consists of 18 Kapanewon and 144 Villages. The data and mapping of this research theme describe the stunting reduction programs and optimization of 1,000 the first days of life in Gunungkidul. The data in this qualitative research were analyzed through thematic analysis based on meaningful information from participants. Within the analysis process, the researcher used *NVivo 12* software. There were 3 themes emerged from the interviews, namely *pre-existing knowledge* related to stunting, strategies in reducing stunting, and expectations pertaining to stunting reduction programs and optimization of 1,000 the first days of life.

Theme 1: *Pre-existing Knowledge* Related to Stunting

The theme of *pre-existing knowledge* illustrates the knowledge that participants previously knew about stunting, nutrition, health monitoring, and knowledge related to existing stunting programs in Quality Family Villages. There are 3 sub-theme findings associated with pre-existing knowledge such as limited knowledge related to stunting, nutrition, health monitoring, and stunting reduction programs.

Limitations of Knowledge Related to Stunting

The sub-theme of limited knowledge related to stunting describes that there is limited knowledge of participants related to stunting. This is illustrated through quotation submitted by informants [A1BM] and [A2BF], as follows:

"What is that, small child? I don't know, maybe the topic was discussed in ICS?" [A1BM]

"I don't know, I've never heard of stunting either" [A2BF]

Based on the results of the quotation above, it can be interpreted that some participants have limited knowledge of stunting. This is due to the limited information, lack of education, and their unpreparedness to become parents.

In addition, participants also mentioned that they knew about the stunting topic of the ICS in their residence. This was illustrated through the quotes of informants [B1BD] and [A1K]:

"*...giving information usually in Integrated Health Service or ICS about stunting, which refers to impaired growth due to malnutrition*" [B1BD]

"There is an ICS in the health service; stunting counseling is also given there, starting from the beginning of pregnancy at 0–9 months; children aged 1-2 years... The program is from pregnancy to the 2-year-old children." [A1K]

Furthermore, in addition to quoting information sources related to stunting that they get from ICS, the participants [A1BB] further added that local cadres usually convey the provision of information related to stunting. This is demonstrated by the following quotation: *"In the Family Planning Village, usually the cadres conduct counseling here, to mothers of toddlers, teenagers also pregnant women*" [A1BB]

Nutrition and Health Monitoring

The sub-theme of nutrition and health monitoring describes participants' knowledge related to stunting prevention through nutrition management and health monitoring. This was conveyed by participants [A1BB] and [B1PK] as follows:

"Yes, how to say it... Maybe about the portion of breakfast, lunch, and dinner, then don't get too close if someone in the family smokes. Don't forget to eat vegetables every day" [A1BB]

"Stunting refers to children with low-height-for-the-age. Children who don't consume nutritious food... To prevent stunting, children should eat nutritious food. The information is also given to the teenagers so they know later how to be healthy during pregnancy. They are also given Blood Supplement Tablets, which are good for their health" [B1PK]

In addition, participants also mentioned they obtained information on nutrition management and health monitoring from the ICS. This is demonstrated by the following quotation:

"The counseling is mostly related to eating. They tell about how children eat and how to maintain cleanliness and hygiene. The ICS measures children's weight, height, and head circumference. When we come to the Community Health Center, they will give us vitamins and anthelmintic medications for treating worms. This medicine is given to 1-year-old children; they will be given again next year. All like this..." [B2BB]

Furthermore, Participants also had a health monitoring check every month. This is as stated in the following quote:

"Every ICS for toddlers has information for mothers of toddlers, pregnant women, and mothers of cadres. So once every 1 month, it is checked by the health of all (BKB) Build a family of toddlers" [B1BB]

Based on the data, it can be concluded that the participants had knowledge related to the prevention of stunting through nutritional management and health monitoring; this knowledge was obtained from the informant and knowledge derived from information obtained through the counseling section.

Existing Programme Prevention

The sub-theme of the existing program prevention describes a stunting reduction program in the local area known by participants. This is illustrated through a quotation submitted by informants [B1PK], as follows:

"If the program is good, giving supplementary feeding program (PMT) for pregnant women is like milk and for toddlers when given processed food. We also got a stunting prevention program from PT Unilever about the cooking demonstration we had carried out at the hamlet hall" [B1PK]

In addition, interviews were obtained from postpartum mothers' informants [B2BF] and pregnant women [A1BB] who said they received the information after participating in the stunting reduction program. This is conveyed through the following quotation:

"Usually, I take part in counseling at ICS. They explain exclusive breastfeeding, too; I was also given PMT during pregnancy" [B2BF]

"The program is like giving vitamins, ICS, the weight and height measurement of the child, giving additional food such as eggs, counseling to mothers of toddlers about parenting patterns for children including stunting" [A1BB]

Based on the data above, it can be concluded that the participants had knowledge related to the stunting reduction program in the local area. The existing stunting reduction programs include providing healthy foods for pregnant women and toddlers, vitamins for children, and ICS activities.

Theme 2: Stunting Reduction Strategies

The theme of the stunting reduction strategy describes stunting reduction programs that already existed in the Quality Family Village area as a strategy to control stunting and optimize 1,000 in the first days of life. There are 3 sub-theme findings related to the theme of stunting reduction strategy: stunting reduction program, role in stunting reduction, and *best practice* in stunting reduction.

a. Stunting Reduction Programme

The stunting reduction program sub-theme describes the overview of stunting reduction program activities and optimization of 1,000 the first days of life in Quality Family Villages. This program was formed in collaboration with cross-sectoral parties as a form of preventive and promotive efforts in stunting prevention. The following are the results of the quotation submitted by Family Planning Field Officers related to the beginning of the formation of the team in the stunting reduction program:

"The stunting prevention program that we have done first is that we formed the mother

TPK Team, the family companion TPK Team, that we form there are 16 Teams. Each team consists of three people: midwives, PKK cadres, and Family Planning cadres, whom we first trained on November 29, 2021. Thank God they all passed and got an Electronic Application for Marriage and Pregnancy (Elsimil) training certificate. All the participants are the TPK Team." [B1P]

Participants explain the tasks of the team in the stunting reduction program:

"First, the TPP (Tim Pendamping Keluarga or Family Companion Team) and second, the TPPS (Tim Percepatan Penurunan Stunting or Stunting Reduction Acceleration Team) jump in the program. If the TPPS usually helps give PMTs, each sub-district budget for the APBD for Stunting Prevention... TPPS is different from the TPK Team, but the ending is the same; that is the stunting problem. TPK should send a report to TPPS because the Secretary is the chief directory, while all urban village heads are the chief executors, all the Secretary are the chief executors of TPPS." [B1P]

In addition, there is information related to the form of stunting prevention program implementation, namely counseling, Posyandu activities, and supplementary feeding (PMT). The following is a quotation from a midwife [B1B] who explained the existing stunting reduction program. This is demonstrated by the quotation:

"There is TPK, pregnant women's classes, toddler classes, and home visits for the program. For the nutritional aspect, there is nutritional surveillance if, for example, there is a risk of stunting and there is a reason for the participants, the nutrition officer, the regional coordinator, and the doctor to do a home visit. TPK is the Indonesian Family Planning Board's program for the class of pregnant women and mothers of toddlers from the ICS. The class of pregnant women should be categorized based on age for counseling, but we cannot categorize each hamlet based on age. It usually does not meet its quota, only 15-20 people. The obstacle is that the mothers of toddlers don't come. If the situation in ICS is the same, we combine it; if there is counseling related to breastfeeding and supplementary food after breastfeeding, they will be invited together."

Additionally, the mothers of toddlers [A2BB] and mothers under [A1BD] said that related to the stunting reduction program in the form of ICS and counseling that they had participated in, this was conveyed through quotation:

"Usually, the program is uncertain, from the Community Health Center. For example, on the 15th, there is ICS. There is counseling and, usually about stunting," [A2BB]

"If to optimize the first 2 years of the child's life, we have also been given information in ICS, so that in the ICS we are not just measuring the weight, measuring hands, but also being given information as well" [A1BD]

This is following the results of research submitted by cadre s [A1K], that in the implementation of stunting prevention programs, there are also activities such as counseling in ICS to the provision of supplementary foods:

"If the midwife of the health center service comes to the posling (mobile ICS) or if there is an invitation to the Posbindu (integrated guidance post) activities, that provides counseling from the health center service. But every month, only Cadre who provides information and measures babies' weight and gives the PMT" [A1K]

In addition to ICS activities, which become routine programs every month, counseling and mentoring activities are provided as a form of promotive efforts. Counseling and assistance are carried out not only by midwives but also by other health workers. As mentioned by the participants [A2BM]:

"Cadre was not present at the event yesterday. Only staff from the health service center and the village head were coming. Since the event was a little long yesterday, from 09.00 to 12.00, many of which were from the health service center. There were dentists, some were from the nutrition department, some were from the midwifery department, but there were different materials" [A2BM]

Then, it was conveyed by PLKB [B1P] that besides promotional efforts such as ICS activities, mentoring activities were also carried out by the team such as cadres, with targets ranging from prospectus parents, pregnant women, postpartum mothers, and mothers of children under five. The following are the

quotations conveyed:

"…If the future parents are anemic, it also has the potential to give birth to stunting children. That is why Cadre assists the prospectus parents. Usually, before the marriage, prospectus parents must be injected with Tetanus Toxoid Vaccine... "[B1P

Furthermore, the participant added that not only assistance, but the stunting acceleration program team also monitored each activity to the target. This was explained in the following quotation:

"...the important thing is that even if you have been accompanied later, yet it turns out that the condition is less than the standard, we will have an intervention. If the TPK also focuses on growth and development. Usually, the TPK has midwives, cadres, PKK, and KB cadres. We also provide information about child development cards, so we send a child development card to e each Village. The card will be filled together with ICS. Through the child development card, the Cadre can monitor children's growth. For example, children at a certain age should be able to be like this. There is a reference; if a child in certain months cannot be like this, then we will refer to it." [B1P]

The efforts made to implement the stunting reduction program and the optimization of 1,000 in the first days of life cannot be separated from the support factors obtained when running the program, including readiness support in program implementation, cross-sector and cross-program cooperation, and community support. The following quotation from interviews with midwife participants [A1B], Secretary [B1C], and PKK [B1PK]:

"There is training for midwives and cadres. The community, which is aware of the role of the officers and the parties across the village sector, are all lending their support. If the village does not give support, we also do not support this. The government programs are supported by the conscious community and also the village government of cadres. In the past, this village was not like that, but now it can be found in other villages" [A1B]

"Our cadres are encouraged because every month there is an incentive also for 50k/month cadres from the village" [B1C]

In addition to the support factor, there are also inhibiting factors that affect the stunting reduction program. The inhibiting factors found in this study include budget problems, the implementation of inefficiently designed programs, lack of public awareness, and socio-cultural, economic, and geographical conditions. The results of the quotation submitted by the informant are as follows:

"We used a small amount of the Cadre's money each month to pay for the upcoming event. A mother who comes to measure the children's weight gives Rp1,000.00 as additional cash. Later, it can be counted as if there are 20 people so that it can be Rp20,000.00 and 30,000 from the previous donation. So, later, Rp50,000.00 can be used to make porridge or sponge cake. We are trying our best to provide nutritional food despite limited funds. Meanwhile, the village fund is used to provide milk for the toddler .." [A1K]

"Many of the budgets at KIA were cut and transferred to PHN. For the class of pregnant women and toddlers, the budget was cut. For the class of mothers of toddlers, one village can hold the class 5 times, and they can target Indonesia Early Childhood Care and Education (PAUD) as well. As pregnant women, one village can hold the class 2 times, but because it is cut, it is only held 1 time" [B1B]

There were also findings that the team's formation was only formed in the last 1 year, so it is not maximal. This is as stated in the quote: *[B1C]*

"The stunting acceleration team has only existed for a year, but it has not yet reached its potential because we are occasionally asked to meetings in the new sub-district." [B1C]

In addition to the relatively new team, there is a lack of public awareness from the community to participate in existing activities. This is conveyed in the quotation:

"Health advice is still rare in the hamlet due to the young man's lack of activity, but when it is offered, most people reject it out of reluctance." [B2CT]

Furthermore, it was also conveyed that geographical conditions were also an obstacle in the implementation of the stunting reduction program, as reported by the following participants:

"If the hurdles are included in what we

sense, the field, yes, if it's not too heavy, but in Kayugerit, it's a bit extreme" [B1P]

"Stunting is a personal matter, especially for someone with a young child. But the water is the issue in my region. Water is occasionally difficult to find. Geographical factors thus become important. [A1P]

From the data, it can be summarized that the different programs pursued to decrease the incidence of stunting and optimize 1,000 the first days of life in the Quality Family Village region undoubtedly also have supporting and inhibiting aspects in their implementation. These elements interact with one another both inside and externally. In terms of, for example, program funding readiness and implementation readiness. Externally, for example, across sectors and communities. These are related to each other to reduce stunting and optimize 1,000 in the first days of life.

b. Integrated Roles in Reducing Stunting

The sub-theme of the role in reducing stunting describes that there is a division for implementing the stunting reduction program and optimization of 1,000 the first days of life. The role in stunting prevention is carried out by cross-sectors or representatives of the implementation of the Indonesian Family Planning Board, including PLKB, Secretary, PKK, Midwives, and Cadres. The following is a quotation from [A1C] related to an example of the actions of cadres involved in the stunting reduction program:

"Cadres are also active now. If anyone is absent, they will visit and measure their weight. There is a group, so the results of the ICS are directly conveyed from the cadres" [A1C]

In addition, participants mentioned that cadres are also assigned to assist the community, starting from the prospectus parent target. This was conveyed by the participant [B1P]

"They then jumped into the field to do the first assistance done to future parents. Future parents need to be accompanied because they will be married soon. The Cadre lives in the village and knows if a future parent is near them. There are still three months remaining, so they accompany future parents by hoping that they can prevent stunted offspring" [B1P]

Not only are cadres deemed active during the current stunting reduction program, but the community has also undergone better improvements, as seen by their involvement in stunting prevention program activities. This is as conveyed by participants [A1K] and [A1C]:

It's good that her mother is involved, and occasionally, they join at arisan (regular social gatherings) to promote knowledge sharing and get young mothers excited about attending ICS and having their kids get to know each other. [A1K]

"Yes, it's a relief that the community's awareness has also changed. Today, it seems that the average community has also been active" [A1C]

Additionally, it was well known that all parties participated in and worked together to implement the current stunting program to cooperate in reducing stunting. Cadres did not just carry this effort. This is proven through the quotation of participants [B1C] and [A1K]

"Collaboration of cadres, Hamlet residence, and the team of cadres...If our Muskal (Village Deliberation) invites cadres, then hamlets, Posyandu administrators, Kapanewon also (village), then Head of the Village, Pak Kamituo (Village Official) as the one in charge..." [B1C]

"All cadres are involved; there are elderly and toddler cadres here. We help each other so every time there is any counseling, all cadres are involved, whether it's elderly or toddlers, always side by side like that, they participate together... " [A1K]

"Yes, there are. From the Cadre, from PLKB, Community Health Services are also there, usually after the KB village event. That's usually, for example, the date of counseling" [A1BB]

This statement was also confirmed by midwives that there was a team formation to reduce stunting and optimize 1,000 in the first days of life. The following are the quotations conveyed:

"So there is a team (midwives, PKKs, cadres) that is formed to prevent stunting...Then for the treatment, starting from future parents, then pregnant women, then postpartum mother and the baby, then children under two years. Well, if there is a case which shows the possibility of stunting, it will be addressed together" [A1B]

Based on the data above, it can be

concluded that many parties have a task or role in the implementation of the stunting reduction program and optimization of 1,000 in the first days of life. The parties involved in the program have the same goal: to reduce the incidence of stunting in the area of Quality Family Villages.

c. Best Practice in Stunting Reduction

The *best practice sub-theme* in reducing stunting describes interesting implementation practices in stunting reduction programs in Quality Family Villages. *Best practice* in this study is illustrated through the support of government programs through budgets, human resources empowerment, cooperation from various responsible parties, implementing parties and the community, cadre activity, and community enthusiasm. This is illustrated through several quotes as follows:

"Thank God, after there was a stunting locus, we got a program from the board center, supervised by the Indonesian Parliament, for the MJK (Completely Healthy Latrine Stimulant) of almost half a billion aimed at 55 families. Well, there is a positive impact here. The fund given by the board center is used for that, which might cost several million rupiahs, and there are some additions, too. That's a positive side of the program that has entered the village."[B1C]

Still, a secretary [B1P] participant in the government assistance program added that the government also assisted in the form of funds during the TPK orientation. This was conveyed in the [B1P] participant's quotation:

"If the fund is given smoothly, the province gives the fund to PKB directly. Like the previous TPK orientation, all have been managed by the province; we then monitored from the beginning until the end." [B1P]

In addition, the next best practice is in the form of collaboration between the TPPS and TPPK teams to reduce stunting in Quality Family Villages. PLKB [B1P] conveyed this:

"There is cooperation between the TPPS and TPK teams. If the TPPS is more involved in the village or policies, it is like a kind of section that moves the working community (no health workers) all across sectors. If there are health workers, they are the executors. So the TPK (Midwives, KB Cadres, PKK cadres) are the executor" [B1P]

There is establishing cooperation between teams, and the cadres that were previously empowered, motivated, and equipped before going into the field. This is proven by the following quotation from [A1C] and [B1C]:

"I visit the hamlets as the PKK leader, along with the administrators (PKK), so I am provided a way to inspire people. For example, when there are older people present, we encourage the elderly on how to maintain their health. Likewise, when toddlers are present, we encourage the toddlers on how to maintain their health." [A1C]

"We give information, especially related to nutrition" [B1C]

Not only empowerment but also the TPK (cadres, midwives, and PKK) was facilitated in the field implementation process, as stated by the following [B1P]:

"Yes, we provide each participant in TPK, which we have done before, Rp100,000.00 per month. Every month, they get Rp100,000.00 for credit. For example, if there is assistance to catin, pregnant women, and mothers of children under two years, they will get Rp10,000.00 for each visit. That Rp100,000.00 will be divided into three (Cadre, midwives, and PKK) so that each assistant has funds again. Today, the credit phone given in assistance is not Rp100,000.00. But we give cash, and the distribution is fifty thousand. We buy credit/month. In addition to assistance, they must also do a resume every time there is an activity, and later it must be uploaded and sent to the sub-district" [B1P]

Furthermore, there were also several quotes stating that the current activeness of the Cadre is the strength in implementing the existing stunting program. This is as conveyed by the following [A1C]:

"Cadres are also active if now if someone is not present, cadres will pay a visit, measure, measure weights. Since there is a group, the results of the ICS are directly conveyed from the cadres. We are grateful for the exceptional spirit of the cadres. They may have socialization at the community health center or village. In addition to serving as cadres, they also work" [A1C]

The PLKB also confirmed that the cadres assigned and involved in this stunting reduction program have a high social spirit. This is as stated in the informant's quote [B1P]:

"The social spirit of the cadres is indeed strong because they have been active in the

village." [B1P]

Additional statements submitted by the [A1K]:

"If I can say maybe the activeness of cadres and, from the Community Health Center too" [A1K]

Not only cadres, public enthusiasm to participate in the stunting program was also found in the interview data, such as the following quotation from [A2BB]:

"So far, the mothers are enthusiastic. Maybe it can be adjusted to the community here. Maybe it can be conditioned. For example, it's a bit late. They presented the information excellently, and the audience was enthused...."[A2BB]

Based on the data above, it can be concluded that various best practices have been carried out to reduce stunting in Quality Family Villages. The government's support proves this: the collaboration between the team in charge of implementing TPK and the team in order of TPPS, as well as the passion and spirit of cadres and the community.

Theme 3: Hope

The theme of hope illustrates the expectations and needs that informants express for stunting prevention programs and optimization of 1,000 the first days of life in Quality Family Villages. There are 2 sub-theme findings related to the theme of hope: expectation and needs

a. Expectation

The sub-theme of hope expresses their aspirations for the future to the evaluation initiatives to avoid stunting and the optimization of 1,000 in the first days of life. As for the quotation submitted by participants [B2BB] and [B1CT], who said that counseling activities related to stunting should be carried out more often. The following are the quotations conveyed:

"Yes, it should be held at least once every three months. Maybe it will benefit both those who have toddlers and those who only have toddlers. As long as I have children, just once, so that other mothers are aware of it as well as those who are unaware of it and those who are unaware of adding" [B2BB]

"I hope there will be more counseling about nutrition" [B1CT]

Another statement was conveyed by the participant [B1BD], who wanted supplementary feeding given to children at risk of stunting and to children with adequate nutrition. This is expressed through the following quotation:

"…We hope socialization continues and PMT like eggs, milk is sent to the house So it's not just for the stunted children" [B1BD]

Based on the results of the quotation above, it can be concluded that there are several expectations expressed by participants related to the stunting reduction program in the future, such as the expectation of educational media that can be accessed online, the provision of more counseling up to the provision of additional food given to children with adequate nutrition.

b. Needs

The needs sub-theme describes that several requirements support stunting prevention programs and optimization of 1,000 in the first days of life. The participant's statement related to the need for a direct approach provided by health workers to residents through home visits. This is what the participant [B1BB] mentioned:

"In my opinion, the health worker must come directly into the house so that the officer can also know the daily life of the person, like the economy, and their home environment" [B1BB]

In addition, findings were also obtained from [B1P] who conveyed that the need for online educational media is appropriate for adolescents so that they are also exposed to health education, especially in controlling stunting from an early age.

"It is challenging to gather the teenagers because they usually go to school and also need permission. So it is not easy if we invite them during working hours. Then, the alternative strategy is we provide education either through leaflets or videos" [B1P]

The same thing was conveyed by the future parent [B2CT], which was described in the quotation:

"In my opinion, for young people, it's easier to go online. If the adults also want to go to the health service center, it's also a bit far from access, and most can't use a motorbike. It's also difficult if their children work and no one is at home, it's also difficult. Well, if older people, it will be better if cadres come to the houses. But for

Table 1. Univariate Analysis

Knowledge	Video Media			
	Pre-test		Post-test	
	F	%	F	%
Poor	5	3.3	0	0
Sufficient	145	93.3	130	83.3
Good	5	3.3	26	16.7
Total	155	100	155	100

Table 2. Normality and Homogeneity Test

Indicator	Normality		Homogeneity	
	Sig.	Limits	Description	
Knowledge				
Experimental Pre-test	0.087	> 0,05	Normal	0.133 (Homogeneous)
Experiment Post-test	0.065	> 0,05	Normal	

teenagers, it seems that via WhatsApp it can also be easier" [B2CT]

Besides, there is a statement from participant [A2BB] related to the need for facilities and infrastructure that can support current ICS activities, such as the following quotation:

"..maybe the height ruler in the ICS is poor and limited, so it sometimes takes a longer time to measure height" [A2BB]

"Scales, the tied scales, we have already proposed change since it has been torn. There are also digital scales that the Community Health Service usually carries. At least the child likes it, you know, it's funny, for measuring height too because here you use the board," [A1K]

Based on the data, it can be concluded that the needs expressed by the informant are related to the stunting reduction program in the future, such as the direct approach by health workers in the form of home visits, the existence of online educational media that can be accessed anytime and anywhere, and the availability of adequate facilities and infrastructure in routine ICS activities that have been routinely carried out in Quality Family Villages. This study was conducted on 155 respondents, consisting of future parents, pregnant women, and mothers of under-five. This quantitative data collection was carried out through online questionnaires using Google Forms and the provision of video education media. The analyses conducted in this quantitative study were univariate analysis and bivariate analysis. The univariate analysis used in this study illustrates the frequency distribution of maternal knowledge about the Optimisation of 1,000 in the first days of life in Stunting Prevention.

Based on Table 1, the univariate analysis indicates a significant difference in respondents' knowledge levels before and after the intervention. Initially, the respondents exhibited varying levels of knowledge, categorized as poor, sufficient, and good. Post-intervention, there was a noticeable improvement in knowledge levels among the respondents, with a marked increase in the number of mothers displaying sufficient knowledge. This improvement demonstrates the positive impact of the intervention on enhancing the respondents' understanding.

Based on Table 2, the normality test for pre-test and post-test knowledge data yielded a significance value greater than 0.05, indicating that the data are normally distributed. Consequently, a paired t-test was employed to determine the mean difference in values before and after the intervention. Additionally, the homogeneity test indicated a significance value greater than 0.05 for knowledge, confirming that the data in this study are homogeneous. This homogeneity signifies that the sample data

Table 3. Results of Differential Test of Video Media on Mother's Knowledge of Optimization of 1,000 the First Days of Life in Stunting Prevention

Video Experiments	**Mean**	**to**	***P-value***
Knowledge Pre-Test	13.33	1,845	0,008
Knowledge Post-Test	14.50	1,570	

possess consistent variance. The results of the bivariate test used a different test related to the effect of video media on mothers' knowledge about the optimization of 1,000 the first days of life in stunting prevention.

Table 3 indicates significant differences in knowledge levels between the pre-test and post-test assessments related to the video media intervention. This is evidenced by a significance value of 0.008, suggesting a notable increase in knowledge about stunting due to the video media intervention, with a p-value less than 0.05. In the stunting reduction program, maternal and family knowledge concerning stunting, dietary provision, and parenting behavior significantly impact the reduction of stunting within the family. Mothers and families equipped with comprehensive knowledge, appropriate behaviors, and adequate nutritional understanding are more likely to provide optimal nutritional intake, thereby preventing stunting and enhancing growth and development during the first 1,000 days of life (Ma *et al*., 2023; Reni *et al*., 2023). Stunting reduction program strategies could involve activities for improving maternal knowledge regarding nutritional management, enabling mothers to prepare healthy food and adopt better feeding practices for infants and toddlers (Rahmadiyah *et al*., 2022).

Previous research in Indonesia including 1,332 respondents revealed that 51.1% of respondents had limited knowledge about stunting, including its definition, causes, prevention, and impacts (Torlesse *et al*., 2016). This was attributed to inadequate counseling on stunting provided by ICS. ICS is a vital source of knowledge for the community, aligning with previous research indicating that 80% of respondents relied on ICS for stunting-related information (Haines *et al*., 2018). Furthermore, information disseminated by health workers is generally considered more reliable than information obtained from the Internet. However, the Internet remains a valuable source of information due to the community's time constraints and the increasing demand for accessible knowledge. ICS plays a crucial role in stunting reduction by offering services such as monitoring children's growth and development, measuring height and weight, administering immunizations and vitamins, as well as providing counseling during its activities.

The government of Indonesia has implemented various strategies to reduce stunting, including forming dedicated teams such as TPPS, TPS, and TPK. Additionally, through cross-sectoral cooperation involving sub-districts, the Indonesian Family Planning Board, Health Offices, and Community Health Centres, the government has initiated multiple activities. These activities include coordination meetings, stunting discussions, education and counseling, and training of cadres and other stakeholders. Additionally, there is also an Elsimil program for preparing brides-to-be for engaging in marriage, pregnancy planning, supplementary feeding programs, distribution of vitamins and iron tablets for at-risk communities, and monitoring growth and development through ICS. Home visits by cadres and health workers are also part of these initiatives. These strategies align with WHO recommendations, which emphasize the crucial role of government commitment in reducing childhood stunting (WHO, 2021).

The government's commitment to stunting prevention began with Indonesia's participation in the 2011 Global Scaling Up Nutrition (SUN) movement, marked by the Minister of Health's submission of a participation letter to the UN Secretary-General. Launched in 2010, this movement is based on the principle that all citizens have the right to adequate and nutritious food. Effective stunting reduction requires cross-sectoral cooperation, involving individuals, organizations, related institutions, and community levels to implement optimal

interventions with multiple sectors and stakeholders (Lameky, 2024). Effective program implementation also requires attention to health insurance accessibility for all societal levels (Agustina *et al.,* 2023). Despite the implementation of various stunting prevention programs, effectiveness and scale remain challenges. A previous study revealed that most pregnant women and mothers of children under the age of two lack sufficient access to essential services, critical for child development during the first 1,000 days of life, and only 28.7% of children under two have access to four basic services simultaneously: birth certificates, drinking water, sanitation, and exclusive breastfeeding (UNICEF-Indonesia, 2020).

Research examining the impact of video media on the optimization of the first 1,000 days of life for stunting prevention indicates a significant increase in the average knowledge score, from 13.33% to 14.50%. This study demonstrates that video media effectively enhances mothers' knowledge about stunting prevention. This finding aligns with annual research, which consistently shows a significant knowledge increase in groups exposed to educational videos compared to those given booklets (Sewak *et al*., 2023). Previous research further elaborates that educational media, particularly videos, offer several advantages due to their visually appealing nature (Salmerón *et al*., 2020). The engaging visual elements facilitate the effective conveyance of messages. Audiovisual content enhances respondents' concentration, making it easier for them to absorb information (Wu *et al*., 2020). Videos not only present images but also provide an auditory dimension, which helps maintain the audience's interest and improves information retention (Abdulrahaman *et al*., 2020). Overall, the research underscores that video media is a powerful tool for educational interventions, particularly in the context of stunting prevention. Its ability to engage multiple senses makes it superior to other forms of educational materials, ensuring that recipients are better informed and more likely to retain the knowledge provided.

This study reflects the community's desires and consistent implementation of stunting prevention programs. However, it has been observed that current initiatives, such as counseling and education, are limited in scope and not regularly scheduled. This inconsistency may be attributed to various factors, including insufficient support due to limited facilities, infrastructure, human resources, socio-economic barriers, and geographical challenges. These obstacles hinder the effective implementation of stunting prevention programs and the optimization of the first 1,000 days of life. Therefore, government strategies are needed to optimize stunting reduction through comprehensive family assistance, which involves the collaboration of various programs and activities across sectors at the village level. Beyond the implementation of programs and activities, family assistance involves cooperation with field cadres from different sectors, leveraging their respective expertise and skills to address gaps in stunting reduction efforts. Moreover, there is a need for systematic monitoring and evaluation, conducted through direct observations and interviews with family assistance teams. This should be conducted in an integrated and systematic manner at least twice a year or as needed. Such measures ensure the effective acceleration of stunting reduction and address the community's expectations for a more structured and sustained approach.

Conclusion

The internal influences on individuals, such as knowledge, socio-cultural factors, geographical conditions, and economic status, significantly impact community awareness related to stunting. The ongoing stunting prevention programs serve as clear evidence of the government's commitment to collaborating with various sectors, including the Government, Health Offices, Community Health Centers, the Indonesian Family Planning Board, and other community organizations. Additionally, educational media in the form of videos has proven to be significantly effective in enhancing the knowledge of research respondents about stunting. This therefore could potentially be an alternative for health education to communities.

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Contracts between Referral Health Facilities and Social Health Insurance in Indonesia and England

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Abstract

Purchasers and providers are important in providing quality health services for participants. This is formally regulated through a contractual mechanism to achieve the potential benefits of strategic health purchasing (SHP) and ensure effectiveness, efficiency, and quality. The experience of contracting with providers differs in each country due to underlying determinants. This study aims to identify differences in contracts between referral health facilities and social health insurance in Indonesia and England. A normative legal research approach is used, utilizing secondary data sources such as literature, regulations, and contractual arrangements. Important clauses in the contract, such as rights and obligations, service tariff setting, agreement period, monitoring and evaluation, settlement of expired or disputed claims, mechanisms for providing information, and handling complaints, have been regulated in contracts in both Indonesia and England. Unlike the case in England, incentive payment policies have not been further regulated in Indonesia's contracts. Additionally, notification and communication procedures for the parties involved have been integrated into the system in England. It is expected that learning from the NHS contracts will provide the potential for developing a more ideal contract implementation, effective monitoring and evaluation, and the delivery of optimal and high-quality health services.

Introduction

Healthcare purchaser organizations must seek the best interventions to purchase the best providers and use the best contractual arrangements to achieve standard and equitable health outcomes. Healthcare purchasers are key stakeholders in the healthcare chain as they can improve provider collaboration by making quality and cost agreements. Therefore, the role of purchasers and health service providers here is very important in efforts to provide quality health services for their participants. The relationship between the role of the purchaser and the healthcare provider is generally regulated in an integrated contract or system. Purchasers can be more passive or more strategic in managing healthcare funding. With passive purchases, information, and evidence are not used to determine a benefit package or to choose a service provider who will provide the service. More passive purchasers also do not use contractual mechanisms to define and enforce quality standards. These purchasers typically pay service providers using a budget based on historical inputs (Sanderson *et al.*, 2019; Noort *et al.*, 2020; Ezenduka *et al.*, 2022) reimbursement, without being explicitly linked to the provision of priority services in healthcare. In other extreme cases, purchasers use open payment of service fees and do not

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have an expense management mechanism (Cashin & Gatome - Munyua, 2022).

The contract mechanism aims to achieve the maximum potential benefits of strategic health purchasing and can guarantee important aspects, namely effectiveness, efficiency, quality, and equality. The contract is an instrument to determine the health service needs of participants and the performance of health care providers, including being able to strategically know which health services should be prioritized for public funding (Klasa *et al*., 2018) what to buy, who will provide services (from whom to buy), and how and how much health care providers will be paid (how to buy). A healthcare contract is defined as a purchasing mechanism used to obtain quality services from healthcare providers within a certain period at an agreed price. The contract involves a prospective and explicit agreement between the purchaser and the service provider regarding the terms and conditions of payment. A contract will specify the type and volume of services provided over a certain period, with specific objectives and indicators to measure contract fulfillment. Under the contract system, the purchaser enters into a contract with a healthcare provider to provide healthcare services to its applicants. Revealed that strategic purchasing requires some form of contract between the purchaser and the health care provider, as well as the separation of the functions of the purchaser and the service provider to facilitate the contractual relationship. In the contract mechanism, the selection process for health facilities, including advanced referral health facilities (FKRTL), is important. The purchaser as the main actor who uses the contract needs to ensure that the health service provider provides quality health services following the specified service criteria (Cashin & Gatome - Munyua, 2022; Mathauer *et al*., 2019; Mbau *et al*., 2018; Etiaba *et al*., 2018; Vilcu *et al*., 2020; Kachapila *et al*., 2023).

In Indonesia, health facilities that collaborate with BPJS Kesehatan are required the fulfill the provisions contained in the contract. The condition in question is that the health facility is recognized and has a permit from the Government agency responsible for the health sector. This is an effort to increase access to services while ensuring the quality of services for participants in the national health insurance program. Similar to in the UK, private hospitals that want to work with the NHS also need to be registered with the Care Quality Commission and the NHS Improvement Institution first. Through the selection of health facilities, service purchasers can assess starting from the availability of human resources (competent medical personnel), the completeness of facilities and infrastructure, the scope of services, and service commitment. The implementation of contracts can be an effective tool to provide excellent service to the community and can contribute to improving the performance of the health system. From a public health point of view, the success of a "contract" depends on many factors, such as the region, the conditions of implementation, the institutional capacity, the modalities of monitoring and evaluation, and the arrangement of the contract. Revealed that the implementation of contracts varies between countries because the determinants that exist in each country are also different. Therefore, this study aims to identify the difference in contracts between Advanced Health Facilities and social health insurance in Indonesia and the United Kingdom (Klasa *et al*., 2018).

METHOD

This type of research is qualitative normative law research that uses secondary data in library materials as the main source of data. Normative legal research can be said to be literature review research in which most of the data sources are secondary data sources. This study was conducted to analyze the content of BPJS Kesehatan cooperation contracts with Advanced Health Facilities (FKRTL) in Indonesia and the content of the NHS UK standard contract used to contract all clinical services with a statutory approach and a conceptual approach. The data collection technique carried out is to combine data from the content of the cooperation contract with Advanced Health Facilities (FKRTL) between BPJS Kesehatan and NHS England and connect it with applicable regulations, as well as other literature studies. Data analysis was carried out qualitatively using descriptive and comparative

analysis instruments to explain the differences in cooperation contracts between BPJS Kesehatan and NHS England. The results of the analysis are displayed in the form of a comparison table and also a descriptive explanation based on the theory related to the contract between the purchaser and the health service provider applicable in Indonesia and the UK based on the clauses stipulated in the contract.

RESULTS AND DISCUSSION

Based on, institutions that can make purchases can be in many forms, such as the Ministry of Health, local government agencies (for example at the provincial or district level), compulsory or voluntary health insurance institutions (or some insurance institutions), community-based health insurance institutions, non-governmental organizations, etc. BPJS Kesehatan is an institution in Indonesia that is responsible for conducting cooperation contracts with hospitals. The number of hospitals that collaborate with BPJS Kesehatan is increasing every year. SISMONEV DJSN data in 2019 shows that 2,213 hospitals have collaborated with BPJS Kesehatan. This number continues to increase until 2023, with the number of hospitals cooperating in 2020 as many as 2,259, in 2021 as many as 2,497, and in 2022 as many as 2,573 hospitals. Data as of May 2023 reports that the number of hospitals, both government and private, in collaboration with BPJS Kesehatan has reached 2,953. Meanwhile, in the UK, cooperation contracts with health service providers are under the full authority of a government agency, called (Mathauer *et al*., 2019; Ariani & Pujiyanto, 2019) the National Health Service (NHS). The NHS Trust is a healthcare provider formed to provide hospitals, community, and other aspects of patient care. There were around 219 NHS Trusts in the UK in 2021. However, this number does not represent the number of Hospitals as some NHS Trusts run more than one Hospital, for example, Manchester University NHS Foundation Trust (MFT) runs a total of nine Hospitals. In 2021, there were around 1,257 hospitals in the UK, this number includes NHS Trust-managed hospitals and additional private hospitals.

Purchasers need to further define and determine from the provider level which types of providers, interventions, and medicines will be available and how these can be accessed from the public sector and/or the private sector. In some cases, the decision may be taken by a higher level of government, but the purchaser needs to concretize and align this with the access conditions mentioned above. When the purchasing function and governance arrangements are in place, the purchaser can directly influence (positively or negatively) the allocation of resources (for priority services and population groups, geographical regions, types of service providers, and so on), accountability, and even incentives that will influence encouraging the behavior of individual providers through contracts. Contract creation is very useful for strengthening accountability between the purchaser and the service provider when the contract mentions the benefits to be provided, the level of payment, the terms of service delivery, referral guidelines, as well as the compensation mechanism. Contractual agreements are the basis for setting standards, performance targets for service providers, and monitoring service delivery competencies, and encouraging service providers to comply with agreements, such as ensuring the availability of skilled staff in sufficient numbers to meet public health service needs. It is important to monitor and enforce contractual agreements with healthcare providers to ensure the desired objectives of those agreements are achieved. Thus, the health service contract seeks to determine the characteristics of the provision of services and the level of reimbursement, as well as to determine performance. In essence, contracts are the primary policy instrument for strategic purchasing and effective payment systems by providing a greater focus on achieving measurable outcomes. Forms of contracts can vary, from highly structured and competitive to more implicit and relational, and the most appropriate approach is likely to be context-specific (Klasa *et al*., 2018; Mikkers & Ryan, 2016; Cashin & Gatome-Munyua, 2022).

Selective contracts and accreditation are key instruments in strategic purchasing to choose which provider to buy. Accreditation is a review process that allows healthcare providers to demonstrate their ability to meet established quality-related standards (e.g., related to

TABLE 1. Comparative Matrix of Cooperation Contracts in Indonesia and the UK

It	Clauses in the Contract	NHS England	Indonesia	Note
1.	Scope of the agreement	✓	✓	
2.	Rights and obligations	✓	✓	NHS adjusts to the conditions of the parties, while Indonesia is standard
3.	Healthcare rates	✓	✓	NHS national rates are based on service specifications that can be developed, while in Indonesia they are based on predetermined service tariff standards.
4.	Incentive payments	✓	✗	
5.	Agreement term	✓	✓	NHS contracts are reviewed every 2 years, while in Indonesia every 1 year
6.	Monitoring and evaluation	✓	✓	
7.	Claim expiration	✓	✓	
8.	Dispute resolution of claims	✓	✓	

structure, processes, and/or outcomes), and thus the accreditation results provide relevant information to purchasers about the provider's performance. Selective contracts mean that the purchaser can choose between (competitive) providers, i.e. the purchaser has the right not to enter into contracts with all available providers. This selection can be based on predetermined criteria or the results of the provider's accreditation to further improve quality and good performance. However, the use of selective contracts is a limited practice for a variety of reasons. On the one hand, especially in rural and remote areas, there may only be one healthcare provider for the community in a given region. On the other hand, including certain service providers, but not contracting with other providers may be a political challenge. However, all of these conditions may be rarely met in low- and middle-income countries. Selective contracts are often impractical or contrary to the purpose of guaranteeing access to health services. Nonetheless, contracts are an important tool for communication, even if they are not meant to spark competition. In some countries, selective contracts are used for private healthcare providers based on the provider's location, the range of services available as set out in the scheme guidelines, and the provider's willingness to contract (Mathauer *et al.*, 2019; Kuwawenaruwa *et al.*, 2022).

If you look at the NHS system, there is something called the NHS Standard Contract. This contract assigns healthcare providers to provide specific healthcare services that can be adapted for use in a variety of services. NHS England is responsible for the preparation and publication of NHS standard contracts. The NHS agency in the UK also oversees and allocates funds to (Petsoulas *et al.*, 2014) Clinical Commissioning Groups (CCGs) to work with public and private hospitals, as well as organize and pay for the delivery of care at the local level. This CCG group is responsible for planning most primary care services, community services, and hospitals including emergency care. Since April 1, 2021, the number of CCGs has decreased from around 209 CCGs to 106 CCGs due to mergers. After the passage of the Health Bill, CCG was abolished in July 2022 and replaced with an (Parkinson *et al.*, 2021) integrated care system (ICS). Private hospitals can offer a range of services that are not covered by the NHS or offer services that can reduce waiting times (Thorbly, 2020; Cooper *et al.*, 2018).

In the cooperation agreement between BPJS Kesehatan and Hospitals regarding advanced referral health services for participants of the National Health Insurance program, some components have been determined which include the scope of the agreement, rights, and

obligations, confidentiality of information, class of treatment, health service rates, procedures for submitting and paying for health services, agreement period, post-claim verification and claim administration audit, monitoring and evaluation, expiration of claims, sanctions, termination of agreements, complaints, dispute resolution, notification, and settlement of disputed claims. The scope of the contract agreement in the UK and Indonesia has listed the types of services that participants can access. In Indonesia, if the Hospital wants to add a new scope of services that are not available at the beginning of the agreement, then the Hospital needs to notify BPJS Kesehatan in writing no later than 3 (three) months. BPJS Kesehatan will then conduct a credentialing on the type of service in question, to then be outlined in the Addendum to the Agreement. The purpose of implementing credentialing is to obtain health facilities that are committed and able to provide health services effectively and efficiently through assessment methods and standards. The standard must be measurable with the objectives that have been identified by the service provider. Thus, there will be no difference in service delivery that will affect patient service satisfaction. However, the process of applying for credentials in various institutions in Indonesia is still varied and has not been standardized (Ulandari & Indrayathi, 2016).

The rights and obligations of BPJS Kesehatan as the purchaser and the Hospital as the health service provider have been listed in the cooperation agreement. In 2022, updates have been made to clarify the rights and obligations clause of each party. The form of contract is standardized and applied the same for all of Indonesia. If you look at the existing contracts in the British NHS, the rights and obligations listed in the contract are not made by default but are adjusted to the conditions of the parties. The term commonly used in stating rights and obligations is set by the NHS as a national guide. If the NHS contract states that the party must do something (e.g. must comply, deliver, or perform), this means that the party has an absolute obligation to do so regardless of the costs or risks incurred. However, rights and obligations can also be mentioned by not requiring both parties to do something. This statement has a lower level of liability than the previous statement, which means that the relevant parties still need to make efforts to achieve the objectives required in the contract. The details of the rights and obligations of the parties are the actual formulation of a cooperation contract. The benchmark for the implementation of an agreement can be seen from the extent to which the parties carry out their rights and obligations well. Revealing that identifying responsibilities in the form of clear rights and obligations between parties is one of the absolute conditions necessary for the determination and enforcement of contracts. Therefore, the preparation of the provisions of the rights and obligations of the parties in the contract requires meticulousness from the normative theoretical aspect and the empirical side. With a good agreement, it is hoped that it can prevent disputes that can occur to the party who commits.(Wolff, 2020; Mikkers and Ryan, 2016; Wolff, 2020).

The standard of health service tariffs in Indonesia has been regulated in the Regulation of the Minister of Health. The service tariff standards currently used in FKRTL are adjusted to the type of hospital, type of hospital ownership, regionalization, inpatient class, and type of service/disease diagnosis. Before the tariff was set in regulation, there was an agreement on the determination of tariff regionalization between the Ministry of Health and BPJS Kesehatan and the Indonesian Hospital Association Organization as representatives of each regional hospital. This aims to reduce the inequities in health service payments based on the regionalization of health facility locations. However, this cannot fully accommodate health service providers and purchasers to negotiate prices and service coverage directly due to the establishment of regulations based on initial agreements that have become binding standard rules. As a result of rigid regulations, saying that healthcare providers are supposed to receive case-based payments, but the rules do not allow them to change the combination of inputs, the expected efficiency gains will not materialize, and the quality of services will decline. In the UK, NHS standard contracts require that CCGs must pay

healthcare providers following the principles and rules set out in the National Tariff Payment System guidelines. Pricing in the National Rates on the NHS UK is based on the actual cost history of the healthcare provider proposing to provide a particular service activity to a patient. For national rates to achieve the expected financial impact, patient activity in the NHS scheme continues to be recorded in detail as the basis for calculating and developing service rates in the future. The national rate for secondary health services is calculated centrally based on the cost information submitted by the service provider. There is legal consultation on the methodology used to determine prices and any changes to payment rules, and fare coverage. If the objection threshold is violated, the methodology will be reviewed. Informal consultations are conducted first on the main proposals, and adjustments are made as needed before the legislative consultation. A clinical group of experts reviews the pricing plan, and manual adjustments can be made. The determination of health service costs is a key component in the purchase of benefit packages (covered services) in the overall financing system. According to, the contract must include the large tariff and terms of the payment method. The amount of the rate set should reflect the actual cost and consider the health system objectives and Mathauer *et al.* (2019)(Barber *et al.*, 2019). Barber *et al.* (2019) broader health outcomes. The number of unfair tariffs will have an impact on the quality of services provided, service efficiency, and the sustainability of the contracts carried out. However, in theory, if an insurance institution covers a large portion of the population, the beneficiaries (the public) can be directed to use the "in-network" service provider contracted by the institution. In such a system, healthcare providers may agree to receive relatively lower rates from insurance institutions to ensure patient volume and income security. However, private service providers or the largest or only service providers in a given region have a strong influence to request higher rates from insurance institutions and can control price changes over time. Clinical standards of care and an impartial line of treatment are the basis of purchasing and pricing. Managerial capacity at the central and healthcare facility levels is required to analyze and implement changes and manage contracts. Prices are also not directly shaped by the interaction of demand and supply, but rather are regulated, negotiated collectively, or negotiated individually.(Schut & Varkevisser, 2017; Berenson *et al.*, 2012; Baker *et al.*, 2014; Barber *et al.*, 2019).

The contract between BPJS Kesehatan and the Hospital does not discuss the payment of incentives or non-financial incentives. The non-financial incentive approach through rewards is one approach in which the system can reward healthcare providers to improve productivity and service quality. Health sector reforms often require policymakers to rethink the incentives they want to set for providers. Indeed, there has been a growing consensus that healthcare purchases must be more active or strategic if a country is to make progress towards (Allen *et al.*, 2014; WHO, 2017) Universal Health Coverage (UHC). However, healthcare purchases are often passive without considering their performance, and benefit packages are not well defined. Therefore, there are few to no financial incentives for service providers to do better. Meanwhile, in the NHS contract, a policy related to national financial incentives has been described, and the Mathauer *et al.* (2019). Commissioning for Quality and Innovation (CQUIN), applicable to contractual relationships that fall within the scope of the Harmonized Payments and Incentives rules in the National Tariff Payment System. However, the rules related to separate arrangements for the Local Incentive Scheme on contracts have been removed since 2022 as they are no longer required. Currently, the NHS has developed some DRG rates that are set by including incentives given to the best services, such as the use of day-case surgery (same-day surgery) where appropriate. Thus, as much as 2.5% of the contract value is associated with the achievement of several quality objectives through the CQUIN initiative. When healthcare providers are rewarded based on the results of the performance achieved, those payments must also be appropriately priced and given the right incentives. Provider contracts can be a way to influence provider behavior and incentivize the provision of quality health care. The allocation

of incentives can ultimately affect the progress of health care delivery aimed at achieving UHC (fairness in resource distribution, efficiency, transparency, and accountability) and long-term UHC goals (utilization of services according to needs, financial protection financial equity, and quality). Purchases are also considered strategic if one of them uses incentives to limit the provision of services that are expensive to provide (Tikkanen *et al*., 2020;Gatome-Munyua *et al*., 2022; Cashin & Gatome-Munyua, 2022; Sieleunou *et al*., 2021).

NHS system in 2020, all Government Hospitals contracted with local CCGs to provide services and were paid according to the nationally determined diagnosis-related group (DRG) rates, which covered medical staff costs. Hospitals are also paid for this type of outpatient consultation at a predetermined rate. However, the scope of services guaranteed by the NHS is not specified in the law, and there is no absolute right for patients to receive specific care. NHS contracts only provide standard service category or specification information, not a detailed list of all possible types of services. So that the content of the contract can be adjusted to reflect the nature of the services that will be provided by the health care provider. The CCG/commissioner makes decisions on the determination of the scope of services and the development of service specifications for the hospitals that will collaborate. The specifications of the developed services will vary according to local circumstances. However, the commissioner can adjust to the procurement suggestion and involve prospective service providers in developing a specification. Clinical and service user engagement is excellent for specification development. With the existence of an independent CCG under the NHS, there will be more negotiation between the purchaser and the service provider to determine what services will be covered and how much will be paid according to the hospital's ability to provide services to participants. In 2022, the NHS has simplified the content of service-related contracts. In many cases, the specifications in the contract are less restrictive and encourage (Thorbly, 2020; Tikkanen *et al*., 2020; Thorbly, 2020) input-driven in the future. This allows healthcare providers more leeway to adapt, improve services over time, and provide the best service to meet the commissioner's long-term goals. Based on this, the service buying landscape is growing as many healthcare provider sectors continue to grow and diversify, including for-profit and non-profit service providers. One of the first steps towards UHC is to determine what services can and will be offered to participants. This shows that determining the health care package has a great impact on health outcomes and financial protection. Therefore, important benefit packages are designed comprehensively and adequately according to the needs of participants to improve access and coverage of services and reduce (Mathauer *et al*., 2019; Aman *et al*., 2019; Pillay *et al*., 2020) out-of-pocket (Mugo, 2023).

The term of the BPJS Kesehatan cooperation agreement with the Hospital is effectively valid for 1 (one) year with a contract review carried out at least every 2 years according to needs. If the extension of the cooperation agreement is to be carried out, the parties to the contract need to notify a maximum of 6 months before the end of the agreement. Meanwhile, in the NHS contract in the UK, the term of the cooperation agreement is valid for 2 years, but there is a policy of reviewing the contract every year. Regular reviews are important to ensure legal compliance and adjustment to changing conditions. The content of the contract must comply with applicable regulations and laws so that through a review the provider can monitor its behavior towards the contract being executed. If there is a change in the recommended treatment or other needs, the results of the review can be used as a guideline for the parties to adjust the content of the contract to the needs of the community and the performance of the provider and develop a payment method. So, contract review is also able to improve the quality of service received by participants. According to the contract, the contract Odendaal *et al*. (2018) The review procedure is the process of analyzing the terms in a contract to ensure that the terms are fair and do not have potential risks. The contract review process is a stage to approve changes in areas that require significant improvements to improve the quality of services provided. The

Mühlbacher *et al.* (2018), the review process is carried out based on the data available to the service provider, so detailed and up-to-date information is very important for purchasers to be able to allocate funds according to service needs. The information needed includes clinical and financial data as well as data on the quality and output of service delivery, all of which require a harmonized or interrelated data system. However, such detailed information is not available or accessible in many low- and middle-income countries, making it difficult to use evidence as the basis for strategic purchasing decisions (e.g. in contract design). As in Indonesia, there are still several obstacles in the implementation of cooperation between purchasers and service providers, namely, there are still service providers whose values are below standard but are still contracted to serve JKN participants because the number is still relatively small. This means an agreement cannot be unilaterally terminated so that people can still access health services. Although the results of the Mathauer *et al.* (2019). Review shows that some performance indicators cannot be met, and regular monitoring is still needed to improve medical quality (Ulandari and Indrayathi, 2016).

Regarding monitoring and evaluation, both in Indonesia and in the UK have included this in contracts with health service providers. This is an important point and follows the statement, which reveals that the monitoring and evaluation provisions in the contract are a benchmark in evaluating the common goal concerning the expected results. In Indonesia, the monitoring and evaluation component consists of Onyango & Juma's (2020). Utilization Review (UR), customer feedback, assessment of compliance with the quality commitment of the implementation of the agreement, and evaluation of the referral potential. In addition, monitoring and evaluation are also carried out through a review of the implementation of the Information Provision and Complaint Handling (PIPP) function in the Hospital which includes the level of attendance or coordination of officers and the resolution of complaints following the Service Level Agreement (SLA) and the quality of SIPP recording, feedback on the level of participant satisfaction with the service through customer feedback, as well as identification and analysis of causes/obstacles to the implementation of the PIPP function of the Hospital in the Hospital. Meanwhile, the NHS contract with healthcare providers in the UK also states that service providers must continue to review and evaluate services, act on information obtained from reviews, and evaluate feedback, complaints, audits, clinical outcome review programs, and patient safety incidents by involving service users, staff, GPs, and the public (through survey results). The success of a contract often depends on whether it creates a sense of accountability as well as formal requirements to monitor compliance and provide information to improve services when needed. Reported that the lack of monitoring and evaluation mechanisms resulted in hospitals setting service prices that exceeded the prices stated in the contract. The absence of monitoring and evaluation mechanisms forces hospitals to raise costs to reflect rising costs and changing economic contexts. Studies in other regions also revealed similar results, some purchaser organizations suffer from poor monitoring and evaluation. These findings show that the purchaser organization as a party to the contract needs to monitor and evaluate the delivery of health services to stay aware of the development of the situation faced by health service providers. (Maluka *et al.*, 2018; Benova *et al.*, 2015).

In the United Kingdom, there is an institution called the Care Quality Commission that regulates the quality of all health and social services for adults. The development of the NHS to regulate the use of resources, financial development, and operational performance is also carried out by the Care Quality Commission. This institution has the authority to monitor performance using quality standards set nationally. This institution assesses the results of hospital evaluation monitoring and can close services when the hospital does not meet the standard requirements. This monitoring process includes an annual survey conducted nationwide to assess the patient's experience in the Hospital. On the other hand, the (Barber *et al.*, 2019). The National Institute for Health and Care Excellence is also developing quality standards, guidelines, and

guidelines for various clinical conditions, safe staffing levels, technology, medication handling, antimicrobial prescribing, and diagnostics that include primary, secondary, and social care services for providers. Monitoring and evaluation activities to improve service quality can be carried out through various activities. Concerning clinical staff, healthcare providers need to evaluate periodically by monitoring the actual number of clinical staff on duty against the planned number in each. Tikkanen *et al.* (2020) shift and conducting and compiling a review of the ratio and workload and its impact on service quality at least once every 1 year. Monitoring and evaluation are also carried out by considering the feedback given, complaints submitted, surveys, and patient safety incidents. All of these activities are used as a basis for decision-making and improvement for health service providers and other stakeholders to improve the quality of services provided. The contract also states that it is important for CCG to use contractual tools to set high-quality standards for healthcare providers and conduct periodic quality monitoring. In addition, there is also a local agency, namely the Local Quality Surveillance Group, which provides a communication forum for local CCGs and other related partners to share information and discuss the best quality of service to be provided. Information on the quality of services at the organizational level, departments, and the condition of some service procedures from the perspective of doctors has been published on the NHS website. The results of the health service quality inspection that have been carried out by the Care Quality Commission are also accessible to the public. Revealed that monitoring and evaluation interventions in health services have been shown to encourage optimal use of resources, and best practices, and help ensure that services are implemented efficiently and effectively and achieve the intended target groups.(Tikkanen *et al.*, 2020; WHO (2017).

In contracts that apply in Indonesia, there is a clause related to the expiration of claims, namely claims that have exceeded the limit of the submission provisions, which is more than six months since the health service has been provided. Regular claim submission by the Hospital to BPJS Kesehatan in practice is carried out collectively every month accompanied by claim submission documents such as service recapitulation, supporting files for each patient, and other proof of service. BPJS Kesehatan as the purchaser will then make payment based on the claim submitted no later than 15 days after all conditions are met. However, there is a condition where the Hospital cannot submit a follow-up claim in the same month as the regular claim submission. In this regard, the parties to the contract, namely BPJS Kesehatan and the Hospital, need to agree to submit a claim to be stated in the Minutes of Agreement with the provision that it does not exceed the expiration limit of the claim. If the submission of a claim exceeds the specified time limit, the claim cannot be resubmitted. A clause on the expiry of claims has also been set out in the draft NHS contract in the UK. NHS contracts require healthcare providers to ensure that indemnity arrangements remain in place until the statutory limitation period on claims expires. Similar to Indonesia, the submission of claims in the UK is also carried out periodically by attaching submission documents. In addition, the NHS also has a system for scheduling monthly file submission deadlines called the " Secondary Uses Service (SUS) Submission Schedule". The date of reconciliation or file submission is set flexibly. Healthcare providers should make every effort to make the data as accurate as possible at this early flexible stage. On the post-reconciliation date, which is the point at which the data submitted by the service provider each month is "frozen", if any data inaccuracies are found, they can be corrected at that time for that month. New service provider payments can be made after the data is corrected. Claim data submitted by healthcare providers to purchasing organizations generally includes information about medical diagnoses, treatment procedures performed, prescribing information, and details of several financial metrics such as costs, expenses, and reimbursement amounts. According to the report, the submission of claims within a certain time frame and all-important information from the service provider as well as the payment period are provisions that need to be mutually agreed upon by the service provider and the

purchaser's organization to be able to implement an effective accountability mechanism. As in other countries, the provider is responsible for filling out and submitting the claim form within the period specified in the contract, which is 30 days after the health service is completed for the patient. The verification process is then carried out to determine the reimbursement of fees provided to the service provider. However, payment suspension is still often experienced by service providers. Payment suspension is inevitable in the process of submitting a claim. Some of the factors that were found to be closely related to the suspension of payments were the completeness of the required documents and the ability or accuracy of the claims administration staff at health facilities (Konrad *et al*., 2020; Hanson *et al*., 2019; Marshall *et al*., 2023; Rahmatiqa *et al*., 2020). The same findings were reported, the submission of inaccurate reports and the lack of ability of qualified officers to prepare claims led to delays in reimbursement of claims costs. This can affect the operational needs to facilitate the provision of services. To reduce the potential for deferral of claims payments, healthcare providers need to: 1) establish a good claims management system with the use of facilities, infrastructure, and technology support, 2) improve the capabilities of parties involved in the claims submission process, and 3) establish good communication with purchaser organizations (Akweongo *et al*., 2021; Tarigan *et al*., 2022).

In addition, the procedure for resolving claim disputes has also been regulated in contracts in Indonesia and the United Kingdom. In Indonesia, the settlement of claim disputes is carried out in stages starting from the district, provincial, and central levels. In addition to being carried out by related parties, this discussion can also involve external parties such as the Quality Control and Cost Control Team (TKMKB), INA CBGs coding organizations or experts, and related stakeholders such as the Ministry of Health and the Clinical Advisory Council (DPK). If deliberation and consensus are not reached, the settlement is carried out through the court. Meanwhile, in the UK, the NHS standard contract has stated that the settlement of claim disputes only applies when the cooperation contract has been signed. This procedure requires the disputing parties to try to resolve differences through negotiation. If the issue has not been resolved, then move up to resolution through senior managers and then board-level representatives as needed. If the dispute remains unresolved, the parties should refer it to mediation, where the appointed mediator will attempt to facilitate a dispute settlement agreement that benefits both parties. However, if mediation still fails to resolve the issue, the dispute should be referred to an independent expert for a decision. The expert verdict on the dispute will be binding on the parties. Dispute claims are problems that can affect budget allocation policies and planning of service providers, increasing the cost burden that will affect the health services provided. Therefore, the procedure for resolving claim disputes needs to be clearly defined in the cooperation contract between the purchaser's organization and the health care provider. Before proceeding to the litigation process, it is important to resolve the dispute through open communication between the parties and turn the dispute into a conflict (Alhassan *et al*., 2016; Amirthalingam, 2017; Hyman *et al*., 2010).

Indonesia does not enforce copayment, and this has been explained in the contract. Hospitals that charge additional fees to participants outside the provisions and/or violate the provisions as stipulated in this agreement, will be given sanctions in the form of written warnings. This is like the situation in the UK in 2020, where the NHS does not impose cost-sharing on patients for services included in NHS coverage in Government Hospitals. However, for certain services such as vision tests, dental services, and transportation costs, there are certain categories of patients who are exempt from the policy. The cost-sharing of vision tests does not apply to children/adolescents, older adults, or low-income adults. Meanwhile, for dental care, cost sharing is exempt for children/adolescents, students, pregnant women, new mothers, inmates, and low-income communities. In addition to those included in the categories mentioned, dental services are subject to a copayment fee of up to USD 365.00 per treatment. Cost sharing for transportation to and from health facilities is also waived for people who qualify for low-income incomes. Including outpatient drug services, only certain patients are exempt from cost-sharing such as children, adolescents aged 16 to 18 years in full-time education, adults over 60 years old, low-income individuals and families, and women who are or have recently become pregnant. Outside of this criterion, you need to pay USD 12.50 per prescription for outpatient drugs. Patients who need prescription drugs in large quantities can purchase a prepaid certificate for USD 41.40 for three months or USD 148 for 12 months. Medications prescribed in NHS hospitals during hospitalization have no (Thorbly, 2020) copayment

(Tikkanen *et al*., 2020). Cost sharing refers to direct payments made by patients to healthcare providers. In the healthcare system, cost sharing is usually used to reduce the demand for health services to control costs. However, cost-sharing reportedly reduces not only unnecessary care but also what patients should need. This policy can also affect the access of low-income groups to health services because they must bear more care costs. Another review found that cost-sharing was associated with lower rates of utilization and adherence to ongoing treatment in different areas of therapy. Therefore, as in the UK, holistic views such as the level of economic ability of the community, the type of services that will be subject to (Stadhouders *et al*., 2019) cost-sharing and the number of fees paid need to be considered before implementing a cost-sharing policy in a cooperation contract (Fusco *et al*., 2023).

In Indonesia, the mechanism for providing information and handling complaints is regulated in a contract in the form of rooms and posters for providing information and handling complaints that are strategically located and easily accessible. In the NHS UK contract, this mechanism for providing information and handling complaints is also explained in the contract. Concerning the provision of information, NHS standard contracts have required that good quality information be provided to enable healthcare providers and commissioners to monitor performance under agreed contracts. Several guiding principles have been determined to support the provision of quality information, including that the provision of information must be used for high-quality care and must be able to answer questions. Parties also need to be aware that some requests for information may require a certain period to respond. In addition, the contract also explains that each service provider must issue, maintain, and carry out complaint procedures following the Fundamental and Legal Standards of Care and other guidelines.

Meanwhile, regarding official communication between the parties to the contract, in Indonesia, it must still be done through correspondence, notices, statements, or written approvals that are delivered directly either by email, expedition, post, or facsimile to the BPJS Kesehatan Branch office. However, in the NHS system, all communication and procedures between parties have been described in an integrated system. So, prospective health service providers who will extend the contract can easily find out the flow/steps to submit a cooperation contract. This can also be used as an example for the implementation of contracts between BPJS Kesehatan and health service providers in Indonesia. Especially now BPJS Kesehatan is in the preparation stage towards comprehensive coverage. One of the main things that must be improved is the information system which still has many challenges in daily management, participant administration, databases, data distribution, and others. Currently, the use of health information systems has become a staple in every health service organization. An adequate and functional information system is the foundation of a strong health system. Information systems help improve service delivery and quality of care because they consist of management systems that affect service delivery. This improves patient safety and contributes to service delivery as it can provide quick access to patient data and distribute it to various databases (Nurhayati and Hidayat, 2018; Haule *et al*., 2022; People *et al*., 2019).

Strategic procurement reform through the strategic contract system does not have to be a major change but can be carried out gradually and in several service packages. Reforms aimed at making purchases more strategic are not always easy, but the most important thing is that they can be carried out step by step to build an information management system, establish benefits to align with payment methods and vice versa, modify payment methods and rates to suit the needs to improve service provision, and implement an accreditation system, etc. These steps can certainly also encourage changes in the health sector system that is currently running in Indonesia.

CONCLUSION

Contracts are recognized as an increasingly important tool for implementing strategic health service purchasing policies in meeting public health needs. Enforcing compliance with contractual agreements between suppliers and purchasers is essential to providing quality services to the community in an efficient manner. For this reason, contract-making requires the purchaser of the service to have the capacity to design, deliver, and manage the contract to know what services the community needs, from whom the service is provided, and how the service is paid. Lessons learned from contracts with healthcare providers implemented in the NHS can provide the potential for contract development between BPJS Kesehatan and existing health service providers in Indonesia, as well as the

development of monitoring ineffective contract implementation. Contracts are a means and not an end in themselves, so they must be used or implemented, especially to provide quality health services for the community. More research is needed to identify determinants in developing contracts with healthcare providers and implementing contracts in specific regions of Indonesia.

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Adolescents and the Prostitution Industry: Changing Patterns of Prostitution, Motivations, Assessments, and Risks Faced

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Abstract

The phenomenon of adolescents involved in the prostitution industry was widespread globally, including in Indonesia. This study focused on the changing patterns of prostitution, motivations, perceptions, and risks faced by adolescent sex workers. The research used a mixed-method approach, employing both quantitative and qualitative designs. Data were collected through surveys involving adolescent sex workers and general adolescents, as well as in-depth interviews with adolescent sex workers. The quantitative study included 360 respondents, comprising 180 general adolescents and 180 adolescent sex workers, while the qualitative study involved 30 adolescent sex workers as informants. The research was conducted in Bali, South Kalimantan, West Java, North Sulawesi, North Sumatra, and Central Java provinces. The findings revealed a shift in prostitution patterns among adolescents from conventional (street-based) prostitution to online prostitution via digital platforms. Adolescents had higher opportunities to become online sex workers due to the diversity of social media platforms and service types available. Economic factors accounted for 81.7% of adolescents' reasons for becoming sex workers. There was a disparity in perceptions between general adolescents and the actual challenges faced by adolescent sex workers. Among adolescent sex workers, 80% had low reproductive health knowledge, 23% had experienced sexually transmitted infections (STIs), 16% had faced unwanted pregnancies, and 7% had undergone abortions. It was concluded that there were significant changes in the patterns, motivations, perceptions, and risks associated with adolescent sex work.

Introduction

The The phenomenon of adolescent sex workers is a complex issue with significant health, psychological, and social implications. Adolescents involved in sex work face a high risk of sexually transmitted infections (STIs), including HIV, as seen in Cameroon, where adolescents who began sex work before the age of 18 reported higher cases of STIs (Ashley *et al*., 2023), and in South Africa, where the HIV prevalence among young female sex workers reaches 40.4% (Minja *et al*., 2022). Additionally, in India, high-risk behaviors such as inconsistent condom use increase the HIV prevalence to 1.2% among adolescent sex workers (Sanjay *et al*., 2023). Psychologically, depression rates are higher among those who started sex work during adolescence, as evidenced in Eswatini, where 55.5% experience depression (Ashley *et al*., 2023). Trauma from sexual exploitation also results in long-term psychological effects (Anne-Lise & Evelyne, 2022). Socioeconomically, financial hardships are a major driver, as seen in South Africa (Minja *et al*., 2022), while physical and sexual violence exacerbates vulnerability, as reported in India and Cameroon (Sanjay *et al*., 2023; Ashley *et al*., 2023). Therefore, a comprehensive approach through public health interventions and socioeconomic support is essential to

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mitigate risks and improve the well-being of these adolescents (Alifah RN et al, 2024).

The advancement of technology has contributed to the increasing number of adolescent sex workers (Fatanti MN, 2021). Technology has become an integral part of human life, indirectly driving changes in communication patterns (Handayani, 2019; 2021). It has been easier for individuals to form networks and interact with others without the limitations of distance and time (Thérèse, 2022; Nugroho E et al, 2025). Technological advancements also influenced the ease of prostitution practices, commonly referred to as online prostitution. They no longer needed to solicit on the streets, in hotels, or other prostitution venues, as they could do so through instant communication applications like WhatsApp, WeChat, Line, and others (Sylvia, 2022). Online prostitution provides more private and discreet services, attracting many adolescents to become online sex workers (Rosemary *et al.*, 2019; Hamilton, 2022). Moreover, adolescents working as online sex workers were in higher demand because most of them were young and attractive (Rimawati E, 2010; Rosey, 2021).

Environmental factors influenced sex workers, such as increasing adolescent needs, peer environment, specific lifestyles, and living far from their parents, which prompted adolescents to find ways to earn extra pocket money (Irawan F *et al*, 2019; Susan, 2021). However, the phenomenon of adolescent sex workers was often taboo in society. It not only made it difficult for adolescents involved in the sex industry to talk about their fears and other feelings but also meant that they might face severe stigmatization and prejudice (Alak, 2020; Madeline & Trish, 2022). Compared to sex workers in general, adolescent sex workers remained under-researched in Indonesia. Studying this issue was essential to understand how teenage sex workers could be accepted by their peers and how adolescent attitudes affected how sex workers perceived themselves regarding self-stigmatization and related challenges and demands.

The most common motivation expressed by adolescents for entering the sex industry was to finance a lifestyle (63.5%) (Ernst F, 2021). Flexible working hours were also an important factor, along with the enjoyment they felt while being involved. The primary fear among adolescents regarding their profession as sex workers was stigmatization, which led to their greatest concern—keeping their occupation a secret. Preliminary research on the phenomenon of student sex workers, commonly referred to as "ayam kampus," in Semarang City revealed several factors behind their involvement, including economic reasons (47%), a luxurious lifestyle (22.6%), social environment (21.8%), personal satisfaction (6%), and prestige (2.6%) (Rimawati E, 2010). Most of them were exposed to sex at an early age, leading them to offer sexual services during their university years.

This data highlights that a significant portion of this population is at risk of contracting sexually transmitted infections (STIs) through prostitution. According to 2004 WHO data, approximately 250 million new STI cases—including gonorrhea, syphilis, and genital herpes—were reported annually worldwide. STIs are a gateway for HIV transmission (Pradnyawati, 2019; Widjaja, 2023). Individuals with STIs are 2–9 times more likely to contract HIV compared to those without STIs. In Central Java Province, the number of new STI cases increased over the years: 8,723 cases in 2009, 9,572 in 2010, and 10,752 in 2011. These figures are likely an underrepresentation, as many cases in the population remain undetected (Sari DA, 2018). This research focuses on the changing patterns of prostitution, motivations, perceptions, and risks faced by adolescent sex workers in Bali, South Kalimantan, West Java, North Sulawesi, North Sumatra, and Central Java provinces. The study examines adolescents working in the sex industry and includes direct experiences from individuals involved in prostitution. First, it concentrates on the characteristics, motivations, feelings, and risks faced by adolescents working in the sex industry, particularly in rural and urban areas of Indonesia. Second, it explores adolescents' knowledge and attitudes toward their peers working as sex workers, focusing on the emotions evoked in adolescents not involved in the sex trade.

Figure 1. Place of Research Implementation

METHODS

The study was conducted in Bali, South Kalimantan, West Java, North Sulawesi, North Sumatra, and Central Java. The research design employed a mixed-methods approach, combining quantitative and qualitative, with the aim of obtaining a deeper understanding of the research topic. The study population consisted of adolescent sex workers and non-sex worker adolescents in these six provinces.

The sample for the quantitative study was calculated using Lemeshow's formula for an unknown population size. With a case-control design ratio of 1:1, the minimum sample size required was 97 adolescent sex workers and 97 non-sex worker adolescents. Considering the margin of error and minimum sample size, the total sample was determined to be 180 non-sex worker adolescents and 180 adolescent sex workers. The sample was distributed across six provinces: Bali, South Kalimantan, West Java, North Sulawesi, North Sumatra, and Central Java. For the qualitative study, in-depth interviews were conducted with adolescents working as sex workers. Triangulation respondents included NGO outreach volunteers for sex workers, representatives from the Social and Child Protection Department, and experts. Participation was voluntary, and no compensation. All participants spoke regional languages or Indonesian, as interviews were in Javanese or Indonesian. A minimum of one informant was recruited from each province, totaling six informants initially. However, during data collection, the number of informants increased to 30 adolescent sex workers.

The questionnaire for adolescent sex workers was structured to include components such as characteristics, knowledge, access to reproductive health information, access to healthcare services, types of services provided, challenges faced, and levels of happiness. For non-sex worker adolescents, the questionnaire included components such as characteristics, knowledge, access to reproductive health information, access to reproductive health services, access to healthcare services, having friends who are sex workers, perceptions related to sex workers, challenges faced by sex workers, and levels of happiness. The interview guide was structured as follows: 1) Included items on sociodemographic data, and 2) Applied to both adolescent sex workers and non-sex worker adolescents. This study defined sex work in a broader sense. Adolescents offering any form of sex work, such as prostitution in the narrow sense, escort services with or without sexual contact, stripping, webcam services, or phone sex, were included. Participants were also allowed to specify additional types of sex work they engaged in.

RESULTS AND DISCUSSION

Sex work is one of the oldest professions and involves the exchange of sexual services for money or goods. It encompasses a range of activities, from direct sexual intercourse to

Table 1. Services offered by Adolescents Sex Workers

Services Offered	Frequency			Total
	Never	**Sometimes**	**Often**	
Sex	1%	40%	59%	100%
Creating Sexy Photo Content	2%	18%	80%	100%
Selling Sexy Photo Content	1%	93%	6%	100%
Creating Sex Video Content	1%	4%	95%	100%
Selling Sex Video Content	1%	2%	97%	100%
Chat Sex	13%	44%	43%	100%
Phone Sex	6%	37%	57%	100%
Video Chat Sex	3%	27%	70%	100%

Source: Primary Data

indirect acts like lap dancing. Different types of sex work, such as "indoor" versus "street" prostitution or "voluntary" versus "forced," are identified in the literature. Societal views on sex work are influenced by biological, cultural, political, and psychological factors, with stigma and criminalization often attached, especially in patriarchal societies that regulate female sexuality. Historically, sex work has been linked to drug addiction, STDs, and perceived moral failings (Prakash P, 2022). Studies, including those in Indonesia and the Philippines, identify supply (poverty, illiteracy) and demand (men's ability to pay) as key factors in the proliferation of sex work. The rise of internet technology has introduced a new form of online prostitution, making transactions more private and safer for both workers and clients. It has expanded the sex trade to virtual spaces, allowing for more discretion and the involvement of adolescents, who may engage more in producing and selling pornography than direct sexual acts (Irawan F *et al*, 2019). In conclusion, the complex factors influencing sex work, along with the impact of modern technology, highlight both the persistence and transformation of this phenomenon in society.

Looking at the advantages of online prostitution, which is now very private, it provides more privacy for the perpetrators. Adolescents feel safer regarding the identity of their profession. Various driving factors such as lifestyle, economic factors, and increasing financial needs push adolescents to engage in commercial sex work. From the search results on online prostitution using social media, the author found that most of the call girls were between 16 and 27 years old. It is the age of schooling, and college, and still considered a very productive age. However, the reality is that the consumerist lifestyle of students in big cities has led some of them to become prostitutes to fulfill their hedonistic needs. The use of social media has become a loophole and a tool for building prostitution networks, both collectively and individually. In line with research by Koops *et al*. (2018), the development of media and webcams has opened up new channels for commercial sex workers on the Internet, which requires further attention. Specifically, the expanding market for child sex trafficking and problematic adults is a target for important interventions. Further use of webcams increases the risk of sexual boundary violations against children and adolescents, ranging from unwanted exposure, and sexual harassment, to commercial sexual exploitation (Fanny, 2020).

The researcher attempts to describe the general perception of issues faced by adolescent sex workers. The perception questions consisted of 14 questions with 3 answer scales: often, sometimes, and never. Based on the research findings, 23% of adolescent sex workers have experienced STIs, 16% have experienced unwanted pregnancies, and 7% have had abortions. In addition, adolescent sex workers often report experiencing stigma (76%), family problems (71%), stress or depression (68%), discrimination (68%), educational issues (66%), verbal abuse (60%), relationship problems with partners or boyfriends (58%), problems with friends (57%), frequent STIs (56%), physical abuse (56%), non-payment by clients (52%),

difficulties in building relationships with others (49%), issues with fellow sex workers (45%), and legal problems (43%). The perceptions of adolescents regarding the issues faced by adolescent sex workers may vary depending on culture, context, and personal experiences. However, some studies suggest that adolescents have different perceptions of the issues faced by their peers involved in sex work. The analysis of findings continues with searching for correlations between research variables and adolescent status. The variables tested for correlation include: a) Knowledge, b) Access to Information, c) Health Services, d) Happiness Perception, e) Trust Perception, and f) Comfort Perception. The distribution of frequencies and correlation test results between variables can be seen in Table 2 below:

The study examines the knowledge of reproductive health among general adolescents and adolescent sex workers, with a focus on areas such as reproductive health, sexual growth, reproductive organs, pregnancy, sexually transmitted infections (STIs), HIV/AIDS, and unwanted pregnancy. Knowledge was assessed with two response options: correct or incorrect. The results show that 22.5% of general adolescents have low knowledge, and 27.5% have high knowledge. In contrast, 40% of adolescent sex workers have low knowledge, indicating a higher proportion of low knowledge in this group. A chi-square test found a significant correlation (p-value = 0.001) between knowledge and adolescent status, suggesting that adolescent sex workers have significantly lower knowledge than their general peers.

Interviews with adolescent sex workers revealed that most were unaware of basic reproductive health concepts but were familiar with practical aspects such as health services and STI tests. This shift in

Table 2. Crosstab Frequency Distribution of Variables: Knowledge, Access to Information, Health Services, Happiness Perception, Trust Perception, and Comfort Perception, with Adolescent's Status.

Variables Non Sex Worker		Adolescent's Status			p-*value*
		Sex Worker	**Total**		
Knowledge	Low	81	144	225	0.001
	High	99	36	135	
Total		180	180	360	
Access to Information	Not Good	63	119	182	0.001
	Good	117	61	178	
Total		180	180	360	
Health Services	Not Good	114	82	196	0.001
	Good	66	98	164	
Total		180	180	360	
Perception of Happiness	Less Happy	87	106	193	0.045
	Heppy	103	74	167	
Total		180	180	360	
Perception of Trust	Lack of Trust	72	118	190	0.001
	Trust	108	62	170	
Total		180	180	360	
Perception of Comfort	Lack of Comfort	75	113	188	0.001
	Comfort	105	67	172	
Total		180	180	360	

Source: Primary Data

focus from theoretical to practical knowledge is linked to their independent work, often without a mentor or pimp, limiting access to comprehensive information. Previous research by Lim (2015) supports these findings, showing that sex workers generally have low theoretical knowledge about reproductive health, STIs, and contraception, which contributes to ineffective preventive practices like poor partner selection and incorrect use of prophylactic antibiotics.

The questions related to information access aimed to obtain an overview of how easily the respondents could access information regarding reproductive health, sexually transmitted infections, reproductive health services, and other related topics. The detailed points of the questions are as follows: Access to reproductive health information through print media, electronic media, social media, parents, schools, and teachers, the frequency of information access, and the completeness and usefulness of the information available. The questions were answered using a 5-point Likert scale: strongly agree, agree, neutral, disagree, and strongly disagree. The frequency distribution of information access for general adolescents and adolescent sex workers is as follows: Among general adolescents, 17.5% have poor access to reproductive health information, and 32.5% have good access to health information. Among adolescent sex workers, 33% have low access to health information, and 16.9% have high access. It can be concluded that adolescent sex workers with low information access are more prevalent compared to other groups.

The chi-square test between information access and adolescent status resulted in a p-value of 0.001. Therefore, it can be concluded that there is a correlation between information access and adolescent status. The next chi-square test was conducted to examine the correlation between information access and knowledge, which resulted in a p-value of 0.001. Thus, the conclusion is that there is a correlation between information access and knowledge. The results of the test can be seen in Table 3.

Based on in-depth interviews with informants who are adolescent sex workers, the majority of informants lacked basic knowledge regarding reproductive health. Most informants stated they often obtain information through the internet and social media. However, they do not understand the information presented and find it difficult to ask or confirm the information they receive. The informants also mentioned accessing information through health service providers such as public health centers (puskesmas) and the Indonesian Planned Parenthood Association (PKBI), but they often forget the information given. Other informants stated that they do not know how to access information related to reproductive health. According to a study by Barnier (2021), many sex workers are unable to optimally utilize technology and information. There is a need for collaboration between the sex worker community and external parties to develop health and workplace safety strategies communicated through information and communication technology (Hermawan DY, 2023).

The study also explored the access to and use of health services among general adolescents and adolescent sex workers, focusing on aspects such as timing, types of services accessed, ease of access, and perceptions of service quality. Respondents answered using a 5-point Likert scale ranging from "strongly agree" to "strongly disagree". The results revealed that 31.6% of general adolescents reported poor access to health services, while only 18.3% reported good access. Among adolescent sex workers, 22.7%

Table 3. Crosstab Frequency Distribution of Information Access and Knowledge Variables

Variables		Knowledge			p-*value*
Low		**High**	**Total**		
Access to Information	Not Good	131	51	182	0.001
	Good	94	84	178	
Total		180	180	360	

Source: Primary Data

reported poor access, and 27.2% reported good access. It indicates that general adolescents face higher challenges in accessing health services compared to adolescent sex workers, who, despite facing some barriers, have a higher percentage reporting good access to services.

A chi-square test showed a significant correlation (p-value = 0.001) between health service access and adolescent status, suggesting that adolescent sex workers have different access patterns compared to general adolescents. Interviews with adolescent sex workers indicated that while they often use reproductive health check-up services, they rarely seek other health services like reproductive health counseling or psychological support. Supporting previous research, Makhakhe (2019) identified challenges sex workers face in accessing reproductive health care, especially in public health facilities, where stigma often prevents them from seeking services. However, non-governmental organizations (NGOs) have been instrumental in providing specialized reproductive health services through mobile clinics and peer-based approaches, which help build trust with healthcare providers and normalize HIV testing. This approach has improved the health-seeking behavior of sex workers by offering specialized services, preventive materials, and essential health information (Bernier, 2021).

Perception or level of happiness was measured using the SOEP (Socioeconomic Panel) instrument. Respondents were asked to indicate how often or rarely they experienced certain feelings over the past four weeks. The feelings requested for completion were anger, worry, happiness, and sadness. Happiness perception was measured using a 5-point scale: very often, often, sometimes, rarely, and very rarely. The frequency distribution of happiness levels for general adolescents and adolescent sex workers is as follows: 24% of general adolescents reported feeling unhappy, and 28.6% reported feeling happy. Among adolescent sex workers, 29.4% reported feeling unhappy, and 20.5% reported feeling happy. It can be concluded that a higher proportion of adolescent sex workers felt unhappy compared to other groups. The chi-square test between happiness and adolescent status resulted a p-value of 0.045. Therefore, we concluded that there is a correlation between happiness and adolescent sex worker status.

Perception or trust was measured using several questions related to the respondents' trust in others, using a 5-point Likert scale: strongly agree, agree, neutral, disagree, and strongly disagree. The frequency distribution of trust perception for general adolescents and adolescent sex workers is as follows: 20% of general adolescents reported feeling distrustful of others, and 30% reported feeling trusting. Among adolescent sex workers, 32.7% reported feeling distrustful of others, and 17.2% reported feeling trusting. We concluded that a higher proportion of adolescent sex workers felt distrustful of others compared to other groups. The chi-square test between trust perception and adolescent status yielded a p-value of 0.001. Therefore, we concluded that there is a correlation between trust perception and adolescent sex worker status.

The study assessed the comfort perception of general adolescents and adolescent sex workers by examining how comfortable they felt in various aspects of their lives, including health, work, income, living conditions, leisure time, family life, and personal life. Comfort was measured on a scale from 1 to 10. The findings showed that 41% of general adolescents reported feeling uncomfortable with their conditions, while a higher proportion, 63%, of adolescent sex workers felt uncomfortable with their status. This discomfort was felt across various life aspects, including work, health, income, housing, leisure, family, and personal life.

The chi-square test revealed a significant correlation (p-value = 0.001) between comfort perception and adolescent status, indicating that adolescent sex workers experience more discomfort compared to their general peers. The discomfort among adolescent sex workers was most pronounced in their work and family life. Economic factors were cited as the primary reason for choosing sex work, with many adolescent sex workers stating that they would stop once their financial situation improved. It highlights the profound impact of economic challenges on their well-being and decisions regarding work and life choices.

Sex workers face numerous challenges in their profession, including violence, legal issues, relationship difficulties, and health problems. Analysis of in-depth interviews with informants revealed that sex workers experience relatively high levels of mental health issues. However, despite these challenges, most have never sought psychological counseling. Some informants reported not considering it necessary, while others cited the high cost of counseling services as a barrier. In addition to mental health struggles, several informants shared experiences of unplanned pregnancies. To prevent such pregnancies, they reported using various contraceptive methods, including emergency contraceptive pills, birth control pills, condoms, and other forms of contraception. This highlights both the physical and emotional burdens that sex workers face, as well as the limited access to affordable psychological and health services.

Regarding healthcare needs, informants stated that they required services, such as general health check-ups, STI tests, VCT (Voluntary Counseling and Testing), Pap smears, and pregnancy tests. They expressed that these services are essential for sex workers. Although informants highlighted various healthcare needs, they also acknowledged their lack of motivation to access these services, whether general healthcare, reproductive health services, psychological counseling, or others. Concerning the ideal support model for adolescent sex workers, informants recommended the following key points: 1) Organizing educational and gender-based online violence (GBOV) mitigation activities for adolescent sex workers, 2) Developing digital services to enhance access to reproductive health information and services, 3) Implementing reproductive health Information, Education, and Communication (IEC) activities involving Peer Educators, integrated with both static and mobile healthcare services, 4) Ensuring that every healthcare facility can provide youth-friendly services, particularly in offering reproductive health services without stigma or discrimination., 5) Engaging sex workers as agents of change for preventing STI transmission, especially HIV/AIDS.

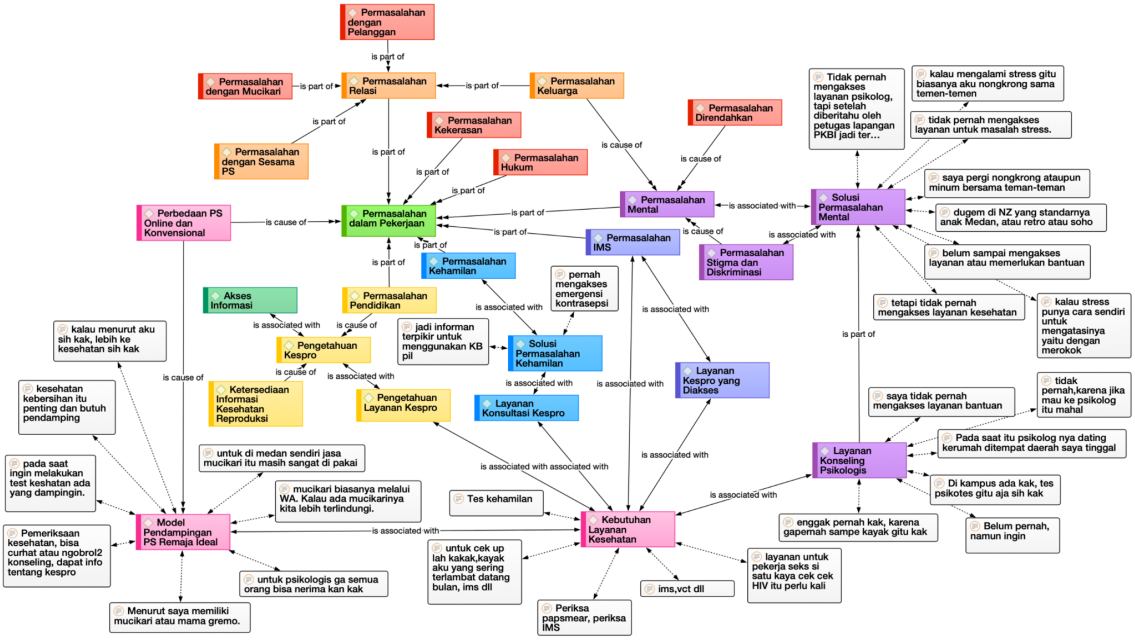

Figure 2. Problems and the Ideal Model of Mentoring Adolescents Sex Workers (qualitative analysis in Bahasa).

CONCLUSION

There has been a shift in prostitution patterns among adolescents, moving from conventional prostitution (street-based) to online prostitution through digital platforms. The opportunities for adolescents to become online sex workers are higher due to the variety of platforms and services offered through social media. Economic factors drive 81.7% of adolescents to become sex workers. There are differences in perceptions between general adolescents about the problems faced by adolescent sex workers and the actual issues experienced by them Findings include 80% of adolescent sex workers have low reproductive health knowledge, 23% have experienced STIs, 16% have faced unintended pregnancies, 7% have undergone abortions.

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Regulation and Warning Determination with Food Labelling in Controlling Consumption Patterns

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Abstract

An unhealthy lifestyle can increase people's risk of developing non-communicable diseases. Obesity, Hypertension, and Diabetes Mellitus are metabolic disorders suffered by people who at the end of this decade attack younger age groups. So, it is important to immediately get handling from the government. For this reason, the government needs to realize policies in the form of stipulating regulations in controlling the consumption of unhealthy products through effective methods. The purpose of the study is to review the effectiveness of regulations and warnings with food labeling in controlling consumption patterns. The systematic review approach of literature review with PRISMA searches for articles in three databases: PubMed, Scopus, and ScienceDirect. Ten articles were selected through several stages of screening and underwent quality assessment. According to the findings of the study, the establishment of government/stakeholder regulations in related sectors and warnings with food labeling with increased food literacy can increase the effectiveness of controlling the consumption of unhealthy products sustainably. Food labeling needs to emphasize information related to healthy or unhealthy products to consume.

Introduction

Based on the results of a survey by the Central Statistics Agency (BPS) related to the number of deaths based on the cause from January 1, 2017, to 2020/2022, the overall number of deaths reached 8.07 million cases, of which the most common causes came non-contagious disease, with 7.03 million cases. Non-communicable diseases are the world's largest cause of death according to the WHO. Non-communicable diseases, such as coronary heart disease, diabetes mellitus, cancer, and substance dependence, cause far greater mortality than infectious diseases and are one of the biggest problems in the field of public health and welfare in this day and age (WHO, 2018). The main risk factors that can cause non-communicable diseases are unhealthy lifestyles, Excessive tobacco consumption, unhealthy diet, drinking excess alcohol, lack of physical activity, as well as air pollution, and eating foods high in sugar, salt, and artificial preservatives. In addition, these risk factors can cause metabolic disorders such as hypertension, overweight and obesity, uncontrolled blood sugar levels, and Hyperlipidemia. Non-modifiable risk factors are genetics, age, gender, race, and ethnicity (Wahidin *et al.,* 2023).

The morbidity and mortality of non-communicable diseases in the community can be prevented. This is because the risk factors for non-communicable diseases are generally related to lifestyles or behaviors that can be controlled or intervened. Although there are indeed several risk factors that cannot be controlled, such as genetic factors which are risk factors type 1 diabetes mellitus and some types of cancer. The four types of non-communicable diseases that cause the most deaths are cardiovascular disease, cancer, diabetes mellitus, and chronic respiratory diseases. Non-communicable diseases cause 74% of deaths in the world, where each year it causes the deaths of about 41,000,000 people.

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Every 2 seconds, 1 person aged <70 years dies from a non-communicable disease, and 86% are in low- and middle-income countries. According to WHO data, 73% of deaths in Indonesia are caused by non-communicable diseases, namely +1,400,000 deaths/year. Details of non-communicable diseases that cause death include cardiovascular disease 25.6%, cancer 8.8%, chronic respiratory disease 4.4%, diabetes mellitus 4.4%, and other non-communicable diseases 29.8% (Ministry of Health, 2019).

To overcome non-communicable diseases in Indonesia, the Ministry of Health carries out P2PTM activities (guidelines for the management of non-communicable disease prevention and control programs), which consist of: 1) Increasing policy advocacy in favor of health programs and socialization of P2PTM, 2) Carrying out promotive, preventive, curative, rehabilitative, and palliative efforts comprehensively, especially through PROLANIS (chronic disease management program), 3) as a service program non-communicable disease health which includes counseling, screening, consultation, and efforts to prevent further complications, 4) Increasing the capacity of human resources, 5) Developing and strengthening surveillance systems, 6) Strengthening networks and partnerships through community empowerment (Ministry of Health, 2019). Food choices are influenced by the increasing availability of processed and packaged foods, increased eating out compared to eating at home, low nutritional literacy, and an inability to evaluate calorie and nutrient information that causes health problems. There have been many efforts that have been made by the government to reduce the number of morbidities and mortality due to non-communicable diseases but they have not been optimal. For this reason, the government/ stakeholders at the central, regional, school/ agency, and government in the smallest units of villages/sub-districts need to increase leverage and optimize existing programs by establishing them into binding regulations or policies for those related to the production and circulation ecosystem of food and beverage products that are traded freely in the community.

Method

This research was conducted using a systematic review method. This review follows the item reporting guidelines for a systematic review from PRISMA 2020 (Haddaway *et al.*, 2022). The authors searched for articles published in various English-language databases (PMC, PubMed, Scopus, and ScienceDirect) and published between 2015-2023. The article search is carried out by the author using keywords that have been compiled and discussed before. The keywords used in all databases are: "food labeling", "food labeling and law", "food labeling and jurisprudence", "food labeling and literacy", and "food labeling and food purchasing". Inclusion criteria are population/community-based research; prospective, cross-sectional, cohort, and experimental studies; involving community participation. The exclusion criteria are research results from the systematic literature review; not reporting relevant findings or results; hospital-based research; and the data used in the same population as the included study. All articles are listed and classified by author, year of publication, research location, research design, sampling technique, sample size, and results.

Results and Discussion

The search strategy resulted in 4173 articles: 1218 from PMC (Pubmed Central), 2176 from Scopus, and 779 from ScienceDirect. After eliminating duplicates, 114 articles were obtained. In addition, 114 abstracts were filtered using the following criteria: type of variable, type of research, and completeness of the article (full text), and 24 articles were obtained in English. A total of 6 articles were issued because they were not articles related to food labeling and law/policy, 6 articles with unclear results, and 2 articles in the clinical field. There were 10 articles obtained from the screening results that could be analyzed according to the inclusion criteria. Figure 1 shows the PRISMA flowchart along with its exclusion criteria and details.

The results of a review of 4173 journal

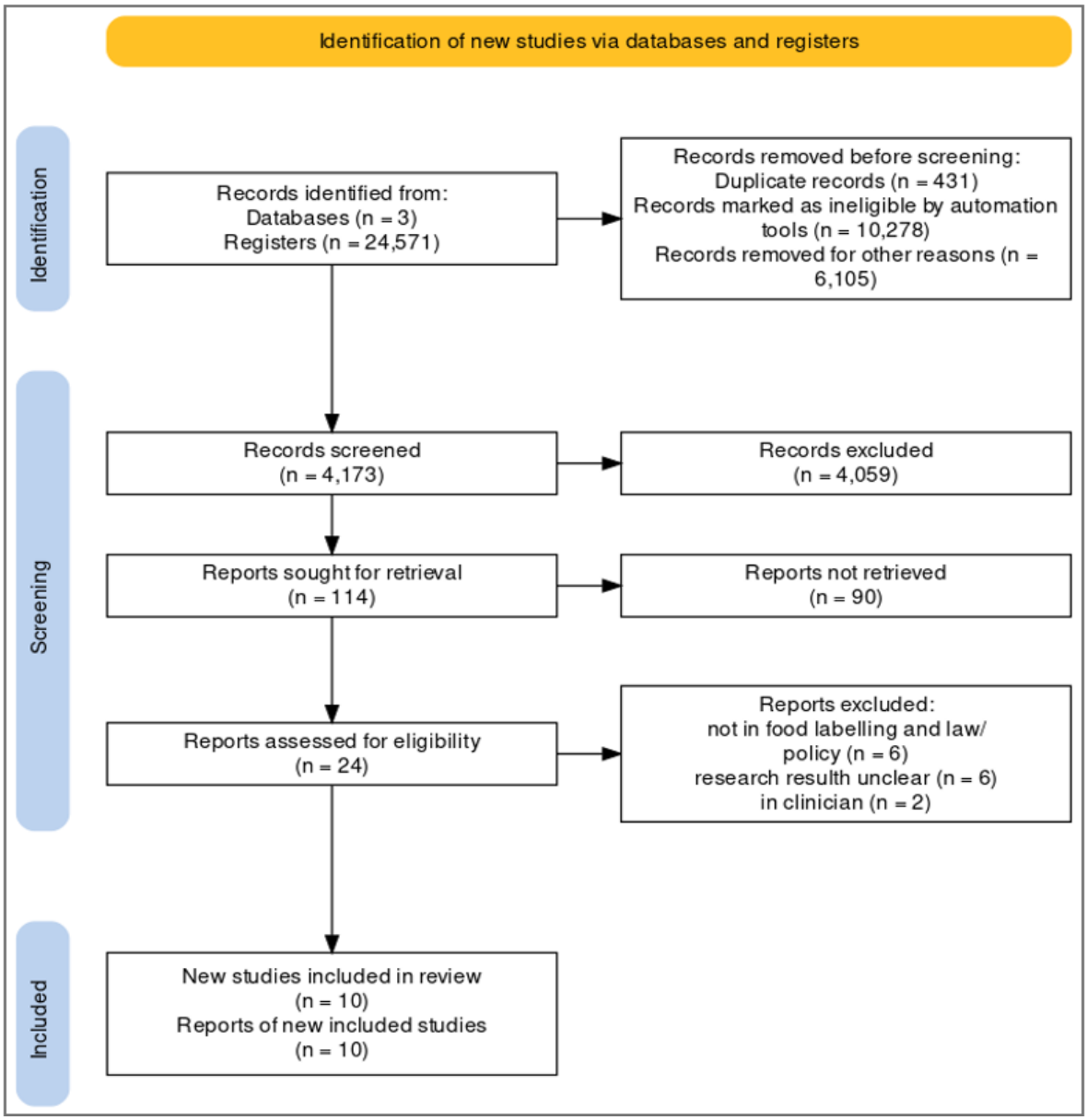

Figure 1. PRISMA Research Flowchart

Table 1. Characteristics of Eligible Articles

It	Author, Year, and Title	Country, Journal, Quartile	Sample method and criteria	Result
1	Taillie, *et al*., 2021 An Evaluation of Chile's Law of Food Labeling and Advertising on Sugar-sweetened Beverage purchases from 2015 to 2017: A before-and-after study (Taillie *et al.*, 2020)	Chile, Plos Medicine, Q1	Observational study, Monthly survey on households living in urban areas (n = 2,383) from January 1, 2015, to December 31, 2017.	37% of heads of households were poorly educated, 40% were secondary, and 23% were highly educated, and the sample became more educated during the study period. The volume of high-beverage purchases decreased by 22.8 mL/capita/day, post-regulation (95% [CI] -22.9 to -22.7; $p < 0.001$). High- and low-educated households showed a similar absolute decrease in high-alcohol purchases (about 27 mL/capita/day; $p < 0.001$). Calories from the purchase of high-end beverages decreased by 11.9 kcal/capita/day (95% CI -12.0 to -11.9; $p < 0.001$). Calories purchased from beverages classified as "not high" increased by 5.7 kcal/capita/day (95% CI 5.7-5.7; $p < 0.001$). Calories from total beverage purchases decreased by 7.4 kcal/capita/day (95% CI -7.4 to -7.3; $p < 0.001$).
2	Felipetto, *et al*., 2022 Brazilian Consumers' Perception Towards Food Labeling Models Accompanying Self-Service Foods (Felipetto *et al.*, 2022)	Brazil, Foods, Q1	This qualitative and quantitative assessment was performed with potential consumers at food services. Four food labeling formats, traditional, simplified, traffic-light, and warning, were proposed to evaluate three types of sandwiches: simple, chicken, and hamburger. Data were collected via an online survey from April to May 2020. The study included 413 subjects.	The respondents preferred the traffic light format, but there was a good understanding and acceptance of all four models. The nutrition labeling model of traffic lights and warnings, which indicate health warnings, led to a reduction in the choice of Simple Sandwich and Hamburger. Most respondents (96.1%, n = 397) agreed that it is necessary to supplement the information on food labels with the ingredients and the number of calories per serving. It is important to have laws that govern the nutritional content information of foods. Consumer choice increases with the increase in information placed on products.

It	Author, Year, and Title	Country, Journal, Quartile	Sample method and criteria	Result
3	Todd, *et al.*, 2022 Healthy or Not Healthy? A Mixed-Methods Approach to Evaluate Front-of-Pack Nutrition Labels as a Tool to Guide Consumers (Todd *et al.*, 2022)	South Africa, Nutrition, Q1	The sequential mix method design of the exploration uses qualitative interviews (n = 49) to gain insight into the labeling challenges and select FOP nutrition labels for consumer testing. Consumers (n = 1261) randomly rated two out of six possible FOP nutrition labels relative to 'labelless' controls in one of 12 online surveys, applied to fictitious cereal products. A mixed model variance analysis was used to compare differences in health ratings for different FOP nutrition labels.	The FOP that is easy for the public to understand is the one that helps consumers identify unhealthy products, the most prominent measure of effect for health warnings ($p < 0.01$), and low health star ratings ($p < 0.01$). The findings of this study not only clarify whether FOP nutrition labeling formats used in other regions such as Europe, South America, and Australia can be useful in the context of South Africa, but they can assist policymakers and decision-makers in selecting effective FOP labels.
4	Zhang, *et al.*, 2020 Red for "Stop": "Traffic-Light" Nutrition Labels Decrease Unhealthy Food Choices by Increasing Activity and Connectivity in the Frontal Lobe (Zhang *et al.*, 2020)	China, Nutrients, Q1	Using functional magnetic resonance imaging to assess the mechanisms by which traffic lights and daily count labels of guidelines influence food-related decision-making. Forty-four female dieters (age, mean = 20.0, standard deviation = 1.45 years) were recruited to participate in the food choice task; Healthy or unhealthy food options were presented with color-coded traffic light labels or pure numerical daily count-of-day guideline labels, and participants were asked to express their preferences.	Prominent red traffic light labels have the potential to reduce unhealthy food-related decision-making and activate superior medial frontal gyrus and additional motor areas, which are involved in the execution of motor response and inhibition, compared to daily number-of-day labels. Labels inspired by traffic lights may be a more effective means of public policy intervention than numerical labels that convey daily count guidelines

It	Author, Year, and Title	Country, Journal, Quartile	Sample method and criteria	Result
5	Seward, *et al.*, 2018 Student experiences with traffic-light labels at college cafeterias: a mixed methods study (Seward *et al.*, 2018)	USA, Obesity Science & Practice, Q2	Cross-sectional, mixed-methods study. Setting: One northeastern US college A total of 1,294 survey respondents; 57 focus group participants Interventions Seven-week traffic-light labeling (green = 'nutrient-rich', yellow = 'less nutrient-rich', red = 'more nutrient-rich choice in green or yellow') intervention at two college cafeterias.	60% found TLL useful, and 57% used it several times a week. When asked if TLL increased the risk of developing an eating disorder, 16% of participants said they did and 47% said TLL could worsen an existing eating disorder. In the focus group, some students thought 'the red color looks thunderous', but most agreed 'the more nutrition information available, the better'. Students generally support TLL.
6	Sato, *et al.*, 2021 Consumers' opinions on warning labels on food packages: A qualitative study in Brazil (de Morais Sato *et al.*, 2018)	Brazil, Plos One, Q1	The qualitative study, 12 focus groups among a diverse sample of adult consumers, to broadly assess: (1) the current use and perception of food labels, and (2) opinions on the application of pre-packaged warning labels to guide food purchases. The data were analyzed by triangulation. The code is divided into six main themes: (1) Reasons for using food labels; (2) Barriers to using food labels; (3) Requirements for new labels; (4) The perceived influence on consumption behavior; (5) The influence felt on children's behavior; and (6) Perception of food manufacturers who use warning labels.	Participants use food labels to check nutrition and ingredient information, but the format of these labels and the technical tents displayed often make the information inaccessible, especially for those with low socioeconomic status. Most of the participants supported the display of the warning label on the front of the packaging on the product and found it useful to inform the purchase. Women believe that they and their children will reduce food consumption with warning labels on the front of the packaging, while men report more polarity in their intentions. The potential of warning labels on the front of the packaging could support healthier behaviors in consumers and their children

It	Author, Year, and Title	Country, Journal, Quartile	Sample method and criteria	Result
7	Reyes, *et al.*, 2020 In June 2016, the first phase of the Chilean Food Labelling and Advertising Law that mandated front-of-package warning labels and marketing restrictions for unhealthy foods and beverages was implemented. We assess food and beverage reformulation after this initial implementation (Reyes *et al.*, 2020)	Chile, Plos Medicine, Q1	Cross Sectional Survey. The dataset with nutrition information from 2015 to 2017 was developed to collect information in 2 time periods: pre-implementation (T0: January-February 2015 or 2016; n = 4,055) and post-implementation (T1: January-February 2017; n = 3,025). The quartile of energy and nutrients of concern (total sugar, saturated fat, and sodium, per 100 g / 100 mL) and the proportion of products with energy and nutrients exceeding the legal limit (i.e., "high" products) compared to before and after the implementation of the law in cross-sectional samples of products with sales of >1% of their specific food or beverage group.	A significant decrease (T0 versus T1) in the proportion of products with "high" (from 51% [95% (CI) 49-52] to 44% [95% CI 42-45]), mostly in the food and beverage group where the regulatory limit is below the 75th percentile of nutrient or energy distribution. The most frequent reductions were in the proportion of "high" sugar products (in beverages, milk and milk-based beverages, breakfast cereals, sweet baked products, and sweet and savory spreads; from 80% [95% CI 73-86] to 60% [95% CI 51-69]) and in "high-sodium" products (in savory spreads, cheeses, ready-to-eat foods, soups, and sausages; from 74% [95% CI 69-78] to 27% [95% CI 20-35]). In contrast, the proportion of "high" products of saturated fat only decreased in savory spreads ($p < 0.01$), and the proportion of "high" energy products decreased significantly between breakfast cereals and savory spreads (both $p < 0.01$).

It	Author, Year, and Title	Country, Journal, Quartile	Sample method and criteria	Result
8	Doustmohammadian, et al., 2022 The association and mediation role of Food and Nutrition Literacy (FNLIT) with eating behaviors, academic achievement and overweight in 10–12 years old students: a structural equation modeling (Doust mohammadian et al., 2022b)	Tehran, Iran, Nutrition Journal, Q1	This study was conducted through two stages: 1) To propose a conceptual model of the relationship between FNLIT and determinants and its results, based on existing evidence and previous models, and 2) To test the proposed FNLIT model through a cross-sectional study on 803 elementary school students (419 males and 384 females, from 34 public elementary schools and 10 private elementary schools), aged 10–12 years using structural equation modeling. Demographic, socioeconomic, and household food security characteristics were collected by interviewing students and their mothers/caregivers using questionnaires. FNLIT is measured by self-managed, locally designed, and validated questionnaires.	The fit index showed sufficient data agreement with the hypothesis model ($\chi 2/df = 2.03$, $p < 0.001$, goodness of fit index (GFI) = 0.90, adjusted goodness of fit index (AGFI) = 0.88, comparative fit index (CFI) = 0.91, incremental fit index (IFI) = 0.91, root mean square error of approximation (RMSEA) = 0.04, standard root mean residual (SRMR) = 0.06). SES is directly and positively related to FNLIT and its subscale in students. FNLIT scores have a direct positive (non-mediating) relationship with healthy eating behavior and academic achievement. This pattern is very inverted in unhealthy eating behavior. There is a full mediating relationship between FNLIT and overweight/obesity through healthy eating behaviors. SES predicts academic performance in part through the mediating effect of Food Label Literacy (FLL). The findings also reveal the full mediating role of Food Choice Literacy (FCL) in the relationship between demographic factors and healthy eating behaviors.

It	Author, Year, and Title	Country, Journal, Quartile	Sample method and criteria	Result
9	Scarpelli, *et al*., 2020 Labeling and Advertising Law in Chile (Scarpelli *et al.*, 2020)	Chile, Nutrients, Q1	We analyzed the food nutrition labeling declarations of 70% of the most consumed packaged foods in Chile. Data collection was carried out in 2013 and 2019 in Santiago. Images of all sides of the package were taken from 476 products, classified into 16 food groups.	All food groups experienced changes in the ENC declaration during the study period. Total sugar content showed the highest decrease (-15.0%; $p = 0.001$). Milk, confitures, and similar sugary drinks had the greatest reduction in energy and total sugar levels ($p < 0.01$). Energy, total sugar, and sodium in the "high in" packaging of the simulation were significantly reduced in milk, sugary drinks, flour-based foods, confitures and the like, fish and seafood, fats and oils, spices, spices and sauces and sugars ($p < 0.05$). The company reformulated the product to adapt to the new regulations.
10	Mediano, *et al*., 2023 Framing a New Nutrition Policy: Changes on Key Stakeholder's Discourses Throughout the Implementation of the Chilean Food Labelling Law (Mediano *et al.*, 2023)	Latin America, International Journal of Environmental Research and Public Health, Q2	analysis of the content of media coverage of food regulations in five major periods from 2007, when the food bill was first introduced in Congress, to 2018, when the second phase of the law was implemented (N = 1295)	Most of the legal coverage is through the elite press. Half of the sources come from the food industry (26.7%) and the government (26.2%), while other stakeholders are less prevalent. The main food industry framework used during the discussion of the legislation was "economic threats" (41.9%), the prevalence of which decreased in the post-implementation period (13%, $p < 0.01$). No other relevant stakeholders changed their framing. Public health communication aspects can be improved to advance food environment policies.

articles showed that in 10 articles from 7 countries, the results identified that warnings with food labeling decreased consumers' energy intake, total fat, reduced sugar and salt consumption, and other unhealthy dietary choices, and increased consumption of foods with good nutrition. Evaluate the response of the industry in labeling the reduced content of packaged food produced. Significant increase in results in the use of Traffic Light Labels and accompanied by the Establishment of Laws and Regulations that govern them (Seward *et al.,* 2018; Kanter *et al.*, 2019; Scarpelli *et al.*, 2020; Taillie *et al.*, 2021; Mediano *et al.*, 2023). These results are also in line with a review of 60 intervention studies, food labeling reduces consumers' dietary intake of selected nutrients and influences industry practices to reduce the content of sodium products and artificial trans fats (Shangguan *et al.*, 2020).

The purchase of high-end beverages decreased significantly after the implementation of Chile's Food Labeling and Advertising Law; These reductions are greater than those observed from stand-alone policies, including the sugary drinks tax previously implemented in Latin America. Future research should evaluate the impact of Chilean policies on high food purchases, food intake, and long-term purchasing changes (Taillie *et al.*, 2021). Our results show that, after the initial implementation of the Chilean Law on Food Labeling and Advertising, there was a significant decrease in the amount of sugar and sodium in some groups of packaged foods and beverages. Further studies should clarify how food reformulation will impact the food quality of the population (Taillie *et al.*, 2020).

The increase in obesity over the decades in a country has led to the establishment of several policies aimed at improving diets, which are thought to play an important role in obesity (Gustafson & Prate, 2019). Many of these policies seek to influence individual behavior. Packaging front labels that provide consumers with important and easy-to-interpret information have shown promise in helping people identify and choose healthier foods. However, economic behavior can offer an opportunity to increase the effectiveness of labels. Label adjustments can be aimed at high-risk communities, including minority and rural populations, which have higher rates of diet-related illnesses than the overall population. Common labels are quite effective in encouraging healthier choices, but the level of understanding depends on the level of knowledge of the meaning of the label (Jo & Jung, 2019). Labels tailored to local communities will be more effective, resulting in a noticeable increase in healthy product purchases, but the implementation is more complex and requires a commitment to stakeholders such as the industry and its ecosystem (Mediano *et al.*, 2023). Adapting healthy food labeling systems using insights from economic behavior can improve program effectiveness (Gustafson & Prate, 2019).

Chile has implemented several strategies to reduce the burden of obesity and chronic diseases with the establishment of the Food Labeling and Advertising Law. The Food Labeling and Advertising Act (Law 20.606) requires a "high" warning label on the front of the package when energy and nutrients of concern (ENC) such as total sugar, saturated fat, and sodium exceed the set limit. The impact of the law is that the total sugar content shows the highest decrease (-15.0%; $p = 0.001$). Milk, confitures, and similar sugary drinks had the greatest reduction in energy and total sugar levels ($p < 0.01$). Energy, total sugar, and sodium of the simulated "high" packaging were significantly reduced in milk, sugary drinks, flour-based foods, confitures and the like, fish and seafood, fats and oils, spices, spices and sauces, and sugars ($p < 0.05$). The company reformulated the product to adapt to the new regulations (Scarpelli *et al.*, 2020). Nutrition labels *Front-of-pack* (FOP) as a rapid assessment tool is being improved to help consumers identify unhealthy products, add the most prominent effect measures for health alerts, and low health star ratings for unhealthy foods. The findings of this study not only clarify whether the FOP nutrition labeling format used is effective but can also assist policymakers and decision-makers in selecting effective FOP labels (Todd *et al.*, 2022; Pérez-Escamilla *et al.*, 2021).

Front-packed food labeling (FoPFL) is increasingly being advocated as an

effective intervention to facilitate behavioral change toward healthier food purchases and consumption, especially concerning products with added sugars. This study assesses the potential caries-related impacts of FoPFL. Interesting results are lesions can be caries prevented, dental care costs avoided, reduced productivity loss, and disability-adjusted life years (DALYs) avoided. Maintenance cost savings of €175.67 million, and productivity losses reduced considerably. Sensitivity analysis showed that the magnitude of the effect was highly dependent on the consumer response to FoPFL. Our findings suggest that FoPFL has the potential to substantially reduce caries, caries-related morbidity, and economic burden. In addition, our research allows for the inclusion of oral health estimates in overall health estimates for sugar-related food labeling. Before prioritizing strategies to address sugar consumption, decision-makers should carefully consider all relevant context-specific factors and implementation costs (Jevdjevic *et al.*, 2021). The usefulness of food labels should be used to check the nutritional content and ingredient information, but the format of these labels and the technicalities of the content displayed often make the information inaccessible (the text is small, the information is not specific, not easy to understand, and placed in less visible parts), especially for those with low socioeconomic status. Women believe that they and their children will reduce food consumption with warning labels on the front of the packaging. For men and their children, a warning label on the front of the package will result in a complete cessation of food intake or continued consumption without any change in quantity. The results highlight the potential of warning labels on the front of the package to support healthier behaviors in consumers and their children (De Morais Sato *et al.*, 2018).

Food labels can be used as a source of information that adds knowledge or literacy for all groups of people. Food and nutrition literacy and its dimensions and components among children consist of two main domains, including cognitive domains and skills. The cognitive domain consists of food and nutrition-related knowledge including four subcategories of "nutrition knowledge", "lifestyle knowledge", "food safety knowledge", and "knowledge about food and its preparation") as well as "food and nutrition understanding". The skill domain consists of three dimensions: "functional", "interactive", and "critical" food and nutrition literacy. The framework developed highlights the importance of the integrated implementation of all dimensions of food and nutrition literacy among these population groups. It can assist policymakers and curriculum developers in assessing educational curricula and developing effective strategies for teaching and learning to improve students' food and nutrition literacy (Doustmohammadian *et al.*, 2022a, 2022b).

Nutrition labels are an important tool to guide consumers about the quality and quantity of food nutrient constituents. Nutrition labels allow consumers to make purchasing decisions based on the information provided (Zafar *et al.*, 2022). Among the food label formats explored, Traffic Light is the most accepted and understood by the public. With Traffic Light Labels, Consumers are engaged in managing their health and seeking healthier food choices. The findings of this study are that the existence of food labels in food services is a consumer demand. The use of these traffic lights for food/industrial service owners and managers can be a great competitive opportunity. Standardization of food labeling requires greater formalization and control of the process so that the application of food labels can be a boon for both producers and consumers. On the other hand, efforts are needed to make consumers aware of the importance of reading labels which are greatly influenced by individual factors (Shahrabani, 2021; Singh *et al.*, 2021; Silva *et al.*, 2022). Educational actions can help make better choices based on an adequate understanding of the information attached to the product (Amuta-Jimenez *et al.*, 2019). If we add up all the aspects mentioned, the positive social and economic impact may be greater than the initial investment. The health of the population is improved by better food choices and the resulting health benefits. The government can reduce investment in hospitalization and other relief measures.

Based on the review of scientific articles, several alternative policies that can be applied

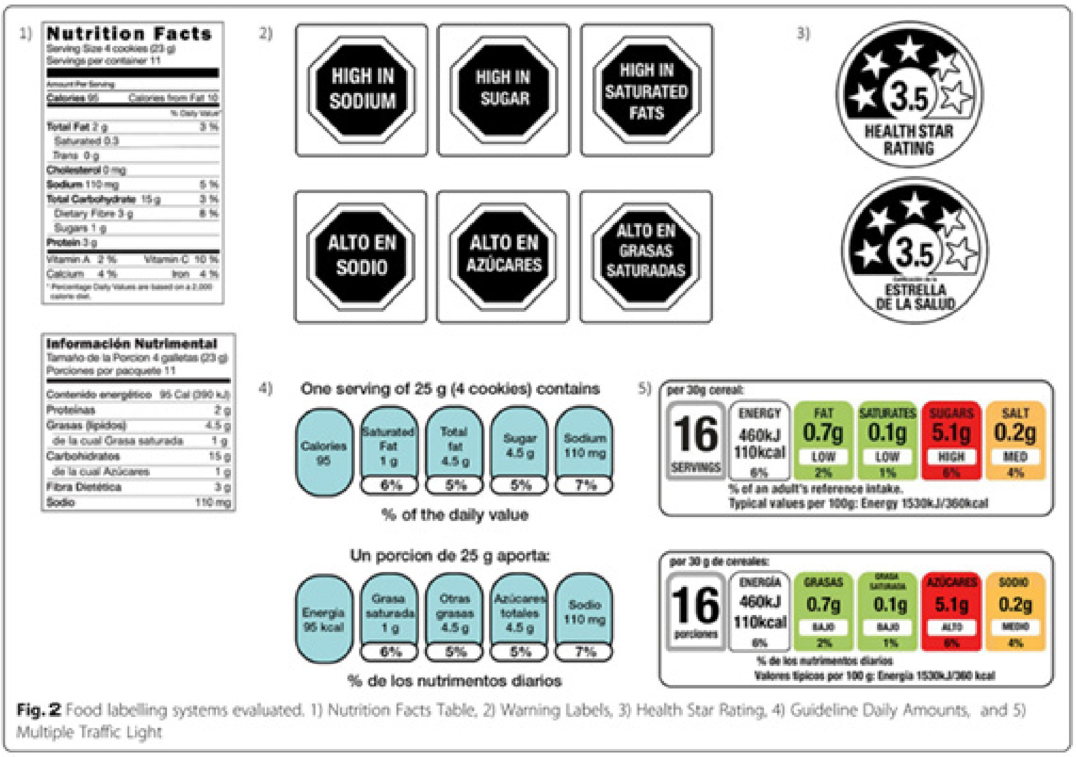

Fig. 2 Food labelling systems evaluated. 1) Nutrition Facts Table, 2) Warning Labels, 3) Health Star Rating, 4) Guideline Daily Amounts, and 5) Multiple Traffic Light

Figure 2. Food Label Nutrition for Literacy Nutrition (Nieto *et al.*, 2019)the most obese countries in the world. Methods: Adults from online consumer panels in the US (Whites n = 2959; Latinos n = 667

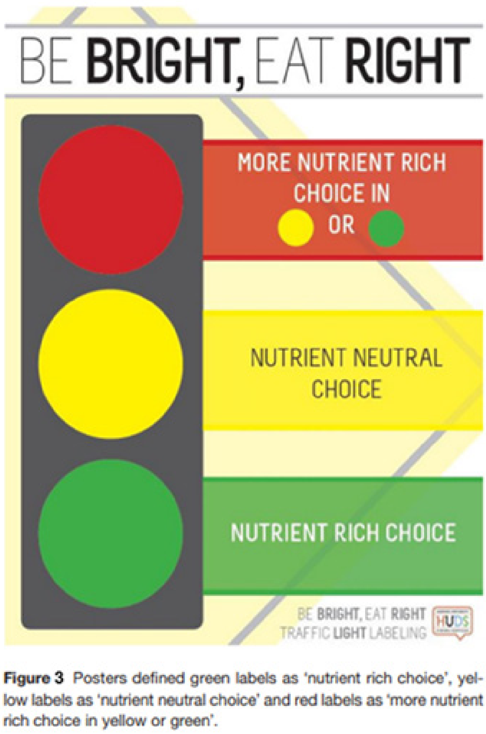

Figure 3 Posters defined green labels as 'nutrient rich choice', yellow labels as 'nutrient neutral choice' and red labels as 'more nutrient rich choice in yellow or green'.

Figure 3. Example of Traffic Light Label (Seward *et al.,* 2018)

by the government or stakeholders in the Control of Unhealthy Consumption Patterns are formulated: 1) improving healthy living behaviors as the basis for comprehensive and integrated disease control, 2) improving public health protection against the circulation of substances harmful to public health; which can be done by monitoring businesses and industries of food/food and related substances, 3) Increasing literacy and information technology as an educational effort to the community; Holding regular and sustainable training both in cadres, communities, stakeholders, cross-sectors and health workers in-depth and comprehensively. Developing the right technology to monitor health, control lifestyle, and increase physical activity. Incorporating the Health curriculum into the world of Education/schools or integrating it with the school/UKS health business program, 4) strengthening cross-sector/cross-program cooperation; building partnerships with the non-health sector for the prevention and control of non-communicable diseases, such as involving food and beverage manufacturing companies, religious sectors, social sectors, women's empowerment and child protection, the education sector, and technology and information development sections to strengthen innovations and findings in reducing cases of non-communicable diseases, 5) Establishing policies related to threshold values for ingredients contained in food and Provide a warning label as a marker whether the food is good, healthy or unhealthy if consumed. Providing the best and clear information so that the food and beverage products traded are not harmful to consumers or the public and so that the public gets the optimal benefits from the products purchased (Nieto *et al.*, 2019). 6) Improve school programs by providing food label information to make healthier food choices, to improve students' knowledge, attitudes, and practices in healthy eating patterns for healthy living, healthy canteen programs, and the implementation of the Nutrition Health Education curriculum in schools (Hoteit *et al.*, 2022).

Conclusion

Prevention and control of non-communicable diseases must be carried out by implementing a healthy lifestyle from an early age, it needs to be carried out by all parties, both the central government to the smallest unit at the village or sub-district level and starting from habits in the family. To improve the implementation of non-communicable disease prevention and control activities related to nutrition and maintenance so that activities can be sustainable, the government needs to establish regulations or policies related to the restriction of substances that can be produced in food and beverage products traded on the market and provide the clearest warning labels so that the public can consider whether the product is healthy or unhealthy for consumed related to calorie, fat, sugar, and fiber labels. Within the scope of schools, it is necessary to implement the Nutrition Health Education curriculum in schools as a health investment for the nation's generation.

Acknowledgments

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Influence of Selenium Supplementation on Oxidative Stress and Inflammatory Response in High-Intensity Exercise

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Abstract

Exhaustive exercise could increase oxygen consumption 10 to 20 times folds which can then increase oxidative stress which is characterized by an increase in Reactive Oxygen Species (ROS). Increased oxidative stress (ROS) during exercise could cause cell damage. Selenium is a trace element that is believed to have antioxidant and anti-inflammatory activity. Objectives: This study aimed to determine the effectiveness of a 28-day supplementation period on plasma MDA and HMGB1 levels after high-intensity exercise activities. Methods: This study was experimental, with a pretest-posttest control group design approach. A total of 28 Sports Science Department students at Universitas Negeri Surabaya who met the inclusion and exclusion criteria participated in the study. Through simple random sampling, participation was divided into 2 groups, namely the selenium group (SG) and the placebo (PL) group. Selenium supplements for SG were 200 mcg/day, and PL was 100mg corn starch capsules, both groups consumed in 28 days. Participants performed bench-stepping by Newham with 10 sets x 10 repetitions, with 1-minute intervals. Plasma MDA and HMGB1 measurements were carried out immediately after, 24 hours after, and 48 hours after bench-stepping. Data on changes in plasma levels of MDA and HMGB1 were tested using repeated measures ANOVA with a significance level of $P<0.05$. Result: there was a significant difference in the plasma MDA and HMGB1 between each group with the significance value of MDA that was $p = 0.000$ and the significance value of HMGB1 that was $p = 0.000$. Conclusion: Selenium supplementation for 28 days reduces the increase in oxidative stress (MDA) and increase in HMGB1 after high-intensity exercise activities.

Introduction

The second goal of the Sustainable Development Goals (SDGs) is to eliminate all forms of hunger by 2030 and achieve food security, aiming to reduce stunting by 40% by 2025 (United Nations, 2023). Stunting remains a significant nutritional health issue globally, particularly in developing countries. In 2020, the prevalence of stunting in Indonesia was alarmingly high at 149.2 million cases, surpassing other nutritional issues such as wasting (45.4 million) and overweight (38.9 million) (WHO, 2021). By 2022, the prevalence of stunting in Indonesia had decreased to 21.6%, yet it still exceeded the WHO standard of less than 20% (Miranda *et al*., 2023). Stunting is characterized by a failure to thrive due to chronic malnutrition during the first 1,000 days of life (de Onis & Branca, 2016). Children are considered stunted if their height-for-age Z-score (HAZ) is less than -2 standard deviations (SD), and severely stunted if the Z-score is less than -3 SD (Suratri *et al*., 2023). The impact of stunting on human resources

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is profound, affecting not only individual physical and cognitive development but also the country's economic potential (Soliman *et al*., 2021). Short-term effects include impaired physical growth and cognitive development, potentially leading to reduced intelligence, lower educational outcomes, and increased poverty (Annisa & Sulistyaningsih, 2022). Long-term consequences include a higher risk of chronic diseases such as heart disease, diabetes, obesity, and stroke (Soliman *et al*., 2021)

The multifaceted causes of stunting include economic disparities, inadequate education, infectious diseases, insufficient nutrition during the first 1,000 days of life, and poor health services and sanitation (Nafisah & Astuti, 2023; Utami & Laila, 2022). Additionally, maternal nutritional status during pregnancy and suboptimal maternal care contribute significantly to the problem (Hanifah & Astuti, 2023). Addressing stunting requires raising awareness among families, particularly women, about the importance of proper nutrition from a young age and during adolescence (Titaley *et al*., 2013). The first 1,000 days of life are critical for a child's growth and development, often referred to as the "window of opportunity" by the World Bank (Titaley *et al*., 2014). The Indonesian government has implemented a nutrition program to protect pregnant women from deficiencies in iron, folic acid, and protein, and to ensure adequate nutrition for children under two years old (Agustina *et al*., 2023). The government also has Presidential Regulation Number 72 of 2021 on the Acceleration of Stunting Reduction mandates and the National Population and Family Planning Board as a lead to implement this program, involving various sectors and creating provincial and local Stunting Reduction Acceleration Teams (TPPS) (Sari, 2023). Gunungkidul is a municipality within Yogyakarta province with a stunting prevalence of 16.4% in 2022, which is considered the highest prevalence among other municipalities in Yogyakarta province (Dinkes-Gunungkidul, 2023). To address this, the Indonesian Family Planning Board has initiated the establishment of *Kampung Keluarga Berkualitas* (Quality Family Village), aimed at improving human resource quality through integrated and convergent strategies. Given the persistently high prevalence of stunting in Gunungkidul and the establishment of Quality Family Villages, this study aimed to understand the implementation of stunting prevention programs and the optimization of the first 1,000 days of life in Gunungkidul.

Methods

This study employed a mixed methods approach with an embedded design (Shorten & Smith, 2017). The first phase of this research applied qualitative methods, with data collection and analysis adhering to standard qualitative research practices. Concurrently, quantitative data were also collected and analyzed, to augment and develop findings derived from the qualitative methods. The results were subsequently interpreted in an integrated manner. The qualitative component of the research adopted a single embedded case study approach, selected due to the singular nature of the case, which encompassed multiple units of analysis necessitating in-depth understanding. In the quantitative component, a one-group pre-test post-test approach was utilized. This method aimed to assess research activities by administering an initial test (pre-test) before delivering an intervention. Following the intervention, a final test (post-test) was conducted. The quantitative research aimed to determine the effect of video media on participants' knowledge regarding the optimization of the first 1,000 days of life in the context of stunting. By integrating these qualitative and quantitative approaches, the study provides a comprehensive analysis of the stunting reduction program and the critical period of the first 1,000 days of life.

This study was conducted in 4 villages within Gunungkidul Municipality, the population was 260 including 34 future parents, 73 women in pregnancy, 20 in the postnatal period, and 133 mothers of children under five. The qualitative phase used purposive sampling based on inclusion criteria set before, and data collection was conducted through semi-structured interviews. The qualitative sample size was 15, involving several groups of stakeholders, including 2 Family Planning Field Officers (PLKB), 2 midwives, 2 Secretaries

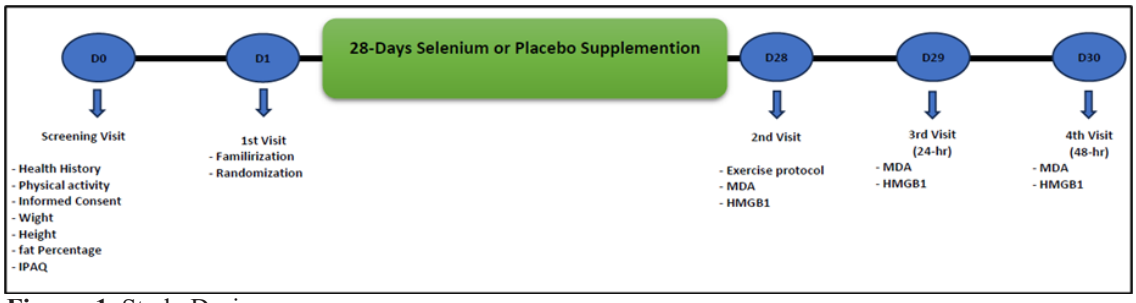

Figure 1. Study Design

of the Family Welfare Movement (PKK), 2 PKK members, 2 cadres, 2 future parents, and 3 women during their maternal period. Additionally, the number of quantitative sample sizes was 155, including prospective parents, pregnant women, and mothers of children under five years old. The sample size of the quantitative component was calculated by using the sample size for a population of 260 with a 95% confidence level, a 5% margin of error, and a population proportion of 0.5 (Creswell & Creswell, 2018).

The qualitative research instruments utilized semi-structured guidelines, employing individual interview techniques. Interview guideline was piloted before interviews were conducted to ensure that it worked properly and aligned with the research objectives. Additionally, an observation list form was also used for qualitative secondary data. As for the quantitative research, questionnaires were employed to assess respondents' knowledge regarding the impact of video media on mothers' understanding of the optimization of the first 1,000 days of life in stunting prevention. The questionnaire was adapted from previous research, which had previously undergone validity and reliability testing. The validity of the questionnaire was confirmed at 100%, and its reliability, measured using Cronbach's Alpha, was 0.809, surpassing the threshold of 0.50. Consequently, it can be concluded that the questions in the questionnaire are reliable.

All the participants in the qualitative and quantitative components were provided with participants' information sheets, informed consent forms, and information on the right to withdraw from this study. Only those who signed the informed consent form were eligible to participate in this study. In this study, qualitative data were collected through one-to-one semi-structured interviews, audio recorded, and supplemented by secondary data obtained from documentation studies. Interviews were conducted in a private room within the office of stakeholders, which was set previously to maintain privacy. These secondary data sources were utilized to support and enrich the existing research data. The recruitment of informants was facilitated by two midwives who work at Community Health Centres, acting as guides. For the quantitative component, primary data were collected through online questionnaires completed by the respondents. The online questionnaires used Google Forms and were distributed to the respondents by using the WhatsApp application with a guideline involving steps for fulfilling the form.

Qualitative research in this study employed analytical techniques, utilizing thematic analysis (Braun & Clarke, 2006). The steps in the data analysis process included data familiarisation, coding qualitative data, building themes, reviewing themes, defining and naming emerging themes, and reporting the analysis results, facilitated by the NVivo 12 software tool. For quantitative research, data analysis was conducted using the paired sample t-test. Before determining the appropriate test, tests for data normality and homogeneity were performed to assess whether the data were normally distributed. This process was supported by computer software using the SPSS 26 application.

This study adhered to rigorous qualitative research standards to ensure the validity and trustworthiness of the data (Johnson *et al.*, 2020), employing multiple strategies to maintain high data quality throughout the research process. Data validity in qualitative research is assessed through trustworthiness, which includes various aspects such as transferability,

TABLE 1. Participants Characteristic

Variables	SG (M ± SD)	PL (M ± SD)	*P-value* [a]
Age (years)	19,43 ± 1,09	19,29 ± 1,14	0,92
Height (cm)	169,64 ± 6,43	168,00 ± 4,62	0,26
Wight (kg)	60,36 ± 7,67	59,50 ± 6,07	0,39
BMI	20,88 ± 1,33	21,04 ± 1,34	0,91
Fat (%)	13,01 ± 1,24	12,63 ± 0,98	0,39

confirmability, dependability, and credibility. Transferability in this research was ensured by considering the characteristics of the research setting, the methods employed, the interview process, data analysis, and the documentation of findings. Discussions with the research team also contributed to strengthening the assessment of the research process. Confirmability was achieved by adhering to the research design, ensuring accurate language translation in interview transcripts, taking comprehensive notes during data collection, including direct quotes from informants to substantiate findings, and holding discussions with supervisors. Dependability was enhanced by incorporating direct quotes from informants and involving other researchers in reading the transcriptions, thus improving data quality. Repeated checks and transcript reviews by other researchers further ensured dependability, with NVivo 12 being used for data storage and organization. Data coding facilitated the analysis process. Credibility was established through the use of recording devices during interviews to ensure accurate recordings, verbatim transcription of interview data, and repeated checks to verify the accuracy of information provided by informants. Discussions with other research team members were conducted to assess data validity. Reflexivity was maintained by the researchers using reflexive notes to complement the data analyzed, as suggested by Morse (2015). This reflexive practice helped ensure comprehensive and accurate data analysis. The

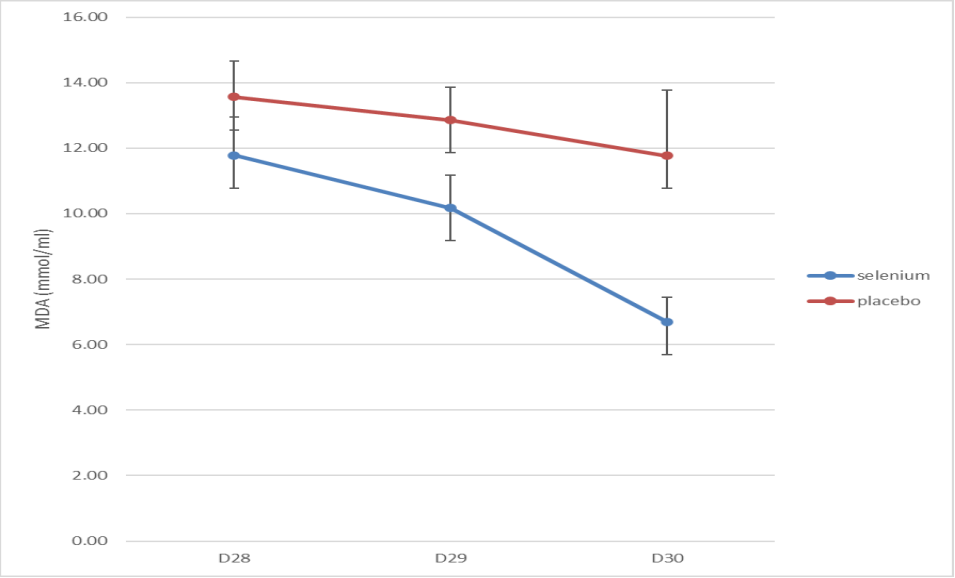

FIGURE 2. Comparison of Changes in MDA Variables at D28, D29, and D30 Post Single Bout High-Intensity Exercises in SG and PL.

research was conducted after obtaining approval from the Health Research Ethics Committee of Universitas Aisyiyah Yogyakarta on May 22, 2023, with reference number No.1644/ KEP-UNISA/V/2023.

Results and Discussion

This research was conducted in Gunungkidul Regency. Gunungkidul Regency is one of the regencies in the Special Region of Yogyakarta. The area of Gunungkidul Regency is 1,485.36 km2 or about 46.63% of the site of the Special Region of Yogyakarta. Gunungkidul Regency consists of 18 Kapanewon and 144 Villages. The data and mapping of this research theme describe the stunting reduction programs and optimization of 1,000 the first days of life in Gunungkidul. The data in this qualitative research were analyzed through thematic analysis based on meaningful information from participants. Within the analysis process, the researcher used *NVivo 12* software. There were 3 themes emerged from the interviews, namely *pre-existing knowledge* related to stunting, strategies in reducing stunting, and expectations pertaining to stunting reduction programs and optimization of 1,000 the first days of life.

Theme 1: *Pre-existing Knowledge* Related to Stunting

The theme of *pre-existing knowledge* illustrates the knowledge that participants previously knew about stunting, nutrition, health monitoring, and knowledge related to existing stunting programs in Quality Family Villages. There are 3 sub-theme findings associated with pre-existing knowledge such as limited knowledge related to stunting, nutrition, health monitoring, and stunting reduction programs.

Limitations of Knowledge Related to Stunting

The sub-theme of limited knowledge related to stunting describes that there is limited knowledge of participants related to stunting. This is illustrated through quotation submitted by informants [A1BM] and [A2BF], as follows:

"What is that, small child? I don't know, maybe the topic was discussed in ICS?" [A1BM]

"I don't know, I've never heard of stunting either" [A2BF]

Based on the results of the quotation above, it can be interpreted that some participants have limited knowledge of stunting. This is due to the limited information, lack of education, and their unpreparedness to become parents.

In addition, participants also mentioned that they knew about the stunting topic of the ICS in their residence. This was illustrated

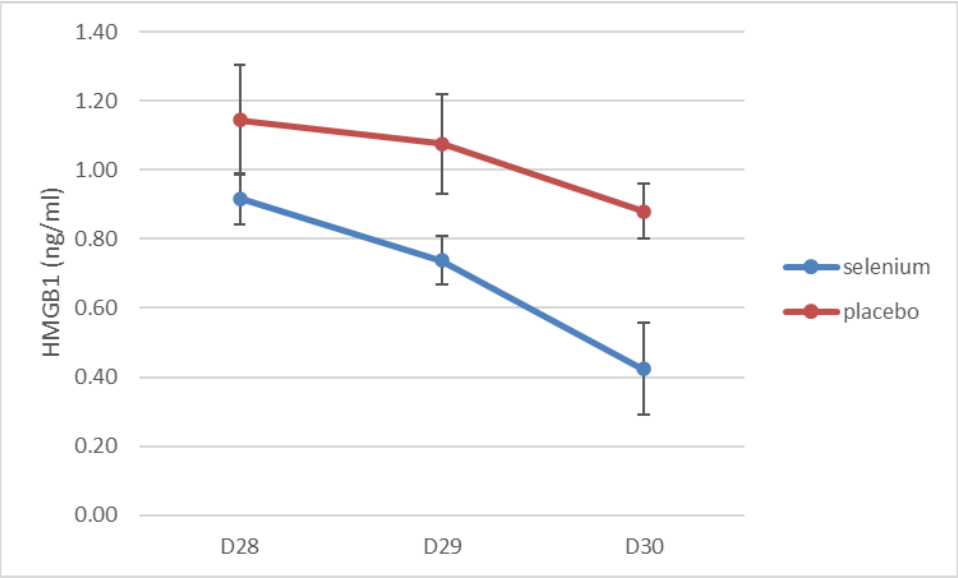

FIGURE 3. Comparison of changes in HMGB1 variables at D28, D29, and D30 post single bout high-intensity exercise in SG and PL.

Table 2. Effect size value with a 95% confidence level

Time Variable	D28	D29	*D30*
MDA	1,56 (11,78/13,56)	2 , 6 8 (10,17/12,86)	3,36 (6,69/11,77)
HMGB1	1,78 (0,92/1,14)	3,07 (0,74/1,08)	4,26 (0,42/0,88)

through the quotes of informants [B1BD] and [A1K]:

"*...giving information usually in Integrated Health Service or ICS about stunting, which refers to impaired growth due to malnutrition*" [B1BD]

"*There is an ICS in the health service; stunting counseling is also given there, starting from the beginning of pregnancy at 0–9 months; children aged 1-2 years... The program is from pregnancy to the 2-year-old children.*" [A1K]

Furthermore, in addition to quoting information sources related to stunting that they get from ICS, the participants [A1BB] further added that local cadres usually convey the provision of information related to stunting. This is demonstrated by the following quotation: "*In the Family Planning Village, usually the cadres conduct counseling here, to mothers of toddlers, teenagers also pregnant women*" [A1BB]

Nutrition and Health Monitoring

The sub-theme of nutrition and health monitoring describes participants' knowledge related to stunting prevention through nutrition management and health monitoring. This was conveyed by participants [A1BB] and [B1PK] as follows:

"*Yes, how to say it... Maybe about the portion of breakfast, lunch, and dinner, then don't get too close if someone in the family smokes. Don't forget to eat vegetables every day*" *[A1BB]*

"*Stunting refers to children with low-height-for-the-age. Children who don't consume nutritious food... To prevent stunting, children should eat nutritious food. The information is also given to the teenagers so they know later how to be healthy during pregnancy. They are also given Blood Supplement Tablets, which are good for their health*" *[B1PK]*

In addition, participants also mentioned they obtained information on nutrition management and health monitoring from the ICS. This is demonstrated by the following quotation:

"*The counseling is mostly related to eating. They tell about how children eat and how to maintain cleanliness and hygiene. The ICS measures children's weight, height, and head circumference. When we come to the Community Health Center, they will give us vitamins and anthelmintic medications for treating worms. This medicine is given to 1-year-old children; they will be given again next year. All like this...*" *[B2BB]*

Furthermore, Participants also had a health monitoring check every month. This is as stated in the following quote:

"Every ICS for toddlers has information for mothers of toddlers, pregnant women, and mothers of cadres. So once every 1 month, it is checked by the health of all (BKB) Build a family of toddlers" [B1BB]

Based on the data, it can be concluded that the participants had knowledge related to the prevention of stunting through nutritional management and health monitoring; this knowledge was obtained from the informant and knowledge derived from information obtained through the counseling section.

Existing Programme Prevention

The sub-theme of the existing program prevention describes a stunting reduction program in the local area known by participants. This is illustrated through a quotation submitted by informants [B1PK], as follows:

"*If the program is good, giving supplementary feeding program (PMT) for pregnant women is like milk and for toddlers when given processed food. We also got a stunting prevention program from PT Unilever about the cooking demonstration we had carried out at the hamlet hall*" *[B1PK]*

In addition, interviews were obtained from postpartum mothers' informants [B2BF] and pregnant women [A1BB] who said they received the information after participating in the stunting reduction program. This is conveyed

through the following quotation:

"Usually, I take part in counseling at ICS. They explain exclusive breastfeeding, too; I was also given PMT during pregnancy" [B2BF]

"The program is like giving vitamins, ICS, the weight and height measurement of the child, giving additional food such as eggs, counseling to mothers of toddlers about parenting patterns for children including stunting" [A1BB]

Based on the data above, it can be concluded that the participants had knowledge related to the stunting reduction program in the local area. The existing stunting reduction programs include providing healthy foods for pregnant women and toddlers, vitamins for children, and ICS activities.

Theme 2: Stunting Reduction Strategies

The theme of the stunting reduction strategy describes stunting reduction programs that already existed in the Quality Family Village area as a strategy to control stunting and optimize 1,000 in the first days of life. There are 3 sub-theme findings related to the theme of stunting reduction strategy: stunting reduction program, role in stunting reduction, and *best practice* in stunting reduction.

Stunting Reduction Programme

The stunting reduction program sub-theme describes the overview of stunting reduction program activities and optimization of 1,000 the first days of life in Quality Family Villages. This program was formed in collaboration with cross-sectoral parties as a form of preventive and promotive efforts in stunting prevention. The following are the results of the quotation submitted by Family Planning Field Officers related to the beginning of the formation of the team in the stunting reduction program:

"The stunting prevention program that we have done first is that we formed the mother TPK Team, the family companion TPK Team, that we form there are 16 Teams. Each team consists of three people: midwives, PKK cadres, and Family Planning cadres, whom we first trained on November 29, 2021. Thank God they all passed and got an Electronic Application for Marriage and Pregnancy (Elsimil) training certificate. All the participants are the TPK Team." [B1P]

Participants explain the tasks of the team in the stunting reduction program:

"First, the TPP (Tim Pendamping Keluarga or Family Companion Team) and second, the TPPS (Tim Percepatan Penurunan Stunting or Stunting Reduction Acceleration Team) jump in the program. If the TPPS usually helps give PMTs, each sub-district budget for the APBD for Stunting Prevention... TPPS is different from the TPK Team, but the ending is the same; that is the stunting problem. TPK should send a report to TPPS because the Secretary is the chief directory, while all urban village heads are the chief executors, all the Secretary are the chief executors of TPPS." [B1P]

In addition, there is information related to the form of stunting prevention program implementation, namely counseling, Posyandu activities, and supplementary feeding (PMT). The following is a quotation from a midwife [B1B] who explained the existing stunting reduction program. This is demonstrated by the quotation:

"There is TPK, pregnant women's classes, toddler classes, and home visits for the program. For the nutritional aspect, there is nutritional surveillance if, for example, there is a risk of stunting and there is a reason for the participants, the nutrition officer, the regional coordinator, and the doctor to do a home visit. TPK is the Indonesian Family Planning Board's program for the class of pregnant women and mothers of toddlers from the ICS. The class of pregnant women should be categorized based on age for counseling, but we cannot categorize each hamlet based on age. It usually does not meet its quota, only 15-20 people. The obstacle is that the mothers of toddlers don't come. If the situation in ICS is the same, we combine it; if there is counseling related to breastfeeding and supplementary food after breastfeeding, they will be invited together."

Additionally, the mothers of toddlers [A2BB] and mothers under [A1BD] said that related to the stunting reduction program in the form of ICS and counseling that they had participated in, this was conveyed through quotation:

"Usually, the program is uncertain, from the Community Health Center. For example, on

the 15th, there is ICS. There is counseling and, usually about stunting," [A2BB]

"If to optimize the first 2 years of the child's life, we have also been given information in ICS, so that in the ICS we are not just measuring the weight, measuring hands, but also being given information as well" [A1BD]

This is following the results of research submitted by cadre s [A1K], that in the implementation of stunting prevention programs, there are also activities such as counseling in ICS to the provision of supplementary foods:

"If the midwife of the health center service comes to the posling (mobile ICS) or if there is an invitation to the Posbindu (integrated guidance post) activities, that provides counseling from the health center service. But every month, only Cadre who provides information and measures babies' weight and gives the PMT" [A1K]

In addition to ICS activities, which become routine programs every month, counseling and mentoring activities are provided as a form of promotive efforts. Counseling and assistance are carried out not only by midwives but also by other health workers. As mentioned by the participants [A2BM]:

"Cadre was not present at the event yesterday. Only staff from the health service center and the village head were coming. Since the event was a little long yesterday, from 09.00 to 12.00, many of which were from the health service center. There were dentists, some were from the nutrition department, some were from the midwifery department, but there were different materials" [A2BM]

Then, it was conveyed by PLKB [B1P] that besides promotional efforts such as ICS activities, mentoring activities were also carried out by the team such as cadres, with targets ranging from prospectus parents, pregnant women, postpartum mothers, and mothers of children under five. The following are the quotations conveyed:

"…If the future parents are anemic, it also has the potential to give birth to stunting children. That is why Cadre assists the prospectus parents. Usually, before the marriage, prospectus parents must be injected with Tetanus Toxoid Vaccine... "[B1P

Furthermore, the participant added that not only assistance, but the stunting acceleration program team also monitored each activity to the target. This was explained in the following quotation:

"...the important thing is that even if you have been accompanied later, yet it turns out that the condition is less than the standard, we will have an intervention. If the TPK also focuses on growth and development. Usually, the TPK has midwives, cadres, PKK, and KB cadres. We also provide information about child development cards, so we send a child development card to e each Village. The card will be filled together with ICS. Through the child development card, the Cadre can monitor children's growth. For example, children at a certain age should be able to be like this. There is a reference; if a child in certain months cannot be like this, then we will refer to it." [B1P]

The efforts made to implement the stunting reduction program and the optimization of 1,000 in the first days of life cannot be separated from the support factors obtained when running the program, including readiness support in program implementation, cross-sector and cross-program cooperation, and community support. The following quotation from interviews with midwife participants [A1B], Secretary [B1C], and PKK [B1PK]:

"There is training for midwives and cadres. The community, which is aware of the role of the officers and the parties across the village sector, are all lending their support. If the village does not give support, we also do not support this. The government programs are supported by the conscious community and also the village government of cadres. In the past, this village was not like that, but now it can be found in other villages" [A1B]

"Our cadres are encouraged because every month there is an incentive also for 50k/month cadres from the village" [B1C]

In addition to the support factor, there are also inhibiting factors that affect the stunting reduction program. The inhibiting factors found in this study include budget problems, the implementation of inefficiently designed programs, lack of public awareness, and socio-cultural, economic, and geographical conditions. The results of the quotation

submitted by the informant are as follows:

"We used a small amount of the Cadre's money each month to pay for the upcoming event. A mother who comes to measure the children's weight gives Rp1,000.00 as additional cash. Later, it can be counted as if there are 20 people so that it can be Rp20,000.00 and 30,000 from the previous donation. So, later, Rp50,000.00 can be used to make porridge or sponge cake. We are trying our best to provide nutritional food despite limited funds. Meanwhile, the village fund is used to provide milk for the toddler .." [A1K]

"Many of the budgets at KIA were cut and transferred to PHN. For the class of pregnant women and toddlers, the budget was cut. For the class of mothers of toddlers, one village can hold the class 5 times, and they can target Indonesia Early Childhood Care and Education (PAUD) as well. As pregnant women, one village can hold the class 2 times, but because it is cut, it is only held 1 time" [B1B]

There were also findings that the team's formation was only formed in the last 1 year, so it is not maximal. This is as stated in the quote: *[B1C]*

"The stunting acceleration team has only existed for a year, but it has not yet reached its potential because we are occasionally asked to meetings in the new sub-district." [B1C]

In addition to the relatively new team, there is a lack of public awareness from the community to participate in existing activities. This is conveyed in the quotation:

"Health advice is still rare in the hamlet due to the young man's lack of activity, but when it is offered, most people reject it out of reluctance." [B2CT]

Furthermore, it was also conveyed that geographical conditions were also an obstacle in the implementation of the stunting reduction program, as reported by the following participants:

"If the hurdles are included in what we sense, the field, yes, if it's not too heavy, but in Kayugerit, it's a bit extreme" [B1P]

"Stunting is a personal matter, especially for someone with a young child. But the water is the issue in my region. Water is occasionally difficult to find. Geographical factors thus become important. [A1P]

From the data, it can be summarized that the different programs pursued to decrease the incidence of stunting and optimize 1,000 the first days of life in the Quality Family Village region undoubtedly also have supporting and inhibiting aspects in their implementation. These elements interact with one another both inside and externally. In terms of, for example, program funding readiness and implementation readiness. Externally, for example, across sectors and communities. These are related to each other to reduce stunting and optimize 1,000 in the first days of life.

Integrated Roles in Reducing Stunting

The sub-theme of the role in reducing stunting describes that there is a division for implementing the stunting reduction program and optimization of 1,000 the first days of life. The role in stunting prevention is carried out by cross-sectors or representatives of the implementation of the Indonesian Family Planning Board, including PLKB, Secretary, PKK, Midwives, and Cadres. The following is a quotation from [A1C] related to an example of the actions of cadres involved in the stunting reduction program:

"Cadres are also active now. If anyone is absent, they will visit and measure their weight. There is a group, so the results of the ICS are directly conveyed from the cadres" [A1C]

In addition, participants mentioned that cadres are also assigned to assist the community, starting from the prospectus parent target. This was conveyed by the participant [B1P]

"They then jumped into the field to do the first assistance done to future parents. Future parents need to be accompanied because they will be married soon. The Cadre lives in the village and knows if a future parent is near them. There are still three months remaining, so they accompany future parents by hoping that they can prevent stunted offspring" [B1P]

Not only are cadres deemed active during the current stunting reduction program, but the community has also undergone better improvements, as seen by their involvement in stunting prevention program activities. This is as conveyed by participants [A1K] and [A1C]:

It's good that her mother is involved, and occasionally, they join at arisan (regular social gatherings) to promote knowledge sharing and get young mothers excited about attending ICS

and having their kids get to know each other. [A1K]

"Yes, it's a relief that the community's awareness has also changed. Today, it seems that the average community has also been active" [A1C]

Additionally, it was well known that all parties participated in and worked together to implement the current stunting program to cooperate in reducing stunting. Cadres did not just carry this effort. This is proven through the quotation of participants [B1C] and [A1K]

"Collaboration of cadres, Hamlet residence, and the team of cadres...If our Muskal (Village Deliberation) invites cadres, then hamlets, Posyandu administrators, Kapanewon also (village), then Head of the Village, Pak Kamituo (Village Official) as the one in charge..." [B1C]

"All cadres are involved; there are elderly and toddler cadres here. We help each other so every time there is any counseling, all cadres are involved, whether it's elderly or toddlers, always side by side like that, they participate together... " [A1K]

"Yes, there are. From the Cadre, from PLKB, Community Health Services are also there, usually after the KB village event. That's usually, for example, the date of counseling" [A1BB]

This statement was also confirmed by midwives that there was a team formation to reduce stunting and optimize 1,000 in the first days of life. The following are the quotations conveyed:

"So there is a team (midwives, PKKs, cadres) that is formed to prevent stunting...Then for the treatment, starting from future parents, then pregnant women, then postpartum mother and the baby, then children under two years. Well, if there is a case which shows the possibility of stunting, it will be addressed together" [A1B]

Based on the data above, it can be concluded that many parties have a task or role in the implementation of the stunting reduction program and optimization of 1,000 in the first days of life. The parties involved in the program have the same goal: to reduce the incidence of stunting in the area of Quality Family Villages.

Best Practice in Stunting Reduction

The *best practice sub-theme* in reducing stunting describes interesting implementation practices in stunting reduction programs in Quality Family Villages. *Best practice* in this study is illustrated through the support of government programs through budgets, human resources empowerment, cooperation from various responsible parties, implementing parties and the community, cadre activity, and community enthusiasm. This is illustrated through several quotes as follows:

"Thank God, after there was a stunting locus, we got a program from the board center, supervised by the Indonesian Parliament, for the MJK (Completely Healthy Latrine Stimulant) of almost half a billion aimed at 55 families. Well, there is a positive impact here. The fund given by the board center is used for that, which might cost several million rupiahs, and there are some additions, too. That's a positive side of the program that has entered the village."[B1C]

Still, a secretary [B1P] participant in the government assistance program added that the government also assisted in the form of funds during the TPK orientation. This was conveyed in the [B1P] participant's quotation:

"If the fund is given smoothly, the province gives the fund to PKB directly. Like the previous TPK orientation, all have been managed by the province; we then monitored from the beginning until the end." [B1P]

In addition, the next best practice is in the form of collaboration between the TPPS and TPPK teams to reduce stunting in Quality Family Villages. PLKB [B1P] conveyed this:

"There is cooperation between the TPPS and TPK teams. If the TPPS is more involved in the village or policies, it is like a kind of section that moves the working community (no health workers) all across sectors. If there are health workers, they are the executors. So the TPK (Midwives, KB Cadres, PKK cadres) are the executor" [B1P]

There is establishing cooperation between teams, and the cadres that were previously empowered, motivated, and equipped before going into the field. This is proven by the following quotation from [A1C] and [B1C]:

"I visit the hamlets as the PKK leader, along with the administrators (PKK), so I am provided a way to inspire people. For example, when there are older people present, we encourage the elderly

on how to maintain their health. Likewise, when toddlers are present, we encourage the toddlers on how to maintain their health." [A1C]

"We give information, especially related to nutrition" [B1C]

Not only empowerment but also the TPK (cadres, midwives, and PKK) was facilitated in the field implementation process, as stated by the following [B1P]:

"Yes, we provide each participant in TPK, which we have done before, Rp100,000.00 per month. Every month, they get Rp100,000.00 for credit. For example, if there is assistance to catin, pregnant women, and mothers of children under two years, they will get Rp10,000.00 for each visit. That Rp100,000.00 will be divided into three (Cadre, midwives, and PKK) so that each assistant has funds again. Today, the credit phone given in assistance is not Rp100,000.00. But we give cash, and the distribution is fifty thousand. We buy credit/month. In addition to assistance, they must also do a resume every time there is an activity, and later it must be uploaded and sent to the sub-district" [B1P]

Furthermore, there were also several quotes stating that the current activeness of the Cadre is the strength in implementing the existing stunting program. This is as conveyed by the following [A1C]:

"Cadres are also active if now if someone is not present, cadres will pay a visit, measure, measure weights. Since there is a group, the results of the ICS are directly conveyed from the cadres. We are grateful for the exceptional spirit of the cadres. They may have socialization at the community health center or village. In addition to serving as cadres, they also work" [A1C]

The PLKB also confirmed that the cadres assigned and involved in this stunting reduction program have a high social spirit. This is as stated in the informant's quote [B1P]:

"The social spirit of the cadres is indeed strong because they have been active in the village." [B1P]

Additional statements submitted by the [A1K]:

"If I can say maybe the activeness of cadres and, from the Community Health Center too" [A1K]

Not only cadres, public enthusiasm to participate in the stunting program was also found in the interview data, such as the following quotation from [A2BB]:

"So far, the mothers are enthusiastic. Maybe it can be adjusted to the community here. Maybe it can be conditioned. For example, it's a bit late. They presented the information excellently, and the audience was enthused...."[A2BB]

Based on the data above, it can be concluded that various best practices have been carried out to reduce stunting in Quality Family Villages. The government's support proves this: the collaboration between the team in charge of implementing TPK and the team in order of TPPS, as well as the passion and spirit of cadres and the community.

Theme 3: Hope

The theme of hope illustrates the expectations and needs that informants express for stunting prevention programs and optimization of 1,000 the first days of life in Quality Family Villages. There are 2 sub-theme findings related to the theme of hope: expectation and needs

Expectation

The sub-theme of hope expresses their aspirations for the future to the evaluation initiatives to avoid stunting and the optimization of 1,000 in the first days of life. As for the quotation submitted by participants [B2BB] and [B1CT], who said that counseling activities related to stunting should be carried out more often. The following are the quotations conveyed:

"Yes, it should be held at least once every three months. Maybe it will benefit both those who have toddlers and those who only have toddlers. As long as I have children, just once, so that other mothers are aware of it as well as those who are unaware of it and those who are unaware of adding" [B2BB]

"I hope there will be more counseling about nutrition" [B1CT]

Another statement was conveyed by the participant [B1BD], who wanted supplementary feeding given to children at risk of stunting and to children with adequate nutrition. This is expressed through the following quotation:

"…We hope socialization continues and PMT like eggs, milk is sent to the house So it's not just for the stunted children" [B1BD]

Based on the results of the quotation above, it can be concluded that there are several expectations expressed by participants related to the stunting reduction program in the future, such as the expectation of educational media that can be accessed online, the provision of more counseling up to the provision of additional food given to children with adequate nutrition.

Needs

The needs sub-theme describes that several requirements support stunting prevention programs and optimization of 1,000 in the first days of life. The participant's statement related to the need for a direct approach provided by health workers to residents through home visits. This is what the participant [B1BB] mentioned:

"In my opinion, the health worker must come directly into the house so that the officer can also know the daily life of the person, like the economy, and their home environment" [B1BB]

In addition, findings were also obtained from [B1P] who conveyed that the need for online educational media is appropriate for adolescents so that they are also exposed to health education, especially in controlling stunting from an early age.

"It is challenging to gather the teenagers because they usually go to school and also need permission. So it is not easy if we invite them during working hours. Then, the alternative strategy is we provide education either through leaflets or videos" [B1P]

The same thing was conveyed by the future parent [B2CT], which was described in the quotation:

"In my opinion, for young people, it's easier to go online. If the adults also want to go to the health service center, it's also a bit far from access, and most can't use a motorbike. It's also difficult if their children work and no one is at home, it's also difficult. Well, if older people, it will be better if cadres come to the houses. But for teenagers, it seems that via WhatsApp it can also be easier" [B2CT]

Besides, there is a statement from participant [A2BB] related to the need for facilities and infrastructure that can support current ICS activities, such as the following quotation:

"..maybe the height ruler in the ICS is poor and limited, so it sometimes takes a longer time to measure height" [A2BB]

"Scales, the tied scales, we have already proposed change since it has been torn. There are also digital scales that the Community Health Service usually carries. At least the child likes it, you know, it's funny, for measuring height too because here you use the board," [A1K]

Based on the data, it can be concluded that the needs expressed by the informant are related to the stunting reduction program in the future, such as the direct approach by health workers in the form of home visits, the existence of online educational media that can be accessed anytime and anywhere, and the availability of adequate facilities and infrastructure in routine ICS activities that have been routinely carried out in Quality Family Villages. This study was conducted on 155 respondents, consisting of future parents, pregnant women, and mothers of under-five. This quantitative data collection was carried out through online questionnaires using Google Forms and the provision of video education media. The analyses conducted in this quantitative study were univariate analysis and bivariate analysis. The univariate analysis used in this study illustrates the frequency distribution of maternal knowledge about the Optimisation of 1,000 in the first days of life in Stunting Prevention.

Based on Table 1, the univariate analysis indicates a significant difference in respondents' knowledge levels before and after the intervention. Initially, the respondents exhibited varying levels of knowledge, categorized as poor, sufficient, and good. Post-intervention, there was a noticeable improvement in knowledge levels among the respondents, with a marked increase in the number of mothers displaying sufficient knowledge. This improvement demonstrates the positive impact of the intervention on enhancing the respondents' understanding.

Based on Table 2, the normality test for pre-test and post-test knowledge data yielded a significance value greater than 0.05, indicating that the data are normally distributed. Consequently, a paired t-test was employed to

determine the mean difference in values before and after the intervention. Additionally, the homogeneity test indicated a significance value greater than 0.05 for knowledge, confirming that the data in this study are homogeneous. This homogeneity signifies that the sample data possess consistent variance. The results of the bivariate test used a different test related to the effect of video media on mothers' knowledge about the optimization of 1,000 the first days of life in stunting prevention.

Table 3 indicates significant differences in knowledge levels between the pre-test and post-test assessments related to the video media intervention. This is evidenced by a significance value of 0.008, suggesting a notable increase in knowledge about stunting due to the video media intervention, with a p-value less than 0.05. In the stunting reduction program, maternal and family knowledge concerning stunting, dietary provision, and parenting behavior significantly impact the reduction of stunting within the family. Mothers and families equipped with comprehensive knowledge, appropriate behaviors, and adequate nutritional understanding are more likely to provide optimal nutritional intake, thereby preventing stunting and enhancing growth and development during the first 1,000 days of life (Ma *et al*., 2023; Reni *et al*., 2023). Stunting reduction program strategies could involve activities for improving maternal knowledge regarding nutritional management, enabling mothers to prepare healthy food and adopt better feeding practices for infants and toddlers (Rahmadiyah *et al*., 2022).

Previous research in Indonesia including 1,332 respondents revealed that 51.1% of respondents had limited knowledge about stunting, including its definition, causes, prevention, and impacts (Torlesse *et al*., 2016). This was attributed to inadequate counseling on stunting provided by ICS. ICS is a vital source of knowledge for the community, aligning with previous research indicating that 80% of respondents relied on ICS for stunting-related information (Haines *et al*., 2018). Furthermore, information disseminated by health workers is generally considered more reliable than information obtained from the Internet. However, the Internet remains a valuable source of information due to the community's time constraints and the increasing demand for accessible knowledge. ICS plays a crucial role in stunting reduction by offering services such as monitoring children's growth and development, measuring height and weight, administering immunizations and vitamins, as well as providing counseling during its activities.

The government of Indonesia has implemented various strategies to reduce stunting, including forming dedicated teams such as TPPS, TPS, and TPK. Additionally, through cross-sectoral cooperation involving sub-districts, the Indonesian Family Planning Board, Health Offices, and Community Health Centres, the government has initiated multiple activities. These activities include coordination meetings, stunting discussions, education and counseling, and training of cadres and other stakeholders. Additionally, there is also an Elsimil program for preparing brides-to-be for engaging in marriage, pregnancy planning, supplementary feeding programs, distribution of vitamins and iron tablets for at-risk communities, and monitoring growth and development through ICS. Home visits by cadres and health workers are also part of these initiatives. These strategies align with WHO recommendations, which emphasize the crucial role of government commitment in reducing childhood stunting (WHO, 2021).

The government's commitment to stunting prevention began with Indonesia's participation in the 2011 Global Scaling Up Nutrition (SUN) movement, marked by the Minister of Health's submission of a participation letter to the UN Secretary-General. Launched in 2010, this movement is based on the principle that all citizens have the right to adequate and nutritious food. Effective stunting reduction requires cross-sectoral cooperation, involving individuals, organizations, related institutions, and community levels to implement optimal interventions with multiple sectors and stakeholders (Lameky, 2024). Effective program implementation also requires attention to health insurance accessibility for all societal levels (Agustina *et al.,* 2023). Despite the implementation of various stunting prevention programs, effectiveness and scale remain

challenges. A previous study revealed that most pregnant women and mothers of children under the age of two lack sufficient access to essential services, critical for child development during the first 1,000 days of life, and only 28.7% of children under two have access to four basic services simultaneously: birth certificates, drinking water, sanitation, and exclusive breastfeeding (UNICEF-Indonesia, 2020).

Research examining the impact of video media on the optimization of the first 1,000 days of life for stunting prevention indicates a significant increase in the average knowledge score, from 13.33% to 14.50%. This study demonstrates that video media effectively enhances mothers' knowledge about stunting prevention. This finding aligns with annual research, which consistently shows a significant knowledge increase in groups exposed to educational videos compared to those given booklets (Sewak *et al*., 2023). Previous research further elaborates that educational media, particularly videos, offer several advantages due to their visually appealing nature (Salmerón *et al*., 2020). The engaging visual elements facilitate the effective conveyance of messages. Audiovisual content enhances respondents' concentration, making it easier for them to absorb information (Wu *et al*., 2020). Videos not only present images but also provide an auditory dimension, which helps maintain the audience's interest and improves information retention (Abdulrahaman *et al*., 2020). Overall, the research underscores that video media is a powerful tool for educational interventions, particularly in the context of stunting prevention. Its ability to engage multiple senses makes it superior to other forms of educational materials, ensuring that recipients are better informed and more likely to retain the knowledge provided.

This study reflects the community's desires and consistent implementation of stunting prevention programs. However, it has been observed that current initiatives, such as counseling and education, are limited in scope and not regularly scheduled. This inconsistency may be attributed to various factors, including insufficient support due to limited facilities, infrastructure, human resources, socio-economic barriers, and geographical challenges. These obstacles hinder the effective implementation of stunting prevention programs and the optimization of the first 1,000 days of life. Therefore, government strategies are needed to optimize stunting reduction through comprehensive family assistance, which involves the collaboration of various programs and activities across sectors at the village level. Beyond the implementation of programs and activities, family assistance involves cooperation with field cadres from different sectors, leveraging their respective expertise and skills to address gaps in stunting reduction efforts. Moreover, there is a need for systematic monitoring and evaluation, conducted through direct observations and interviews with family assistance teams. This should be conducted in an integrated and systematic manner at least twice a year or as needed. Such measures ensure the effective acceleration of stunting reduction and address the community's expectations for a more structured and sustained approach.

Conclusion

The internal influences on individuals, such as knowledge, socio-cultural factors, geographical conditions, and economic status, significantly impact community awareness related to stunting. The ongoing stunting prevention programs serve as clear evidence of the government's commitment to collaborating with various sectors, including the Government, Health Offices, Community Health Centers, the Indonesian Family Planning Board, and other community organizations. Additionally, educational media in the form of videos has proven to be significantly effective in enhancing the knowledge of research respondents about stunting. This therefore could potentially be an alternative for health education to communities.

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Assessing Child Marriage in Indonesia: A Call for Educational Empowerment

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Abstract

Although the age of first marriage is generally increasing, many young women continue to marry as children in Indonesia. This study aims to assess the prevalence and predictors of child marriage in Indonesia. The data were obtained from the 2019 Performance and Accountability Survey of Population, Family Planning, and Family Development with a total sample of 46,220 married reproductive-age women. Multivariate binary logistic regression models were used to identify the significant associated predictors of child marriage. Overall, the prevalence of child marriage was 23.7 percent and ranged from only 0.1 percent in West Papua to 27.7 percent in West Java Province. Child marriage practice was found to be 54.80 (95%, CI: 41.01, 73.24) and 47.42 (95%, CI: 37.18, 60.49) times higher among uneducated women with primary education level compared to educated women with a university level of education. Those who live in Kalimantan islands were 2.13 (95%, CI: 1.73, 2.60) times more likely to experience child marriage compared to women who live in Maluku or Papua Islands. Child marriage was 1.28 (95%, CI: 1.22, 1.35) higher among rural residents compared to urban. The government, the private sector, and the community must continue empowering young girls, particularly regarding education.

Introduction

Child marriage is a public health concern and also a human rights violation that exposes children to the risk of exploitation, violence, and abuse. Article 1 of the Convention on the Rights of the Child (CRC) states that a person is considered a child if they are younger than 18 years old (Nawaz *et al*., 2021). According to UNICEF, Child marriage refers to any marriage or union in which one or both spouses are under the age of 18 years. Over the past decade, this issue has been addressed in a variety of ways on a global level. Indonesia is one of the 194 nations that have ratified The CRC through Presidential Decree Number 36 of 1990 and then ratified The Child Protection Act Law Number 23 of 2002 (Makka *et al*., 2020). The Indonesian government has been actively involved in international conventions and set development goals that are committed to stopping child marriage and complying with human rights standards stated in the 17 Sustainable Development Goals (SDGs). The SDGs include a target to end the harmful practice of child marriage by 2030. Specifically, Target 5.3 seeks to eliminate all harmful practices such as child, early and forced marriage, and female genital mutilation. The *Girls Not Brides* initiative also revealed that unless significant progress is made to prevent early marriage, eight of the 17 SDGs may be accomplished (Girls Not Brides, 2020). Even though the above strategies have been implemented, Indonesia has one of the highest prevalences of child marriage worldwide (BPS *et al*., 2020). Indonesia ranks seventh in the global top ten, with the highest absolute number of child marriages in 2016 (UNICEF Indonesia, 2016).

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The Indonesian government tries to regulate marriage with a national law that bonds to all Indonesian citizens. This law is expected to create legal unification in marriage and family laws. Per 2019 the law on "Marriage" fulfilled/completed prior, the legal minimum age for marriage in Indonesia is 19 years for both males and females. However, the law would allow for earlier marriage under particular circumstances, that is, through marriage dispensation. Marriage dispensation is a deviation from the minimum age requirement, which should have been submitted for urgent reasons and is only granted by the Court or other official, accompanied by sufficient supporting evidence. However, the reasons sometimes are less urgent ("unintended pregnancy", "the feeling of love", "felt a good fit"), resulting in the legality of underage marriage (Makka *et al*., 2020; Mayandra, 2020).

Although the age of first marriage is generally increasing, many young women continue to marry as children in Indonesia, and this has not changed much. Through the 2020-2024 National Medium Term Development Plan (RPJMN), the Indonesian government is targeting to reduce child marriage from 11.2% in 2018 to 8.74% in 2024. It is targeted that the prevalence of early marriage by 2030 is 6.94% (BPS *et al*., 2020). However, over the past decade, Indonesia has only attained a 3.5% decline, from 14.67% in 2008 to 11.21% in 2018 (BPS *et al*., 2020). Across Indonesia, 11.21% of women between 20 and 24 were married before age 18, and over 61,000 young women were married before their 15th birthday (BPS *et al*., 2020). In Indonesia, the practice of child marriage varies between provinces and is frequently concentrated in specific geographic regions or among particular ethnic groups. In 2020, data from 34 provinces reported that the highest prevalence of child marriage was in Sulawesi Island and Kalimantan Island. Data indicated that the child marriage cases were 19.43% in West Sulawesi, 19.13% in Central Kalimantan, 18.96% in Southeast Sulawesi, 17.64% in West Kalimantan and 17.63% in South Kalimantan (BPS *et al*., 2020).

Previous studies have reported different reasons or causes for child marriage. In specific contexts, economic or financial concerns may play a more significant role than social status, cultural norms, lack of education, employment opportunities, fear of girls' sexuality, and unplanned pregnancy (Belachew *et al*., 2022; Najib *et al*., 2021; Nawaz *et al*., 2021; Psaki *et al*., 2021; Subramanee *et al*., 2022; Tekile *et al*., 2020). Although boys are also married off as minors, girls are affected by child marriage in significantly higher proportions than boys. This incidence is a manifestation of gender inequality. In Indonesia, 11% of women between the ages of 20 and 24 married before turning 18, compared to one percent of men in the same age group (BPS *et al*., 2020). Furthermore, the majority of child-married cases indicated that girls are married to older men. Girls are not physically, physiologically, and psychologically mature enough to shoulder the responsibilities as spouses, homegrown laborers, and eventually a mother at a bit of age (Girls Not Brides, 2020; Nawaz *et al*., 2021; Subramanee *et al*., 2022; Tekile *et al*., 2020).

In addition, child marriage also implies gender inequality in determining their rights and choice to acquire education (Judiasih *et al*., 2020). In many societies within Indonesia, getting married earlier means the girls must fade away from their dream to attain a high education level because the education system does not accommodate it. Besides, in a country with a patriarchal ideology, married girls in Indonesia tend to devote their time and energy to their families, so they have to leave their school, and their education level is lower, influencing their rights to engage in labor force participation (Judiasih *et al*., 2020). Early marriage has been associated with increased household poverty, fewer employment chances, school withdrawals, less dynamic power within the marital home, less authority over necessary family resources, and an increased risk of intimate partner violence (Girls Not Brides, 2020; Mayandra, 2020; Nawaz *et al*., 2021; Subramanee *et al*., 2022).

Child marriage has several detrimental effects on the health and social standing of both women and their children (Subramanee *et al*., 2022; Tekile *et al*., 2020). Young women who married early were more likely to experience unwanted pregnancies. Due to her narrow pelvis and impending childbirth, the young girl

may deliver her baby early or late, both of which can be dangerous (Nawaz *et al*., 2021). Ten to 14-year-old girls had a five to seven times higher risk of dying during childbirth due to post-pregnancy drain, sepsis, and labor difficulties (Girls Not Brides, 2020; Nawaz *et al*., 2021). Moreover, babies born to girls under the age of 15 are more likely to be stunted, have low birth weights, have inadequate nutrition, and are at a higher risk of dying before their fifth birthday (Girls Not Brides, 2020). Mentally, these risks include depression and suicidality (Nawaz *et al*., 2021). Progress is needed to achieve SDG 5.3 and the 2020-2024 National Medium Term Development Plan target. UNICEF stated that, by completing these targets, millions of young women would have the chance to live a better life and access all the opportunities available. Furthermore, The Child Protection Law clearly states the obligation to prevent child marriage. Providing information on the incidence of child marriage and contributing factors will simplify the strategies for reducing child marriage. Therefore, this study aimed to determine the prevalence of child marriage, as well as its predictors in Indonesia. The findings of this study will make an input for the policymakers and planners to respond to the practice of child marriage.

Method

This study utilized data from the Indonesian Performance and Accountability Survey of Population, Family Planning, and Family Development (SKAP), a nationally and provincially representative household survey conducted by the National Population and Family Planning Board in 2019. Stratified sampling in two stages was used to choose study participants. In the first stage, Enumeration Areas (EAs) were chosen randomly, and in the second stage, households were selected (BKKBN, 2019). A total weighted sample of 46.220 married women between the ages of 15 and 49 was included in the study. The primary outcome measure was child marriage, defined as young women first married (formal or informal union) with their partner before reaching 18 years of age. The data was classified into two categories: "yes" =1 for women whose first cohabitation or marriage happened before their 18th birthday, and "no" =0 for those who first married or cohabitated after turning 18. The independent variables included in the analysis were age, educational level, women's employment status, wealth index, media exposure, place of residence, and region.

The analysis of the data was done with SPSS version 23. Both bivariate and multivariate binary logistic regressions were performed. Bivariate logistic regression was performed, and variables with a p-value of less than 0.05 were included in the multivariable binary logistic regression analysis to identify the predictors of child marriage among married women of reproductive age. Variables in the multivariate logistic regression were considered statistically significant if their *p*-values were less than 0.05. The association was provided as an odds ratio with 95% confidence intervals.

Results and Discussion

Descriptive results in Table 1 showed that one in five (23.7%) women married before 18. This finding is higher than previous studies conducted in Indonesia, which was between 14% and 16% (Berliana *et al*., 2021; Rumble *et al*., 2018; Wahyudi *et al*., 2019). Apart from being pregnant outside marriage, the high prevalence of child marriage in Indonesia correlated with several circumstances, including socioeconomic status, religious beliefs, and cultural values (Astuti *et al*., 2021; Laksono *et al*., 2021; Makka *et al*., 2020; Mayandra, 2020). With the largest Muslim population, the nation places a high value on virginity and defines marriage as a means of preventing illicit sexual activity (Astuti *et al*., 2021; Laksono *et al*., 2021). In some communities, parents would prefer to marry their daughters off than have them become unsaleable maidens (Astuti *et al*., 2021; Najib *et al*., 2021; Widyastari *et al*., 2020). Table 1 presents the characteristics of women in this study. Of the total respondents, 40.1% of women were aged between 35-44 years, 32.5% had primary education, 65.1% had no work, and 84.4% had media exposure. More than half (52.6%) of women were rural dwellers. Regarding their economic status, 23.6% of women were from a poor wealth index. The highest proportion of women resided on Java Island (60.9%).Being geographically

TABLE 1. Characteristics of Reproductive Age Women in Indonesia (n=46,220)

Variables	Categories	Frequency	Percentage (%)
Woman's age (years)	15-19	611	1.3
	20-24	3,872	8.4
	25-29	7,063	15.3
	30-34	8,496	18.4
	35-39	9,572	20.7
	40-44	8,966	19.4
	45-49	7,639	16.5
Level of education	Uneducated	640	1.4
	Primary	15,042	32.5
	Lower secondary	11,677	25.3
	Upper secondary	13,756	29.8
	Higher secondary or further	5,106	11.0
Women's employment	Unemployed	30,075	65.1
	Employed	16,145	34.9
Wealth Index	Poor	10,901	23.6
	Middle	22,098	47.8
	Rich	13,222	28.6
Media exposure	No	7,205	15.6
	Yes	39,015	84.4
Place of residence	Rural	24,300	52.6
	Urban	21,920	47.4
Region	Java	28,168	60.9
	Sumatra	9,141	19.8
	Kalimantan	2,768	6.0
	Sulawesi	2,795	6.0
	Bali & Nusa Tenggara	2,355	5.1
	Maluku & Papua	993	2.1
Child marriage	Yes	10,965	23.7
	No	35,255	76.3

clustered, the practice of child marriage in Indonesia, which has 34 provinces, is not equally distributed. The highest rate of child marriage was observed in West Java (27.7%), which was more than the national rate average, followed by Central Java (14.4%) and East Java (14.1%). It is interesting that most provinces on Java Island, except Yogyakarta and Jakarta, showed a higher prevalence of child marriage than other provinces within Indonesia. Other than higher population numbers, the wide diversity of socio-cultural and economic status across provinces on this island might be the reason for this condition. With the majority of adherents of Islam, marriage practice in some provinces in this region might be influenced by religious values. Maintaining religious norms by preventing premarital sex is one of the popular reasons prevailing in Muslim societies (Kusmayanti & Mulyanto, 2020). In addition, in many highly populated poor communities, early marriage is also considered a solution to the economic burden (Judiasih, 2020). A study in a district in East Java province revealed that marrying a daughter as early as possible would reduce a parent's financial burden because her

husband would take responsibility for her, including her spending (Rofika & Hariastuti, 2020). Nevertheless, this expectation often seems far from reality because most early married women have an unstable income because of low educational attainment, which may aggravate a financial burden on families. On the other hand, the lowest child marriage prevalence was found in West Papua (0.1%), followed by Riau Island, North Kalimantan, and Maluku, each 0.3% (Figure 1). The low prevalence of child marriage in these Provinces can be attributed to several factors. Riau island for example, generally has higher levels of economic development, better educational infrastructures, and higher rates of girls completing secondary education, which correlates with a reduction in child marriage (Rumble *et al*., 2018; Utomo *et al*., 2022). As for Papua and Maluku, this can be attributed to traditional customs, where formal marriage registration is not always prioritized and many rural and remote areas have limited access to government services, including legal systems for marriage registration (Girls Not Brides, 2020).

As shown in Table 2, child marriage was significantly associated with all the independent variables (p-value=0.000 <0.005). The highest proportion of child marriage was observed in the age group 15-19 years (69.2%). The educational level and child marriage cross-tabulation also revealed that a minor proportion of child marriage (1.4%) was observed for women having higher or further education. In contrast, the highest proportion of child marriage was observed for uneducated women (41.6%). Child marriage practice was common among unemployed women (24.8%). Regarding economic status, the proportion of child marriage was highest among the poor wealth index (32.1%). The proportion of child marriage was significantly higher among women who had no exposure to media (34.1%) and residing in rural areas (29.4%). Regarding regional distribution, the proportion of child marriage was 29.5%, 27.3%, and 25.0% among women living in Kalimantan, Sulawesi, and

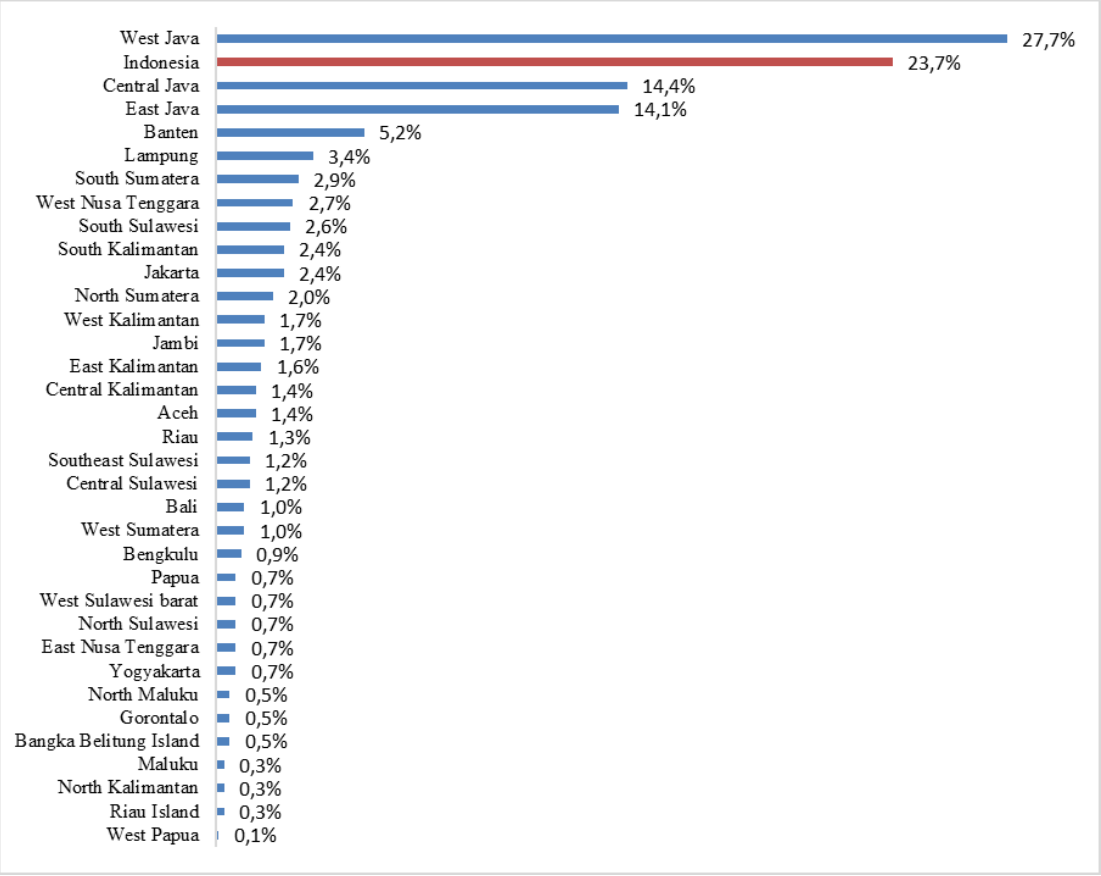

FIGURE 1. Prevalence of Child Marriage in 34 Provinces in Indonesia

TABLE 2. Distribution of child marriage by women's characteristics (SKAP, 2019)

Variables	Categories	Child Marriage		*P*-value
		Yes (%)	No (%)	
Woman's age (years)	15-19	423 (69.2%)	188 (30.8%)	0.000
	20-24	1,017 (26.3%)	2,855 (73.7%)	
	25-29	1,386 (19.6%)	5,676 (80.4%)	
	30-34	1,704 (20.1%)	6,793 (79.9%)	
	35-39	2,116 (22.1%)	7,456 (77.9%)	
	40-44	2,245 (25.0%)	6,721 (75.0%)	
	45-49	2,073 (27.1%)	5,566 (72,9%)	
Level of Education	Uneducated	282 (44.1%)	358 (55.9%)	0.000
	Primary	6,258 (41.6%)	8,783 (58.4%)	
	Lower secondary	3,288 (28.2%)	8,389 (71.8%)	
	Upper secondary	1,067 (7.8%)	12,689 (92.2%)	
	Higher secondary or further	70 (1.4%)	5,036 (98.6%)	
Women's employment	Unemployed	7,463 (24.8%)	22,612 (75.2%)	0.000
	Employed	3,502 (21.7%)	12,643 (78.3%)	
Wealth Index	Poor	3,495 (32.1%)	7,405 (67.9%)	0.000
	Middle	5,643 (25.5%)	16,455 (74,5%)	
	Rich	1,828 (13,8%)	11,394 (86.2%)	
Media exposure	No	2,458 (34,1%)	4,748 (65.9%)	0.000
	Yes	8,507 (21.8%)	30,507 (78.2%)	
Place of Residence	Rural	7,144 (29.4%)	17,155 (70.6%)	0.000
	Urban	3,821 (17.4%)	18,100 (82.6%)	
Region	Java	7,052 (25.0%)	21,116 (75.0%)	0.000
	Sumatra	1,681 (18,4%)	7,461 (81.6%)	
	Kalimantan	816 (29.5%)	1,953 (70.5%)	
	Sulawesi	762 (27.3%)	2,033 (72.7%)	
	Bali & Nusa Tenggara	486 (20.6%)	1,869 (79.4%)	
	Maluku & Papua	169 (17.0%)	824 (83.0%)	

Java, respectively.

Table 3 presents the results of multivariate logistic regression analysis. Of the sociodemographic factors, the study found that women with low educational attainment, women residing in rural areas, and women living in Kalimantan and Sulawesi areas were more susceptible to being married off at an early age compared to their better-educated, residing in urban areas and living in Maluku and Papua counterparts. Regarding educational level, the study found that the odds of child marriage were 54.8 (95% CI: 41.00, 73.24) times higher among uneducated women and 47.4 (95% CI: 37.18, 60.49) times higher among those women with primary education compared to women who had Diploma or further degree of education. Higher-educated women probably have more knowledge about the appropriate age to be married and the consequences of having an early marriage, which empowers them to make informed marriage-related decisions. Higher education is frequently associated with higher socioeconomic status, allowing people to access resources and services and influencing their knowledge and awareness about child marriage

(Fatima, 2023). In many cases, education and financial capacity are directly interrelated. More often, financially struggling families choose to marry off their daughters to relieve some financial burden rather than pay for their daughters' education. Girls and their families may see marriage as the only realistic option when the opportunity for continued schooling is limited. This finding is similar to previous studies conducted in Bangladesh, Ghana, Iraq (Saleheen *et al*., 2021), Nepal (Marphatia *et al*., 2021), Amhara Region of Ethiopia (Tekile *et al*., 2020), Zambia (Phiri *et al*., 2023) and nine Sub-Saharan African countries (Belachew *et al*., 2022) which found that women's educational level was a strong predictor of child marriage. Improving access to secondary education, offering scholarships for girls, and providing social safety nets for families in poverty have shown success in reducing child marriage practices.

The type of residence was reported as being associated with child marriage. Women living in rural areas were 1.28 (95%, CI: 1.22, 1.35) more likely to get married before age 18 than those living in urban areas. This finding is similar to a previous study from Indonesia (Wahyudi *et al*., 2019) and those from four countries in South Asia: Bangladesh, Nepal, India, and Pakistan (Scott *et al*., 2021), Iraq (Saleheen *et al*., 2021), Amhara Region of Ethiopia (Tekile *et al*., 2020), Nigeria (Avogo & Somefun, 2019) and nine Sub-Saharan African countries (Belachew *et al*., 2022). The situation may result from girls' limited access to education and employment opportunities. In rural areas, girls face numerous barriers to education and employment, with limited access to schools, healthcare, and economic resources. These factors create a cycle of poverty where marriage is often viewed as the best option for a girl's future. Furthermore, cultural traditions, such as arranged marriages, continue to prevail in rural areas, where families see marriage as a way to ensure social security for their daughters. This dynamic is worsened by the low decision-making power of girls, who are rarely consulted in matters of marriage (Psaki *et al*., 2021). Additionally, weak enforcement of child marriage laws in rural areas contributes to the persistence of this harmful practice. These findings suggest that addressing child marriage in rural areas requires a multifaceted approach, tackling both the structural inequalities and deeply ingrained cultural practices that drive early marriage.

Furthermore, child marriage is the consequence of dowry practices in Central and South Sulawesi, where the 'price' of girls will increase as the age rises (Ratnaningsih *et al*., 2022). In this case, parents may arrange marriage as soon as possible to prevent paying a higher dowry to the bride's family. The study reveals significant geographical disparities in child marriage across Indonesia's regions, with the odds of child marriage being 1.24 times higher in Sumatra, 1.78 times higher in Java, 2.13 times higher in Kalimantan, 2.01 times higher in Sulawesi, and 1.24 times higher in Bali and Nusa Tenggara, as compared to Maluku and Papua. In keeping with the simplicity of the result interpretation, the child marriage cases were classified by regions based on geographic location for both bivariate and multivariate analysis. Thus, the prevalence showed slight differences compared to one in a single province. The difference was striking among provinces in the Java region, with the possibility of the influence of minor incidences of child marriage in the Yogyakarta and Jakarta provinces. The bivariate analysis presented in Table 2 showed that among married women, the percentage of child marriage was high in the regions of Kalimantan (29.5%), Sulawesi (27.3%), and Java (25%). These findings align with global trends in child marriage, such as those observed in Ethiopia, where similar regional differences are shaped by a complex interplay of cultural and socioeconomic factors (Alem *et al*., 2020). Kalimantan, with the highest likelihood of child marriage, illustrates the role of economic stressors. In this region, poverty plays a significant role, compelling families to marry off their daughters early as a strategy to reduce financial burdens (Susanti *et al*., 2021). Early marriage is often seen as a way to limit household expenses, particularly in areas where girls' education is viewed as secondary to their roles as wives and mothers. Moreover, economic hardships often force children to drop out of school, perpetuating a cycle of poverty and limiting their prospects,

TABLE 3. Factors associated with child marriage in Indonesia (SKAP, 2019)

Variable	Categories	OR (95% CI)	P-value
Woman's age (years)	45-49 (ref)	1	0.000
	15-19	9.21 (7.55, 11.23)	0.000
	20-24	1.54 (1.40, 1.70)	0.000
	25-29	1.09 (1.00, 1.19)	0.051
	30-34	0.97 (0.90, 1.05)	0.515
	35-39	0.99 (0.91, 1.06)	0.730
	40-44	0.95 (0.88, 1.02)	0.186
Level of Education	Higher secondary or further (ref)	1	0.000
	Uneducated	54.80 (41.00, 73.24)	0.000
	Primary	47.42 (37.18, 60.49)	0.000
	Lower secondary	24.71 (19.38, 31.50)	0.000
	Upper secondary	5.59 (4.37, 7.16)	0.000
Women's employment	Unemployed (ref)	1	
	Employed	1.04 (0.99, 1.10)	0.093
Wealth Index	Poor (ref)	1	0.844
	Middle	1.02 (0.96, 1.08)	0.585
	Rich	1.00 (0.93, 1.08)	0.898
Media exposure	Yes (ref)	1	
	No	1.05 (0.99, 1.11)	0.108
Place of Residence	Urban (ref)	1	
	Rural	1.28 (1.22, 1.35)	0.000
Region	Maluku & Papua (ref)	1	0.000
	Java	1.78 (1.48, 2.14)	0.000
	Sumatra	1.24 (1.03, 1.51)	0.025
	Kalimantan	2.13 (1.73, 2.61)	0.000
	Sulawesi	2.01 (1.64, 2.47)	0.000
	Bali & Nusa Tenggara	1.24 (1.00-1.53)	0.048

further reinforcing early marriage as a viable solution.

In Sulawesi, cultural norms exert a strong influence on child marriage. Traditional beliefs dictate that adulthood begins after marriage, pushing parents to marry off their daughters as soon as they reach puberty (Idrus, 2022). Additionally, dowry practices in regions like Central and South Sulawesi exacerbate the situation. The cultural expectation that a bride's dowry increases with age incentivizes parents to arrange marriages early, to avoid higher dowry payments later (Ratnaningsih *et al*., 2022). These norms not only reinforce gendered expectations but also create financial motivations for child marriage, intertwining cultural traditions with economic pressures. Java and Sumatra, while experiencing slightly lower rates of child marriage compared to Kalimantan and Sulawesi, are still affected by deeply ingrained religious and socio-cultural values. In these regions, particularly in rural areas, marriage is often seen as a means to preserve family honor, especially in cases where premarital relationships are suspected. As in many other parts of Indonesia, religious interpretations that emphasize the importance of female chastity before marriage also contribute to the practice of child marriage, especially in conservative rural communities.

These findings demonstrate that child marriage is not merely a product of economic disadvantage, but also deeply rooted in cultural and religious traditions. Addressing child marriage in Indonesia requires a multifaceted approach that tackles both the economic drivers, such as poverty and lack of education, and the socio-cultural norms that continue to sustain the practice. Given this study has used national and provincial data, which was collected using standard and validated data collection tools, the finding of this study provides a picture of child marriage in Indonesia. However, the study has several limitations. First, due to the data's cross-sectional nature, this study could not show causality between dependent variables and child marriage. Second, there is a possibility of recall bias because the survey participants were asked to report events that happened in the past. Finally, the outcome variable was measured retrospectively using the reported age at first marriage for the currently married women. However, the independent variables reference when the survey was conducted, meaning there is a possibility of a variance between the factors at the time of marriage and those at the time of the survey.

Conclusions

This study established the prevalence and highlighted factors associated with child marriage in Indonesia. The study identified educational level, place of residence, and region as the main factors related to child marriage practice. Because women's level of education was a significant factor in child marriage, strengthening educational intervention for women should be prioritized. Encouraging and supporting women to continue their education is an alternative to marriage. Also, mobilizing community awareness and engagement programs, which aim to address cultural and social norms by raising discussions among parents, religious and community members, including men, highlights the value of educating girls about rights and the risks of child marriage. Digital platforms and media campaigns could be used effectively to convey messages to educate young people on sexual and reproductive health.

Because there is a wide variation in the number of child marriages, strengthening intervention programs, focusing on rural areas, and differentiating intervention between regions through the implementation and enforcement of national laws and also developing legal or policy intervention at the district or local level, which aim to create local regulation and policy environment that makes child marriage more challenging. In addition, empowerment initiatives should be developed to increase girls' opportunities and equip them with knowledge, support, and fundamental life skills education to become economically independent and engaged. Girls must receive comprehensive information regarding their rights, sexual and reproductive health, and the consequences of child marriage and learn to assert their interests. By implementing these strategies, child marriage practice may be reduced more sustainably. The path to achieving eight of the other SDGs by the year 2030, including those related to poverty, food security, health, education, gender equality, economic growth, peace, and justice, may be cleared (Girls Not Brides, 2020).

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Stunting Among Children Aged 6-59 Months in Gorontalo, Indonesia

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Abstract

Stunting remains a significant public health challenge in Indonesia, particularly among children aged 6-59 months. Stunting, defined as low height-for-age, results from chronic undernutrition during the most critical periods of growth and development. This study aims to analyze the sociodemographic and socio-cultural factors associated with stunting in Gorontalo, Indonesia, to inform targeted interventions. A cross-sectional study was conducted with 325 children aged 6-59 months, selected consecutively. Data were collected using a structured questionnaire covering seven sociodemographic and two sociocultural factors, alongside the Individual Dietary Diversity Score (IDDS) questionnaire. Bivariate analysis was performed using Chi-Square tests, while multivariate analysis employed Logistic Regression to identify significant predictors of stunting. The prevalence of stunting among the sample was 35.7%. Bivariate analysis identified Birth Length, Birth Weight, Family Income, Exclusive Breastfeeding, Complementary Foods, Food Diversity, and Parenting as factors associated with stunting. Multivariate analysis revealed that Birth Length (OR=0.377; 95% CI: 0.188-0.754), Birth Weight (OR=0.231; 95% CI: 0.095-0.561), Exclusive Breastfeeding (OR=0.307; 95% CI: 0.164-0.575), and Food Diversity (OR=0.064; 95% CI: 0.033-0.123) were significant protective factors against stunting. Conversely, Family Income and Education were identified as confounding factors. The findings underscore the critical importance of the first 1000 days of life in preventing stunting. Efforts should improve maternal nutrition to ensure optimal birth weight and length, promote exclusive breastfeeding, and enhance dietary diversity among young children. Addressing these factors can significantly reduce the prevalence of stunting and improve child health outcomes in Gorontalo.

Introduction

The Malnutrition remains a critical public health issue globally, particularly in low and middle-income countries (LMICs), including Indonesia, which faces the dual burden of undernutrition and overnutrition. In 2020, an estimated 149.2 million children under five years of age worldwide suffered from stunting, 45.4 million from wasting, and 38.9 million from overweight. The global prevalence of stunting has declined from 33.1% in 2000 to 22% in 2020. Yet, Asia continues to bear the highest burden with 53% of cases, and Southeast Asia ranks highest within the region at 30.7%. Despite the stunting rate in Indonesia has decreased to 21.5% in 2023, this figure is still far below the national target of 14% in 2024 (Kementrian Kesehatan RI, 2023; Rachmi *et al*., 2016; Riset Kesehatan Dasar (RISKESDAS), 2018; UNICEF, 2021). Stunting is a type of chronic malnutrition that occurs when a child does not receive enough nutrition and experiences frequent infections during critical periods of growth and development, such as during pregnancy and early childhood. Children who are affected by stunting may not reach their full height potential and often experience impaired cognitive development, which can result in poor academic performance, reduced economic productivity in adulthood, and increased susceptibility to chronic diseases. These negative consequences contribute to a

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cycle of poverty and inequality, highlighting the pressing need for effective interventions (Agustian *et al*., 2023; Delima *et al*., 2023; Mustakim *et al*., 2022)

Improving socioeconomic conditions and expanding the availability of postpartum vitamin supplements are crucial in reducing the significant impact of stunting. Implementing family planning activities and programs prioritizing maternal health during pregnancy and lactation is essential for enhancing child health outcomes and reducing the likelihood of stunting (Kusumajaya *et al*., 2023; Nomura *et al*., 2023; Thahir *et al*., 2023). Comprehensive strategies addressing both prenatal factors—such as maternal height, weight gain, and anemia—and postnatal factors—including breastfeeding practices, infection control, and dietary diversity—are necessary for effective stunting prevention (Krisnana *et al*., 2020; Sartika *et al*., 2021). Research has consistently identified several determinants of stunting, including maternal characteristics (e.g., education, short stature, poor nutritional status before and during pregnancy), child-specific factors (e.g., age, disease burden, inappropriate feeding practices during the first 1,000 days of life), household conditions (e.g., wealth index, family size, place of residence), and access to essential services (e.g., healthcare utilization, water, and sanitation facilities) (Bustos *et al*., 2023; Permatasari *et al*., 2023; Yefri *et al*., 2022). Additionally, numerous studies have explored the impact of various risk factors on stunting, such as malnutrition, infectious diseases, household environment, child sex, birth weight, maternal body mass index, food security, maternal occupation, household size, number of children under five, exclusive breastfeeding duration, and the timing of complementary feeding introduction (Imaniar *et al*., 2022; Kasmita *et al*., 2023; Linawati, 2022; Louis *et al*., 2022; Mahudeh *et al*., 2023; Nurlita sari *et al*., 2022; Puspitasari *et al*., 2023).

Despite the wealth of knowledge on the determinants of stunting, there remains a significant gap in understanding the role of local factors, such as cultural practices, customs, and beliefs, which may uniquely influence stunting in specific contexts. This gap underscores the importance of conducting localized studies to identify and address the specific causes of stunting within different communities. This study aims to analyze the sociodemographic and sociocultural factors associated with stunting among children aged 6-59 months in Gorontalo, Indonesia. The novelty of this study lies in its focus on the unique cultural and contextual factors influencing stunting in Gorontalo, which have not been extensively explored in previous research. By identifying these local determinants, this study aims to inform targeted interventions and policies to effectively reduce stunting rates in the region. The findings are expected to contribute to the broader body of literature on stunting by highlighting the importance of considering local contexts in the design and implementation of nutrition and health programs.

Method

This study employs a descriptive-analytic research design with a cross-sectional approach to analyze sociodemographic and sociocultural factors associated with the incidence of stunting in the Tilango Subdistrict of Gorontalo Regency in 2022. Cross-sectional studies observe subjects at a single point in time, with measurements conducted concurrently with the study. This approach is suitable for examining associations between various factors and the occurrence of stunting within the specified timeframe. The population for this study comprises all toddlers residing in the Tilango Subdistrict, Gorontalo Regency, totaling 1,377 individuals. To determine an appropriate sample size, the population proportion formula was used, factoring in a stunting prevalence of 12.4%, a desired level of absolute accuracy (d) of 5%, and a significance level (Zα) of 95% (1.96). The calculated sample size meets the minimum requirements established by the rule of thumb formula, which recommends a sample size of 5-50 times the number of independent variables under study, with 10 times being the most recommended.

Sampling was conducted using a consecutive sampling technique. This method ensures that all eligible participants who meet the study criteria are included until the required sample size is reached. The inclusion criteria for this study were parent and child

pairs where the child is aged 6-60 months, residing in the Tilango Subdistrict, and the mother possesses a KIA (Maternal and Child Health) book. Additionally, parent and child pairs had to be willing to participate as research subjects. Exclusion criteria included mothers with children with congenital abnormalities, as these conditions could confound the study's results. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) Version 25. Univariable analysis determined the frequency distribution of both dependent and independent variables. Bivariable analysis used the Chi-Square test to examine relationships between sociodemographic and sociocultural factors and stunting.

Table 1. Prevalence of Stunting in Tilango Subdistrict, Gorontalo Regency, 2022

Height	n	(%)
Normal	209	64,3
Stunting	116	35,7
Total	325	100

Source: Primary Data, 2022

Table 2. Characteristics Based on Sociodemographic Factors:

Factors	n	%
Birth Body Length		
Normal (≥ 48)	201	61,8
Short (<48)	124	38,2
Birth weight		
Normal (≥2500)	271	83,4
Low (<2500)	54	16,6
Gender		
Woman	164	50,5
Man	161	49,5
Mother's Age		
Safe (20-35)	241	74,2
At risk (<20/>35)	82	25,2
Maternal Education		
College	33	10,2
Senior High School	113	34,8
Junior High School	68	20,9
Elementary School	76	23,4
Not Graduated from Elementary School	35	10,8
Father's Education		
College	22	6,8
Senior High School	101	31,1
Junior High School	42	12,9
Elementary School	108	33,2
Not Graduated from Elementary School	52	16
Income		
RMW (≥ Rp 2.384.020)	86	26,5
RMW (< 2,384,020)	239	73,5
Mother's Height		

Normal (>150)	182	56
Short (<150)	143	44
ANC		
Sufficient (≥ 6)	244	75,1
Less (<6)	81	24,9
Upper arm circumference		
Normal (≥ 23,5)	237	72,9
Less(<23.5)	88	27,1
Parity		
Primipara	88	27,1
Multipara	237	72,9
Lactation		
EBF	168	51,7
No EBF	157	48,3
Complementary foods		
Suitable (≥6 months)	168	51,7
Early (<6 months)	157	48,3

Source: Primary Data, 2022

Table 3. Characteristics Based on Parenting Factors and Food Diversity

Factors	n	%
Food Diversity Diverse Not Diverse	193 132	59,4 40,6
Feeding Parenting Good Less	125 200	38,5 61,5

Source: Primary Data, 2022

Table 4. Association of Sociodemographic Factors with Stunting Incidence in Tilango Subdistrict, Gorontalo Regency (n=325)

Variable	Height		Total n (%)	p	PR
	Normal n (%)	Stunting N (%)			(95% CI)
Birth length: Normal (≥ 48) Short (<48)	 152 (75,6) 57 (46)	 49 (24,4) 67 (54)	 201 124	0,000	3,65 (2,261-5,88)
Birth weight: Normal (≥2500) Low (<2500)	 195 (72) 14 (25,9)	 76 (28) 40 (74,1)	 271 54	0,000	7,3 (3,774-14,238)
Gender: Female Male	 104 (63,4) 105 (65,2)	 60 (36,6) 56 (34,8)	 164 161	0,734	0,92 (0,587-1,456)
Mother's age: Safe (20-35) Risky (<20/>35)	 154 (63,1) 56 (68,3)	 89 (36,9) 26 (31,7)	 243 82	0,636	0,81 (0,456-1,562)

Mother's Education:					
College	27 (81,8)	6 (18,2)	33		1,0
Senior High School	75 (66,4)	38 (33,6)	113		2.23 (0,867-5,996)
Junior high school	39 (57,4)	29 (42,6)	68	0,163	3,35 (1,223-9,157)
Primary school	47 (61,8)	29 (38,2)	76		2,78 (1,023-7,535)
No School	21 (60)	14 (40)	35		3,00 (0,985-9,135)
Father's Education:					
College	17 (77,3)	5 (22,7)	22		1,0
Senior High School	71 (70,3)	30 (29,7)	101		0,37 (0,119-1,157)
Junior high school	21 (50)	21 (50)	42	0,7	0,53 (0,266-1,066)
Primary school	71 (65,7)	37 (34,3)	108		1,26 (0,558-2,850)
No School	29 (55,8)	23 (44,2)	52		0,657 (0,334-1,292)
Income:					
RMW (≥ Rp 2.384.020)	60 (69,8)	26 (30,2)	86	0,218	1,394 (0,821-2,367)
Less RMW (< 2.384.020)	149 (62,3)	90 (37,7)	239		
Mother's Height:					
Normal (>150)	124 (68,1)	58 (31,9)	182	0,105	1,459 (0,924-2,303)
Short (<150)	85 (59,4)	58 (40,6)	143		
Ante Natal Care:					
Enough (≥ 6)	162 (66,4)	82 (33,6)	244	0,173	1,429 (0,854-2,392)
Not enough (<6)	47 (58)	34 (42)	81		
Upper Arm Circumference:					
Normal (≥ 23,5)	156 (65,8)	81 (34,2)	237	0,349	1,272 (0,768-2,106)
Lack (<23,5)	53 (60,2)	35 (39,8)	88		
Parity:					
Primipara	57 (64,8)	31 (35,2)	88	0,915	1,028 (0,616 – 1,715)
Multipara	152 (64,1)	85 (35,9)	237		
Breast Milk:					
EBF	131 (78)	37 (22)	168	0,000	3,586 (2,217-5,799)
Not EBF	78 (49,7)	79 (50,3)	157		
Complementary foods for breast milk:					
In accordance (≥6 months)	131 (78)	37 (22)	168	0,000	3,586 (2,217-5,799)
Early (≥6 months)	78 (49,7)	79 (50,3)	157		

Source: Primary Data, 2002, *Chi-Square Test*

Table 5. Association of Factors in Food Diversity and Parenting Style with Stunting in Tilango Subdistrict, Gorontalo Regency (n=325)

Variable	Height		Total n (%)	p	PR
	Normal n (%)	Stunting n (%)			(95% CI)
Food Diversity:					
Various	167 (86,5)	26 (13,5)	193	0,000	13,764 (7,924-23,908)
Not Diverse	42 (31,8)	90 (68,2)	132		
Parenting Pattern of Feeding:					
Well	90 (43,1)	35 (30,2)	209	0,030	1,750 (1,081-2,834)
Not enough	119 (56,9)	81 (69,8)	116		

Source: Primary Data, 2002, *Logistic Regression Test*

Table 6. Modeling Results of Multivariate Analysis of Factors Related to Stunting in Tilango Subdistrict, Gorontalo Regency (n=325)

Variables	P Value	PR (95% CI)
Birth Lenght	0,006	0,377 (0,188-0,754)
Birth Weight	0,001	0,231 (0,095-0,561)
Exclusive Breastfeeding	0,000	0,307 (0,164-0,575)
Food Diversity	0,000	0,064 (0,033-0,123)
Mother's Education		
Mother's Education (1)	0,065	0,237 (0,051-1,096)
Mother's Education (2)	0,403	0,629 (0,212-1,865)
Mother's Education (3)	0,820	0,875 (0,277-2,769)
Mother's Education (4)	0,767	0,844 (0,275-2,589)
Family Income	0,207	0,610 (0,283-1,315)

Result and Discussion

Based on Table 1. data collected from 325 subjects revealed that 116 (35.7%) experienced stunting. The frequency distribution of respondents can be seen in the table below:

The table reveals several results regarding the characteristics of the respondents, notably, 38.2% of children were born with a shorter body length (<48 cm), and 16.6% had a low birth weight (<2500 g). A significant portion of families (73.5%) had incomes below the Regional Minimum Wage (RMW), and 44% of mothers were of shorter stature (<150 cm). Additionally, 24.9% of mothers had insufficient antenatal care visits (<6), and 27.1% had a low upper arm circumference (<23.5 cm).

The result shows that 40.6% of children did not receive a diverse diet, and 61.5% experienced less effective feeding parenting. Various sociodemographic factors related to the incidence of stunting in the Tilango Health Center's operational area were examined among 325 mother-child. The analysis was conducted based on bivariate analysis of each independent variable, which included sociodemographic factors (birth body length, birth weight, gender, mother's age, maternal and paternal education, family income, mother's height, antenatal care (ANC), maternal nutritional status, parity, exclusive breastfeeding, and timing of complementary feeding). The results are presented in Table 4 which identifies several significant sociodemographic factors associated with stunting. Short birth length (<48 cm) and low birth weight (<2500 g) were strongly linked to higher stunting rates, with prevalence ratios (PR) of 3.65 and 7.3, respectively. Exclusive breastfeeding (EBF) and timely introduction of complementary foods (≥6 months) were protective against stunting, with EBF showing a PR of 3.586. These results emphasize the critical importance of adequate prenatal and postnatal care, proper nutrition, and feeding.

Table 4. identifies several significant

sociodemographic factors associated with stunting. Short birth length (<48 cm) and low birth weight (<2500 g) were strongly linked to higher stunting rates, with prevalence ratios (PR) of 3.65 and 7.3, respectively. Exclusive breastfeeding (EBF) and timely introduction of complementary foods (≥6 months) were protective against stunting, with EBF showing a PR of 3.586. These results emphasize the critical importance of adequate prenatal and postnatal care, proper nutrition, and feeding practices in preventing stunting. Meanwhile, children who did not receive a diverse diet had a substantially higher risk of stunting, with a prevalence ratio (PR) of 13.764. Additionally, inadequate feeding practices were associated with a higher likelihood of stunting, indicated by a PR of 1.750. These findings underscore the importance of promoting diverse diets and proper feeding practices to mitigate stunting in children. The result of the bivariate analysis in Table. 5 highlights the significant impact of food diversity and parenting patterns on stunting.

The multivariate analysis identifies several significant factors associated with stunting in Tilango Subdistrict, Gorontalo. Birth length (p=0.006), birth weight (p=0.001), exclusive breastfeeding (p=0.000), and food diversity (p=0.000) were strongly associated with reduced stunting risk. Specifically, diverse food intake showed a particularly low prevalence ratio (PR) of 0.064, indicating a strong protective effect. These findings emphasize the importance of ensuring adequate birth measurements, exclusive breastfeeding, and dietary diversity to effectively reduce stunting rates. The result can be shown in the Table 6.

Table 4 identifies several significant sociodemographic factors associated with stunting; one of them is a short birth length with a p-value of 0.000. A short birth length carries a 3.65 times higher risk of stunting compared to a normal birth length. The baby's body length at birth describes the baby's linear growth during pregnancy. A low linear measurement usually indicates a state of malnutrition that was due to a past lack of energy and protein that started with slowing or delayed fetal growth (Destarina, 2018; Krebs *et al*., 2022). Insufficient maternal dietary intake before and during pregnancy leads to fetal growth disruptions, resulting in newborns with reduced birth lengths. Due to prenatal malnutrition, these infants are at a higher risk of experiencing stunted growth during childhood. Pregnant women must consume adequate nutrition both before and during pregnancy to promote optimal development of their children (Ali, 2021; Asna & Syah, 2023; Kofinti *et al*., 2022). Addressing and preventing malnutrition in pregnant women is essential to breaking the cycle of stunted growth and improving overall health outcomes for future generations.

Based on the results, birth weight showed a p-value of 0.000 and a PR of 7.3, indicating that low birth weight carries a 7.3 times higher risk of stunting. Infants with low birth weight (LBW) typically experience slower growth and development compared to those born at normal weights (Ramadhan *et al*., 2023; Sutarto *et al*., 2021). LBW newborns have an underdeveloped immune system, which makes them more prone to illnesses. This increases the chances of infant death, chronic diseases in adulthood, mental delays, and stunted growth. All of these factors add to the potential for stunting (Ramadhan *et al*., 2023; Zahriany, 2017). This increased vulnerability underscores the critical need for targeted healthcare interventions. Research indicates that significant improvements in postnatal growth are closely linked to enhanced intrauterine growth, particularly during early pregnancy. Effective prenatal care, including proper maternal nutrition and health monitoring, is essential in mitigating these risks (Simbolon *et al*., 2021; Tyas & Setyonaluri, 2022). By improving maternal health and addressing factors contributing to LBW, healthcare providers can better support the growth and development of these infants, ultimately reducing the long-term risks associated with stunted development (Amaha & Woldeamanuel, 2021). This comprehensive approach highlights the importance of early and sustained interventions to ensure healthier outcomes for LBW infants.

Infants who are solely breastfed for the initial six months experience a substantial 3.8-fold decrease in the likelihood of stunting. Ensuring that feeding methods are aligned with the developmental needs of newborns is

essential for both minimizing early growth disruptions and promoting long-term health advantages. This strategy is supported by multiple studies (De Castro *et al*., 2023; Ekholuenetale *et al*., 2022; Hura *et al*., 2022). Excessive breastfeeding delivers optimal nutrition essential for healthy growth and development. Thus, promoting exclusive breastfeeding is paramount in ensuring optimal growth and reducing the burden of childhood malnutrition-related issues.

Introducing complementary feeding either too early or too late, or providing it inadequately, can result in nutritional deficiencies and growth problems. This improper timing can disrupt the balance of essential nutrients needed for optimal infant development, leading to issues such as stunting, undernutrition, or even obesity. Research consistently shows that infants who receive timely and appropriate complementary foods experience better health outcomes compared to those with poorly timed or insufficient feeding practices (De Castro *et al*., 2023; Ekholuenetale *et al*., 2022; Hura *et al*., 2022). For instance, studies have highlighted that adhering to recommended guidelines for complementary feeding significantly reduces the risk of growth faltering and ensures a more balanced intake of vital nutrients. Thus, emphasizing the importance of proper timing and adequacy in complementary feeding is essential for safeguarding infant health and promoting optimal growth and development.

Food diversity is a key indicator of the quality of a toddler's diet, which reduces the likelihood of stunting by 13 times as shown by the p-value 0,000 and PR 13,7. Low dietary diversity is linked to an increased risk of stunting and other nutritional issues, such as overweight, dyslipidemia, and metabolic syndrome. Local factors, including customs and community beliefs, significantly influence food diversity. Ensuring a diverse diet is crucial because it provides a range of essential nutrients necessary for proper growth and development. Previous studies have consistently shown that children with a more varied diet have better health outcomes. For example, research has demonstrated that dietary diversity is associated with improved micronutrient intake and overall nutritional status, vital for preventing stunting and other health complications (De Castro *et al*., 2023; Ekholuenetale *et al*., 2022; Hura *et al*., 2022).

The parenting pattern of feeding plays a pivotal role in influencing the occurrence of stunting in children. Studies consistently demonstrate that responsive and nurturing feeding practices, where caregivers are attuned to the nutritional needs and cues of their children, are associated with better growth outcomes and reduced risk of stunting (Abdulaziz *et al*., 2024; Humaira *et al*., 2023). In contrast, authoritarian or neglectful feeding patterns, characterized by rigid or inconsistent feeding schedules, may contribute to inadequate nutrient intake and growth faltering. Research by several scholars underscores that positive feeding interactions, such as responsive feeding and encouragement of healthy eating habits, foster optimal nutritional intake and support linear growth in children (Nita *et al*., 2023; Putri & Rong, 2021). These findings highlight the critical need for caregivers to adopt nurturing and responsive feeding practices that promote a supportive feeding environment, thereby mitigating the risk of stunting and ensuring overall well-being in early childhood.

Conclusion

The findings of this investigation highlight a persistently high prevalence of stunting in the Tilango Subdistrict, amounting to 35.7%. Significant associations were observed between sociodemographic factors such as birth length, birth weight, exclusive breastfeeding, and timely introduction of complementary foods, alongside socio-cultural factors including food diversity and parenting patterns, all influencing the incidence of stunting. Birth length and birth weight emerged as primary determinants, underscoring the critical impact of prenatal nutrition and early developmental stages on childhood growth outcomes. Concurrently, food diversity played a pivotal role, indicating the importance of a varied diet in mitigating stunting risks.

Furthermore, maternal education and household income were identified as confounding variables, highlighting their indirect but influential roles in shaping

nutritional outcomes among children. These findings underscore the imperative of optimizing the first 1000 days of life, particularly through enhanced maternal nutrition during pregnancy to ensure optimal birth weight and length. Promoting exclusive breastfeeding and enhancing food diversity are crucial strategies to ameliorate stunting rates. Addressing these multifaceted factors through targeted interventions tailored to local contexts is essential for achieving sustained improvements in child health and nutrition in the Tilango Subdistrict and similar settings globally.

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Diabetes Treatment Satisfaction on Hospital Outcome through Patient Empowerment

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Abstract

This study examines the relationship between Patient Satisfaction with Diabetes Treatment and Hospital Reputation, with Patient Empowerment and Well-being acting as mediators. Additionally, this study includes Lifestyle as the moderating component. This quantitative, cross-sectional study employs a survey methodology using a structured questionnaire of respondents selected by quota sampling. A total of 160 respondents were obtained from two private hospitals. Data was analyzed using Partial Least Square-Structural Equation Modelling (PLS-SEM). Diabetes Treatment Satisfaction is assessed as a higher-order construct (HOC) consisting of dimensions of Patient Empowerment as a lower-order construct (LOC). The three LOCs are Patient Control, Patient Participation, and Patient Support. This study employs a disjoint two-step methodology. The research findings indicate a strong and positive relationship between Diabetes Treatment Satisfaction and Hospital Reputation mediated by Patient Empowerment and Patient well-being. The indirect effect is statistically significant (p-value < 0.05, CI 95%). The analysis also reveals a strong relation between Patient Well Being and Hospital Reputation (β=0.842, f2=2.427). However, the Lifestyle variable did not substantially relate to the relationship between Diabetes Treatment Satisfaction and Patient well-being. This study model has been empirically validated to provide sufficient explanatory and predictive capacities for assessing hospital reputation.

Introduction

A recent study conducted by The Lancet indicates that the global prevalence of diabetes is projected to affect over 1.31 million individuals by the year 2050 (Lancet, 2023). This discovery highlighted the worldwide consequences of diabetes, resulting in changes to quality of life, death rates, and additional health issues (Sun *et al*., 2021). The occurrence of diabetes in Indonesia has been consistently rising. The World Health Organization's report revealed that Indonesia ranks in the top 10 countries with the highest prevalence of diabetes, affecting a staggering 8.5 million individuals (WHO, 2022). Therefore, it is imperative to implement a more holistic approach to treating diabetes patients, focusing on enhancing private hospitals' role in empowering patients.

The healthcare providers mirror the substantial transformation taking place over the years. 4 This fosters an intricate and ever-changing perspective in the healthcare sector, particularly in patient empowerment. Patient empowerment aims to provide patients with information, assistance, and self-assurance, enabling them to engage and collaborate actively in health-related decisions (Mogueo & Defo, 2022). The deployment of this context in patient care within the healthcare business significantly relates to the quality of life and life expectancy of individuals, as well as enhances the quality of medical care and patient satisfaction (Stampe *et al*., 2021). Patient empowerment is continuously growing, with healthcare providers and patients

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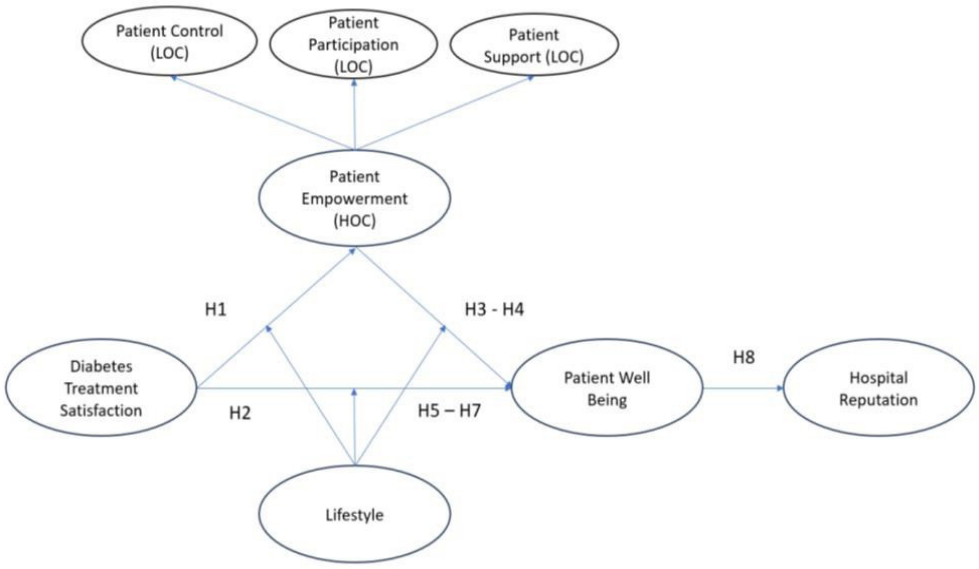

FIGURE 1. Conceptual Framework

playing a role in its advancement. A study conducted by Weisbeck, Lind, and Ginn (2019) demonstrated that patient empowerment significantly contributed to the successful continuation of long-term therapy, enhancing the overall therapeutic outcome, including the survival rate. Empowerment improves patients' autonomy and participation in decision-making and healthcare, particularly in chronic conditions. Individuals diagnosed with chronic diseases often experience significant concerns regarding the numerous uncertainties they meet and the limitations imposed on their daily activities as a result of their health condition.

This uncertainty may be accompanied by a sense of helplessness and a feeling of impotence that arises from the disruption of the physical, psychological, and social components of the patient's existence. According to research conducted by Stepanian *et al.* (2023), patient empowerment is crucial for enhancing the ability of individuals with chronic diseases to take charge of their health. Implementing patient empowerment in care delivery is anticipated to yield several favorable results for the organization, including enhancing the quality of treatment delivery, boosting patient satisfaction, and promoting patient involvement in decision-making (Gregg *et al.*, 2019). Diabetes patient care entails a systematic approach prioritizing regular and patient-focused therapy, which necessitates continuous communication and collaboration between the patient and the healthcare team (Garcimartín *et al.*, 2020). One common approach to assess a hospital's reputation among patients is to use patient satisfaction surveys that measure service quality (Verweij *et al.*, 2022). Attaining patient satisfaction is vital in diabetes therapy as it can improve self-efficacy, medication adherence, and long-term glycemic control (Hickmann *et al.*, 2022).

Previous studies contend that patient empowerment, self-management education, and lifestyle modification are pivotal in managing diabetes mellitus (Navarro Martínez *et al.*, 2021). Another recent study stated that patient empowerment aims to enhance patients' understanding, abilities, and self-assurance in handling their healthcare (Acuña Mora, Sparud-Lundin, Fernlund, *et al.*, 2022; Acuña Mora, Sparud-Lundin, Moons, *et al.*, 2022). Patient involvement positively affects patient loyalty, and this effect is partly mediated by patient satisfaction. In addition, patient loyalty in primary care is a significant measure of care quality and well-being (Yeo *et al.*, 2021). This study investigates the relationship between patient empowerment, patient satisfaction, and patient well-being and their perception of the hospital, eventually affecting its reputation. This research seeks to better comprehend the interaction and connection between these factors concerning the patient's experience. This

insight will contribute to improving diabetes care and enhancing hospitals' reputation as great healthcare providers. This research can also provide a foundation for developing more effective strategies to strengthen healthcare in collaboration with the private sector.

Within the conceptual framework, patient empowerment and welfare mediate the relationship between diabetes treatment satisfaction and hospital reputation. Patient empowerment encompasses three distinct dimensions: patient control, patient involvement, and patient support. Similarly, the way of life influences the connection between satisfaction with diabetes treatment and patient empowerment and health.

Materials and Method

The quantitative survey was conducted cross-sectionally in 2024 at two private hospitals in Manado, Indonesia. Both are accredited hospitals with an internal medicine outpatient department facilitated by more than 200 beds and services specifically integrated for diabetic patients, making them ideal study subjects. For this study, the Research Committee Ethic of Pelita Harapan University has granted ethical approval (No: 023/M/EC-Nov/XI/2023). All eligible participants voluntarily completed the questionnaire. The targeted population of this study were diabetic type II patients without terminal complications, such as multi-organ failure or patients needing dialysis. Respondents were taken purposively based on several criteria. Inclusion criteria are chronic patients diagnosed with diabetes; respondents must be fully aware and awake, willing to collaborate when completing the questionnaire, and have previous experience meeting and communicating with the doctors. The study was carried out from October to November of 2023. The sample size was calculated using G*power (version 3.1.9.4) with a significance of 0.05, an effect size of 0.15, and a power of 0.90 (Sarstedt *et al*., 2022). The minimal sample size was determined to be 116 respondents. According to the recommendations for analysis, Partial Least Square-Structural Equation Modeling (PLS-SEM) was used. However, the inverse square root method is recommended based on the reference for the minimum sample size for research using PLS-SEM. If the power cannot be determined, the minimum sample required is at least 160 respondents. This quantity fulfilled the requirements for the minimal sample requirement. For data analysis, 160 questionnaires were considered eligible.

This research instrument uses a structured questionnaire with closed questions. A 1–5 Likert scale was used to quantify these study variables, and the question items were taken from earlier studies from Sekaran and Bougie (2020). Diabetes treatment satisfaction was adapted from (Saisho, 2018). Hospital reputation was adapted from Satir (2006). Patient wellbeing and patient empowerment were adapted from Law, Steinwender and Leclair (1998) and Robyn, Jillian and Lester (2015), respectively. Lastly, the lifestyle variable was adapted from a study by (Glendinning *et al*., 1995). A professional linguist translated this questionnaire from English to Indonesian and assessed it by an expert panel of three academics to ensure validity. After receiving input from the expert panel, improvements were made to the question sentences so that respondents could better understand them. SmartPLS® version 4.1.0.2 was used for the PLS-SEM analysis, as it offered a bootstrapping menu for significance testing. This approach was chosen for its ability to test complex models in explanatory survey research. The primary models used in PLS-SEM were the measurement model (outer model) and the structural model (inner model) (Bougie & Sekaran, 2020). The reliability and validity of the connections between the indicators and constructs were evaluated using the measurement model. The structural model was used to assess the critical association between each component in the study model (Sarstedt *et al*., 2022; Shmueli *et al*., 2019).

Result and Discussion

A total of 160 respondents who fulfilled the study's requirements were included in the research. According to their demographic profile, most respondents (52.8%) were female. According to the age group, most of the participants were in the age range of 46 to 60 years. Most patients had their recent visit to the internal medicine outpatient department within the last 1 – 3 years. More than half of the patients only consumed oral anti-diabetics treatment, and most of the respondents also showed

TABLE 1. Respondents Characteristic

Demographic variables	Category	Sample (n)	Percentage (%)
Gender	Male	76	47.5
	Female	84	52.5
Age	17–25 years old	1	0.6
	26–36 years old	2	1.3
	37–45 years old	14	8.8
	46–60 years old	143	89.4
Weight	40–50 kg	15	9.4
	51–60 kg	48	30
	61–70 kg	53	33.1
	> 70 kg	44	27.5
Education	Elementary	0	0
	Junior high	24	15
	Senior high	88	55
	University	48	30
Recent visit to internal medicine outpatient	1–6 months	38	23.8
	6 months–1 year	21	13.1
	1–3 years	59	36.9
	3–5 years	42	26.3
Anti-diabetic medication used	Oral	109	68.1
	Insulin	40	25
	Combination	11	6.9
Diabetes-related complications	Yes	20	12.5
	No	140	87.5
Health insurance	Public insurance	160	100
	Private insurance	0	0
	Others	0	0

no diabetes-related complications. This data shows that most patients in this study have achieved reasonable glycemic control with oral medications. All of the respondents in the present study received treatment with public insurance. The demographic profile (Table 1) displays the characteristics of the research participants.

The Heterotrait-Monotrait (HT/MT) ratio determined the discriminant validity test. Given that every indicator in the research model had been adequately discriminated against to allow the assessment of each construct, it was determined that all the constructs in this study's validity test had values less than 0.9 (Table 2) (Henseler *et al*., 2015; Sarstedt *et al*., 2022). R2 determined the structural model's explanatory strength, while Q^2_predict assessed its predictive relevance. The standard method bias (CMB) caused by errors or biases in the measurement process was previously evaluated using the inner variance inflation factor (VIF). The results of this investigation suggest that there is no standard method bias in this model, as all constructs have an inner VIF value between 3 and 5 (Shmueli *et al*., 2019).

The results of this study model indicate that the HR and PWB variable R^2 were classified as having moderate to vital predictive accuracy at 0.708 and 0.683, respectively. Subsequently, variable PE was found to have weak predictive accuracy with an R^2 value of 0.386. These findings indicate that this model has adequate explanatory power. PLS_predict was deployed

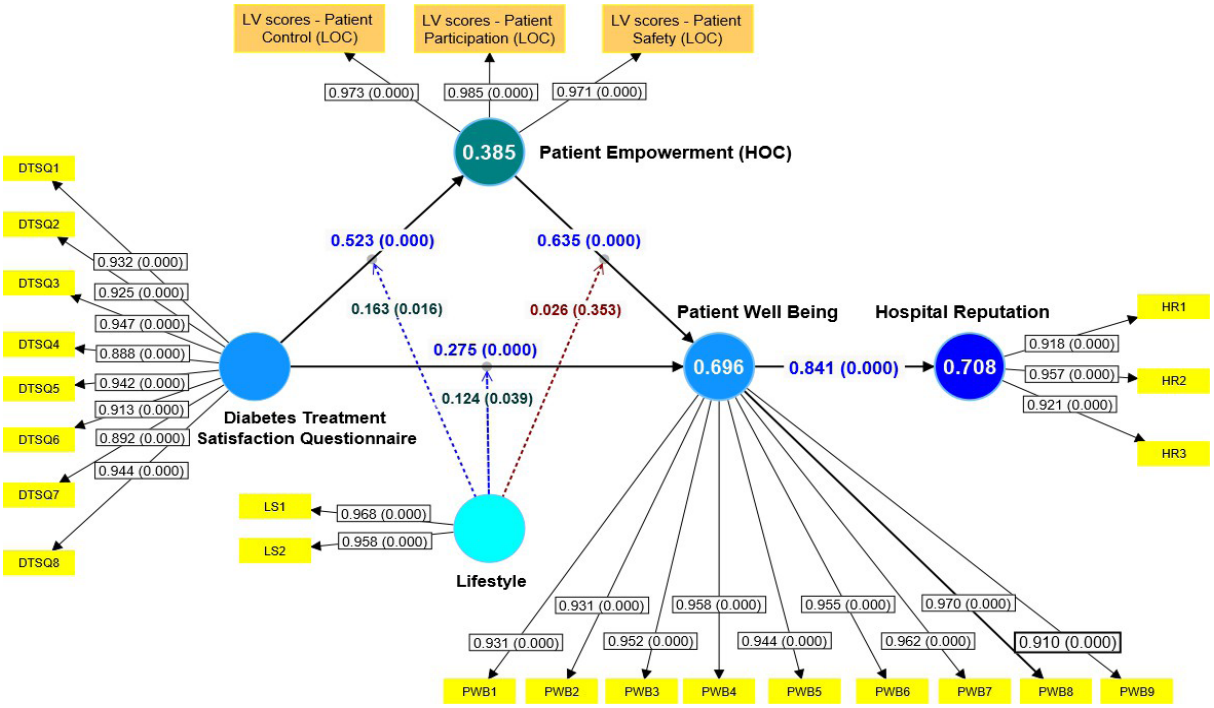

FIGURE 2. PLS-SEM Structural Model

TABLE 2. Heterotrait-Monotrait Ratio (HTMT) – Matrix

First Stage						
	DTSQ	HR	PP	PC	PS	PWB
DTSQ	1					
HR	0.780	1				
PC	0.612		1			
PP	0.568		0.964	1		
PS	0.533		0.920		1	
PWB	0.550		0.670		0.702	1

Second Stage						
	DTSQ	HR	LS	PE	LS x DTSQ	LS x PE
DTSQ	1					
HR	0.780	1				
LS	0.322	0.186	1			
PE	0.588	0.646		1		
PWB	0.550	0.878		0.681	1	
LS x DTSQ	0.131	0.446		0.092	1	
LS x PE	0.122	0.121		0.249	0.661	1

to assess the model's overall prediction ability. The cross-validated predictive ability test (CVPAT) was a better method for evaluating a model's predictive performance (Hair *et al.*, 2019). The average indicator (IA) and PLS-SEM are compared in the research findings. The linear model thus displays a negative value compared to IA, indicating a smaller error value in PLS-SEM. In contrast, a positive value for LM suggests that the model has adequate

TABLE 3. Cross-Validated Predictive Ability Test

	PLS-SEM Vs. Indicator Average (IA)		PLS-SEM Vs. Linear Model (LM)	
Variable	Average Loss Difference	P-Value	Average Loss Difference	P-Value
HR	-0.916	0.000	0.361	0.000
PE	-0.503	0.000	0.767	0.000
PWB	-0.701	0.000	0.865	0.000
Overall	-0.578	0.000	0.758	0.000

TABLE 4. Hypotheses Test Result

Hypotheses		P-values	Confidence Interval		Result	f2
			5.0%	95.0%		
DTSQ → PE	0.523	0.000	0.462	0.591	Hypothesis supported	0.380
DTSQ → HR	0.275	0.000	0.181	0.371	Hypothesis supported	0.152
PE → PWB	0.635	0.000	0.551	0.717	Hypothesis supported	0.780

predictive power (Shmueli *et al.*, 2019). The results of CVPAT are shown in Table 3.

Based on the bootstrapping feature hypothesis testing findings (Table 4), seven hypotheses were accepted with $p < 0.05$ and confidence intervals (CI) of 5% and 95% in the hypothesized direction. H7, on the other hand, was not supported since they needed to match the importance requirements. This implies that lifestyle has no significant effect as a moderating factor between patient empowerment and patient wellbeing, meaning patients' perceptions regarding their daily health-related habits must be elevated to increase their awareness.

All variables with direct routes to PE, PWB, and HR exhibit significant effect sizes. The paths from DTSQ to PE, PE to PWB, and PWB to HR all have a significant effect size. Notably, the path from PWB to HR has the most significant effect size, with a f^2 value of 2.247. This demonstrates a robust relationship between PWB and HR, suggesting that PWB substantially influences HR. However, the impact of LS x DTSQ on PE is deemed moderate, as indicated by an f^2 value of 0.017, which suggests that the effect of LS and DTSQ on PE is relatively minor compared to other variables. The relationship between LS x PE and PWB was determined to have a negligible effect size, as indicated by a f^2 value of 0.001. This suggests no meaningful association or influence of LS x PE on PWB. Thus, the available evidence does not support the claim that the interplay between these variables adequately explains the heterogeneity of PE and PWB. These results suggest that the model demonstrates a satisfactory effect size.

This study aims to empirically examine the research model within the specific context of diabetes treatment satisfaction. Diabetes mellitus is a complex metabolic condition defined by elevated blood sugar levels caused by either insufficient insulin production, impaired insulin function, or a combination of both. The persistent high blood sugar levels in diabetes are linked to unique long-term issues affecting small blood vessels. Therefore, providing high-quality treatment for diabetic patients requires an intricate delivery of care, focusing on patient centricity. A meticulous approach is oriented around the needs and preferences of the individual patient (Punthakee *et al.*, 2018). More research needs to be done on the relationship between psychological empowerment and hospital reputation in Indonesia. This research is expected to provide a valuable contribution to the field of hospital management, especially in the context of quality of diabetes treatment satisfaction, patient empowerment, patient well-being, and the hospital's reputation.

According to the data analysis, it is evident that seven of the eight paths examined

have a substantial relation that aligns with the hypothesis. A significant discovery from this study is that patient well-being can mediate other variables effectively, with a coefficient value of 0.842. This is followed by the relation of patient empowerment to patient wellbeing, with a coefficient of 0.620. In addition, the indirect relation analysis revealed that the most influential path was from patient empowerment to hospital reputation, mediated by patient wellbeing, with a coefficient value of 0.522. However, the path from PE to PWB mediated by LS is found to be not supported. This might be related to various exogenous and endogenous reasons that could affect an individual's lifestyle. Generally, the idea of health determinants includes the social, economic, and physical environment and additionally the person's characteristics and behavior (Hillger, 2008). In some contexts, patient empowerment may not always be positively related to patient well-being. This follows a research by Brown (Brown *et al*., 2023), which provides an example that too much control and responsibility given to patients without adequate support can cause excessive stress, thus hurting their well-being. Research by McMaughan (McMaughan *et al*., 2020) also suggests that in cases where the patient's lifestyle is unhealthy, the negative impact of patient empowerment may be amplified. A poor lifestyle can place an additional burden on patients who feel empowered, as they may feel more pressure to manage their health without adequate support. Apart from that, there are also other factors such as social support, quality of treatment, or the patient's basic health condition which may have more influence on the patient's well-being and empowerment than their lifestyle (Lee *et al*., 2022).

This finding is consistent with prior research conducted by (Bailo *et al*., 2019) and (Yeh *et al*., 2018), demonstrating that empowering patients with chronic diseases has various beneficial effects. These effects include higher patient satisfaction with their care, improved adherence to treatment self-management, and better clinical outcomes. However, this study offers novel insight that PE should mediate the relationship between DTSQ and behavior intention. As patients are the ones who start and create behavioral change, the possibility of manipulating or imposing values is reduced. Essentially, patient education is to empower patients to reorient themselves independently. The findings of this study align with the proposition put forth by (Lin *et al*., 2020) that behavioral intention serves as a crucial mediator between patient empowerment and behavioral intention, which in turn directly impacts diabetes self-care behaviors. Patient's well-being in healthcare can be seen as a service experience that resembles a process that involves their notions of well-being and a requirement for assistance in dealing with the decline in their health (Ryynänen, 2023). The findings of this study are consistent with the research conducted by (Ramos-Vera *et al*., 2022), which concluded that patient well-being plays a crucial role as a mediator in the link between satisfaction with medical care and physical health. Prior research has also demonstrated a relationship between satisfaction with healthcare services and overall health conditions (Paul *et al*., 2016). Placing patients' well-being as a top priority is crucial in ensuring high-quality healthcare. This can be accomplished by providing personnel with effective, culturally adaptable, and competent training to promote healthy lifestyle choices among patients, followed by a thorough evaluation (Ramos-Vera *et al*., 2022).

The study's findings indicate that hospital administration should prioritize enhancing patient empowerment, particularly among individuals with chronic illnesses such as DMT2. Patient empowerment is becoming one of the determinants in DMT2 patients as the population at risk. Research has shown that patient empowerment is linked to favorable health results, such as the ability to control one's health, belief in one's abilities, cost efficiency, and overall quality of life (Ahmed *et al*., 2023). Private healthcare facilities, in particular, can benefit from patient empowerment by enhancing patient happiness, improving health outcomes, and promoting improved communication. Patients actively involved in their healthcare are more likely to follow their treatment programs, resulting in lower costs and improved efficiency. These activities reinforce relationships, cultivate trust, and augment the

hospital's reputation, ultimately attracting a more extensive patient base and enhancing the overall quality of care. Enhanced educational initiatives, psychological support programs, psychosocial interventions, and intense counseling can enhance performance and yield favorable patient outcomes. It is essential to examine general tactics such as improving communication, increasing accessibility to educational services, and implementing complication-prevention programs. Ongoing assessment is necessary to guarantee continual enhancement in the calibers of healthcare solutions.

Especially in the healthcare industry, the relationship between private hospitals and the government has been increasingly important, particularly in enhancing the quality of care for chronic patients. As the demand for healthcare services continues to grow, the role of private hospitals as governmental partners in the delivery of high-quality care has become more prominent. One key factor that significantly impacts this partnership is the level of treatment satisfaction experienced by patients. Patient satisfaction with their treatment is a crucial determinant of healthcare facilities' overall quality of care. Improved service quality, leading to patient satisfaction and positive behavioral intentions, can help hospitals build long-term relationships with their patients and adhere to the therapy. Additionally, patient experiences and satisfaction levels can offer valuable insights into the willingness of diabetic patients to get involved and thereby be more actively engaged in adhering to their treatment regimens. A crucial example is when patients complain about their illness, they will be more open to communicating their symptoms with their doctors. This research also noted a few limitations: first, this study was only conducted in one city. Therefore, the study's findings only apply to this particular demographic and cannot be directly applied to populations of diabetes patients at other hospitals or in different regions. Patient characteristics can differ between hospitals and geographical areas, which could relate to the study's external validity. Second, self-reporting bias may have resulted from the online questionnaires used for data collection. Potential data distortion may arise from patients' propensity to give answers interpreted as more socially acceptable or expected than they are. As a result, care should be taken while analyzing the data to prevent drawing sweeping judgments.

Conclusion

This study illustrates that the Diabetes Treatment Satisfaction Questionnaire (DTSQ) is valuable for evaluating the quality of care provided to diabetic patients, particularly in private hospitals. The long-term outcome of patient well-being significantly predicts the hospital's reputation, highlighting its relevance. The DTSQ instrument can effectively assess treatment satisfaction, its relationship with patient empowerment, and the relationship between patient empowerment and patient wellbeing. If both the empowerment of patients and their well-being increase, it will ultimately improve the hospital's overall performance. The findings of this study provide a fresh perspective on the need to consider and combine these two factors to deliver care for diabetes patients effectively. This study also found that private hospitals are crucial in managing diabetes within the community.

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The Key to Successful Care Coordination and Patient-Centeredness in Cardiac Surgery

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Abstract

In the healthcare sector, delivering patient-centered care is vital for enhancing results and ensuring favorable experiences for individuals. Coordinating care contributes critically in attaining patient-centricity by enabling smooth and efficient interaction and partnership among healthcare professionals, patients, and their families. Efficient care coordination advances patient-centered care by guaranteeing that all aspects of a patient's medical journey are interconnected and tailored to their specific requirements. This connectivity and personalization can be accomplished through various approaches such as evidence-based practice, electronic medical records utilization, promotion of patient safety, cross-functional teamwork, mutual communication, goal alignment, and shared accountability. Achieving efficient care coordination for cardiac surgery involves assembling a varied team that collaborates to develop personalized treatment plans for every patient. This approach ensures the smooth coordination of all elements of patient care, including pre-operative assessments, surgical procedures, and post-surgery rehabilitation plans. Prioritizing the significance of coordinated care in hospital administration can assist policymakers and healthcare systems in striving to deliver tailored, patient-focused care that contributes to enhanced health results for individuals. Through communication and teamwork enhancement, distributing tasks equitably, and advancing evidence-based practices among medical professionals, the overall coordination of care in cardiac surgery can be notably enhanced resulting in improved personalized patient care and ultimately better health outcomes.

Introduction

Cardiovascular disease (CVD) remains a contributing cause of death and morbidity in Indonesia, and CVD death has increased substantially and remained increased in the last ten years (Harmadha *et al.*, 2023). The total annual healthcare costs per person with coronary heart disease from the Indonesian Case Base Group data in 2018 were estimated to be US$5,720 (IDR 81,620,376) (Uli *et al.*, 2020). Around 1 to 1.5 million heart surgeries are conducted every year in countries with lower to middle incomes, or 55.1 per 100,000 of the population. Not to mention the expensive cost, which can range from tens to hundreds of thousands of dollars per heart surgery (Dominique *et al.*, 2023; World Health Organization, 2023).

Teaching hospitals have a role in developing high-quality cardiovascular care. One of the defining features of teaching hospitals is their integration of clinical, research, and educational missions within the academic health center framework. The educational component of teaching hospitals is also crucial in shaping the future of healthcare delivery, facilitating the cultivation of a healthcare workplace which highly proficient, empathetic, and dedicated to providing patient-centric care. The teaching hospitals facilitate the cultivation

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of a healthcare workforce that is highly skilled and dedicated to continuous professional development through the provision of extensive practical training opportunities for medical students, residents, and fellows (Sadeghi *et al.*, 2022; Burke *et al.*, 2017). Although teaching hospitals seem to have perfect medical services, the complex nature of teaching hospitals can contribute to patient complaints about the health services they provide. Patients often receive an overwhelming amount of information at once from different medical or non-medical staff, and the information given can be inconsistent, leading to confusion and complaints.

Care coordination plays an important role in ensuring patient-centricity in cardiac surgery. The complex nature of cardiac surgery demands excellent collaboration and coordination among various healthcare professionals to ensure optimal patient outcomes. Healthcare providers can elevate the quality of patient-centered cardiovascular care and ultimately improve outcomes and satisfaction levels for individuals undergoing cardiac procedures by prioritizing care coordination (Khanna *et al.*, 2022).. Efficient coordination of care in cardiac surgery starts with bringing together a varied team that works together to create customized treatment plans for each patient. This method guarantees the smooth integration of all facets of patient care, such as pre-surgery assessments, surgical procedures, and post-operative recovery strategies (Geiger *et al.*, 2021). Coordinating these various stages of care is crucial for delivering thorough and patient-focused treatment.

Assembling a collaborative team and the usage of electronic health records are both essential for enhancing communication and information sharing among the specialists involved in cardiac surgery. Electronic medical record platforms enable immediate access to critical patient data, including medical test results, medication histories, and surgical reports (Abdekhoda *et al.*, 2019). It facilitates well-informed decision-making and promotes consistent delivery of healthcare services. Cultivating a culture emphasizing shared responsibility and patient safety is essential for providing cohesive and secure patient-centered care in cardiac surgery. Each healthcare team member plays a vital role in delivering high-quality patient care, and ensuring effective communication and aligned objectives are crucial for delivering comprehensive and safe patient-centered treatment. Collaborative responsibility among healthcare providers fosters a team-based approach to patient care, resulting in enhanced coordination and seamless transitions between various phases of cardiac surgery (Prakash & Srivastava, 2021; Rosen *et al.*, 2018). This environment promotes accountability among team members for achieving shared goals, ultimately enhancing patient care quality and safety.

Emphasizing evidence-based practice is crucial for coordinating care in cardiac surgery. Healthcare providers should utilize the most up-to-date and reliable evidence to guide their decision-making and practices, ensuring patients receive the most effective and appropriate care. By implementing care coordination, healthcare professionals and policymakers can collaborate to establish uniform guidelines and protocols informed by current research and proven strategies (Prakash & Srivastava, 2021; Rosen *et al.*, 2018). This approach encourages the implementation of evidence-based practices and promotes consistency as the objective among healthcare stakeholders. All this approach can substantially enhance the overall effectiveness of care coordination in cardiac surgery, leading to improved health outcomes for individuals and fostering a patient-centric approach to healthcare delivery. The conceptual research framework shows how care coordination acts as a mediator in the individual behaviour aspect and interpersonal relation aspect of patient centricity, depicted in **"Figure 1."** Structural equation modeling is employed to examine and analyze the connections between theoretical concepts, testing earlier hypotheses about correlations and covariance of latent variables (Sarstedt *et al.*, 2022).

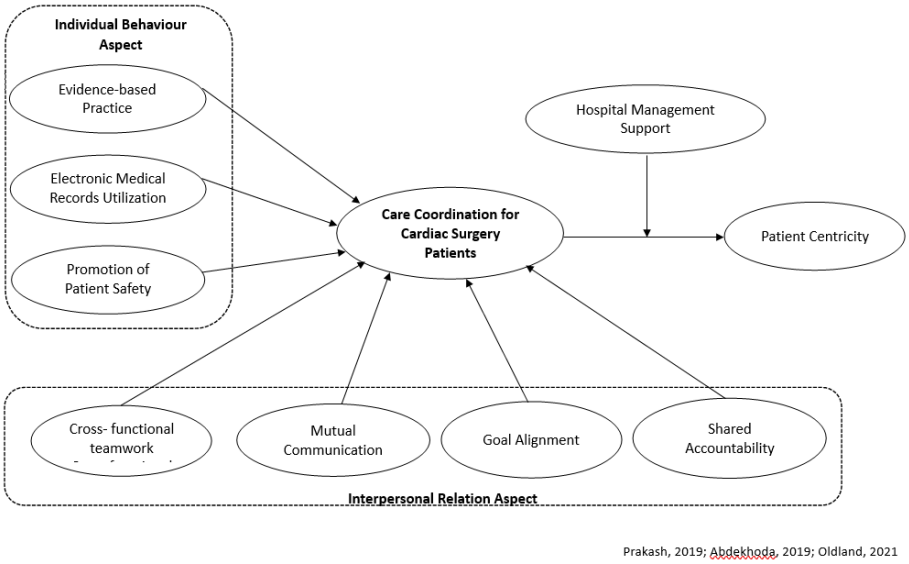

Figure 1. Conceptual Research Framework

Table 1. Construct Definition

Variables	Definition	References
Evidence-Based Practice	Evidence-based practice in healthcare during cardiac surgery care; based on client's preference and clinical condition; assessed by healthcare professional	Oldland *et al.*, 2020
Electronic Medical Records Utilization	Electronic medical records usage in healthcare services daily	Abdekhoda *et al.*, 2019
Promotion of Patient Safety	Hospital efforts to provide care with greater attention to patient safety	Oldland *et al.*, 2020; Carini *et al.*, 2020
Cross-Functional Teamwork	Cross-functional teamwork is collaboration and cooperation between individuals from various functional areas or scientific disciplines in an organization, in this context the cardiac surgery team	Prakash & Srivastava, 2021; Rosen *et al.*, 2018
Mutual Communication	Mutual communication is the dynamic exchange of information, ideas, and perspectives among healthcare professionals involved in patient care	Prakash & Srivastava, 2021; Rosen *et al.*, 2018
Goal Alignment	Goal alignment is the process of ensuring that the goals and objectives of individual healthcare providers, teams, and organizations are aligned with each other and ultimately support the mission and vision of the healthcare facility as a whole system	Prakash & Srivastava, 2021; Rosen *et al.*, 2018
Shared Accountability	Shared accountability is a collective commitment among healthcare professionals to take responsibility for patient care outcomes.	Prakash & Srivastava, 2021; Rosen *et al.*, 2018
Care Coordination for Cardiac Surgery Patients	The deliberate organization of patient cardiac surgery care activities between two or more participants (including the patient) involved in a patient's care to facilitate the appropriate delivery of health care services.	Schultz & McDonald, 2017; Prakash & Srivastava, 2021

Patient Centricity	Patient centricity is a dimension of hospital performance in which the hospital places patients at the center of care and services by paying attention to needs, expectations, autonomy, access to the hospital network, communication, confidentiality, dignity, choice, desire for appropriate care for patients and his family	Arah *et al.*, 2003; Carini *et al.*, 2020;
Hospital Management Support	Hospital management support to achieve patient centered-care	Abdekhoda *et al.*, 2019

Method

This cross-sectional study adopted the total sample method. The study was conducted in the Cardiovascular Department at a teaching hospital in Indonesia. The protocol was reviewed and approved by The Research Committee Ethic (KEP FEB) Faculty Economic and Business Universitas Pelita Harapan No. 005/M/EC-Mrt/III/2024. In this study, a total of 204 medical staff who joined the cardiac surgery team were recruited and completed structured questionnaires. The questionnaire was distributed for ten days via Google Form link to the participants without asking for personal data such as name, telephone number, email address, or others to ensure participants were able to answer anonymously. It is also stated in the questionnaire introduction that the questionnaire can be filled in voluntarily and anonymously. The inclusion criteria are as follows: willingness to fill out the questionnaire form, age 18 – 65 years old, join the cardiac surgery team for more than three months.

The study utilized the questionnaire, consisting of 43 questions consisting of three variables for the individual behaviour aspect (evidence-based practice, electronic medical records utilization, promotion of patient safety), four variables for the interpersonal relation aspect (cross-functional teamwork, mutual communication, goal alignment, shared accountability), care coordination for cardiac surgery patients, patient centricity, and hospital management support. There were six experts, including four academics and two hospital practitioners, who assessed the questionnaire content validity by rating the alignment of items on a Likert scale from 1 as strongly disagree to 5 as strongly agree. They also evaluated the significance and clarity of the translated inquiries for each item. The feedback from these experts improved the validation process and helped refine the translations.

The analysis utilized SmartPLS® 4.0 software, known for its advanced analytical capabilities. This approach yields two main types of results: the outer model (measurement model) and the Importance-Performance Map Analysis. The outer model evaluates the relationship between indicators and their variables to establish reliability and validity through measures such as indicator reliability (outer loading), construct reliability, convergent validity (average variance extracted/AVE), and discriminant validity within this research framework. Following this, IPMA evaluates both the importance and performance of the targeted construct to provide detailed managerial recommendations based on average or mean values obtained from respondents' responses. IPMA classifies indicators into four quadrants representing distinct strategies: quadrant A with high importance/low performance as the top priority; quadrant B with high importance/high performance to be maintained; quadrant C with low importance/low performance as a low priority; and Quadrant D with low importance/high performance.

Result And Discussion

The initial stage of the PLS-SEM analysis assesses the outer loading of the reflective model as an indicator of reliability. All indicators should exhibit outer loading values above 0.708 to ascertain their reliability. There are 43 indicators, with 1 indicator outer loading value < 0.708 but the AVE values > 0.5, so the indicator was not eliminated in this

Table 2. Demographic Data of Participants

Baseline characteristics	n = 260	%
Age		
18 - 30 y.o	32	15.6
31 - 50 y.o	161	79
51 - 65 y.o	11	5.4
Profession		
Specialist doctor	34	16.7
Resident	86	42.1
Bachelor/Higher Degree Nurse	43	21.1
Diploma Nurse	25	12.3
Other	16	7.8
Length of Employment		
1 - 3 tahun	111	54.4
> 3 tahun	93	45.6

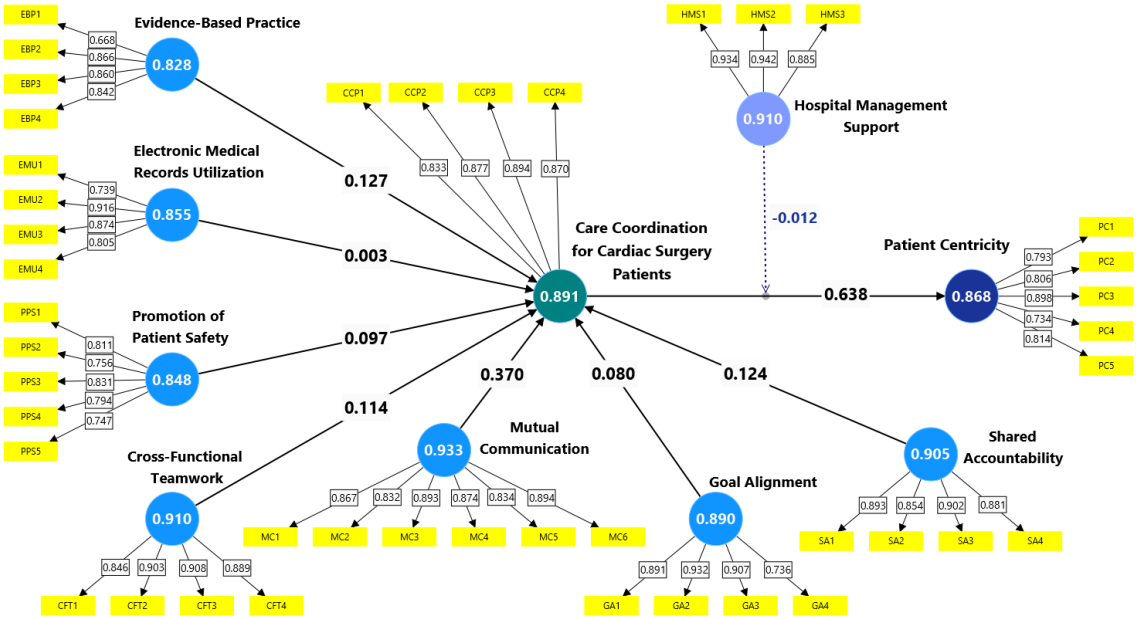

Figure 2. First Stage Outer Model Analysis

study. This study examined 26 indicators with outer loading values exceeding 0.708, along with one indicator below this threshold but still above 0.40, all meeting the required criteria for reliability and validity assessment. In the second step of the analysis, internal consistency was tested; constructs were regarded as reliable if they demonstrated a Cronbach's alpha greater than 0.7 and composite reliability within a range from [0.7–95]. The third step involved measuring AVE to evaluate convergent validity - refer to "Table 3." for details on these results.

This study established that all constructs had an AVE ≥ 0.5 to satisfy literature requirements by explaining at least half (50%) of item variance in the model, thus achieving convergent validity. The result of the reliability and validity test of the conceptual research framework is described in "Table 2." and "Figure 1." All 43 indicators within the analysis have met the requirement for indicator reliability, construct reliability, and convergent validity. In the discriminant test using this method, the heterotrait value (an indicator with its own

Table 2. Reliability and Validity Test

Variables	Indicators	Outer loading	Cronbach's Alpha	Composite reliability (rho_α)	Composite reliability (rho_c)	Average Variance Extracted (AVE)
Evidence-Based Practice	EBP1	0.668	0.828	0.860	0.885	0.661
	EBP2	0.866				
	EBP3	0.860				
	EBP4	0.842				
Electronic Medical Records Utilization	EMU1	0.739	0.855	0.873	0.903	0.700
	EMU2	0.916				
	EMU3	0.874				
	EMU4	0.805				
Promotion of Patient Safety	PPS1	0.811	0.848	0.851	0.891	0.622
	PPS2	0.756				
	PPS3	0.831				
	PPS4	0.794				
	PPS5	0.747				
Cross-Functional Teamwork	CFT1	0.846	0.910	0.914	0.937	0.787
	CFT2	0.903				
	CFT3	0.908				
	CFT4	0.889				
Mutual Communication	MC1	0.867	0.933	0.934	0.947	0.750
	MC2	0.832				
	MC3	0.893				
	MC4	0.874				
	MC5	0.834				
	MC6	0.894				
Goal Alignment	GA1	0.891	0.890	0.907	0.925	0.756
	GA2	0.932				
	GA3	0.907				
	GA4	0.736				
Shared Accountability	SA1	0.893	0.868	0.908	0.934	0.779
	SA2	0.854				
	SA3	0.902				
	SA4	0.881				
Care Coordination for Cardiac Surgery Patients	CCP1	0.833	0.891	0.892	0.925	0.754
	CCP2	0.877				
	CCP3	0.894				
	CCP4	0.870				

Patient Centricity	PC1	0.793	0.868	0.878	0.905	0.657
	PC2	0.806				
	PC3	0.898				
	PC4	0.734				
	PC5	0.814				
Hospital Management Support	HMS1	0.934	0.910	0.915	0.943	0.847
	HMS2	0.942				
	HMS3	0.885				

Notes: Abbreviation: Care Coordination for Cardiac Surgery Patients (CCP), Cross-Functional Teamwork (CFT), Electronic Medical Records Utilization (EMU), Evidence-Based Practice (EBP), Goal Alignment (GA), Hospital Management Support (HMS), Mutual Communication (MC), Patient Centricity (PC), Promotion of Patient Safety (PPS), Shared Accountability (SA).

Table 3. Discriminant Validity HT/MT Ratio

Variables	CCP	CFT	EMU	EBP	GA	HMS	MC	PC	PPS
CCP									
CFT	0.765 CI (0.702-0.826)								
EMU	0.565 CI (0.450-0.668)	0.50 CI (0.392-0.614)							
EBP	0.745 CI (0.655-0.828)	0.664 CI (0.575-0.748)	0.649 CI (0.539-0.754)						
GA	0.820 CI (0.750-0.885)	0.873 CI (0.817-0.926)	0.634 CI (0.541-0.718)	0.726 CI (0.629-0.815)					
HMS	0.672 CI (0.589-0.753)	0.749 CI (0.663-0.829)	0.534 CI (0.419-0.648)	0.648 CI (0.541-0.755)	0.726 CI (0.715-0.871)				
MC	0.865 CI (0.806-0.917)	0.838 CI (0.778-0.891)	0.606 CI (0.496-0.703)	0.777 CI (0.699-0.850)	0.929 CI (0.884-0.970)	0.770 CI (0.687-0.844)			
PC	0.865 CI (0.817-0.911)	0.695 CI	0.529 CI (0.413-0.642)	0.683 CI (0.586-0.772)	0.785 CI (0.712-0.855)	0.663 CI (0.565-0.753)	0.801 CI (0.726-0.869)		

PPS	0.731 CI (0.647-0.809)	0.67 CI	0.634 CI	0.813 CI	0.750 CI (0.654-0.838)	0.675 CI (0.599-0.751)	0.769 CI (0.691-0.843)	0.683 CI (0.591-0.772)	
SA	0.820 CI (0.756-0.881)	0.823 CI	0.665 CI	0.759 CI	0.924 CI (0.872-0.971)	0.717 CI (0.607-0.819)	0.925 CI (0.870-0.973)	0.742 CI (0.656-0.823)	0.708 CI (0.616-0.796)

Notes: Abbreviation: Care Coordination for Cardiac Surgery Patients (CCP), Cross-Functional Teamwork (CFT), Electronic Medical Records Utilization (EMU), Evidence-Based Practice (EBP), Goal Alignment (GA), Hospital Management Support (HMS), Mutual Communication (MC), Patient Centricity (PC), Promotion of Patient Safety (PPS), Shared Accountability (SA).

construct) is contrasted with the monotrait value (another indicator with its own construct). If the HT/MT ratio is below 0.9, it indicates no issues with discrimination within the arrangement and confirms that the results are acceptable and, therefore, considered valid. These findings confirm that the indicators for each specific construct in the model are suitable and precise for measuring their respective constructs individually. In this study, the assessment of discriminant validity was conducted by examining the heterotrait-monotrait ratio (HT/MT Ratio). This ratio is deemed more precise in detecting discrimination issues and is currently advised for regular use. This method for discriminant testing is regarded as a more advanced approach than the traditional Fornell Larcker discriminant test in PLS-SEM analysis (Sarstedt *et al.*, 2022; Hair, 2022).

IPMA analysis was used to identify indicators for prioritizing their improvement activities (Ringle & Sarstedt, 2016). IPMA analysis allows the definition of the indicators and variables into four quadrants that allow for setting out four distinct strategies. In this study, care coordination for cardiac surgery patients was determined as the target construct because of its significant mediating role. The IPMA statistical method combines two aspects in one mapping to identify the relative position of variables and indicators in the research model. The first aspect is related to what is considered vital (importance) which is depicted in the axis or X-axis. The value is the result of inferential analysis, namely the total effect. Align with the coefficient value, the total effect value ranges from 0 to 1 (negative values are ignored in IPMA). The second aspect is related to performance in the eyes of respondents. This aspect is depicted on the Y axis, the result of answers to questionnaire items. This figure comes from the average of respondents' answers on a Likert scale (values 1 to 5) for each questionnaire item. This scale is then re-scaled to a value of 0 to 100. The results of IPMA statistical analysis are mapping, which variables or indicators managers need to prioritize in the decision-making process. By identifying these priorities, managers can allocate the resources they have. IPMA analysis is carried out by first getting the average value of the total effect and performance. The data used in calculations with IPMA is unstandardized. From this average value, a line will then be drawn in the output image of the IPMA calculation results with SmartPLS®4. The IPMA values for the constructs and the averages can be seen in **"Table 4."**

From "Table 4.", the mean value for importance and performance for both variables and indicators. The mean for the importance and performance of variables are 0.131 and 78.203, respectively. Values below this mean are considered low. The values above it are considered high. From this data, two lines can be drawn so that the four quadrants can be grouped in the graph, as shown in "Figure 2." From "Figure 1.", the target construct of the research model is none of the variables in the upper right quadrant. This quadrant shows important areas that have performed well. In the right lower quadrant, there was mutual communication (MC), which is a construct with the highest importance but

Table 4. Indicators and Variables Performance and Importance CCP

*Variable*s	Importance	Performance	Indicators	Importance	Performance
CFT	0.114	81.043	CFT1 CFT2 CFT3 CFT4	0.032 0.028 0.034 0.035	75.980 80.025 84.191 83.211
EBP	0.003	83.966	EBP1 EBP2 EBP3 EBP4	0.027 0.040 0.048 0.039	78.186 79.412 72.304 86.601
EMU	0.127	78.915	EMU1 EMU2 EMU3 EMU4	0.001 0.001 0.001 0.001	87.255 83.333 79.412 87.092
GA	0.080	73.750	GA1 GA2 GA3 GA4	0.024 0.026 0.023 0.018	79.575 71.569 69.363 75.123
MC	0.370	77.260	MC1 MC2 MC3 MC4 MC5 MC6	0.073 0.069 0.072 0.068 0.070 0.076	72.059 73.284 69.608 84.926 83.007 81.863
PPS	0.097	78.820	PPS1 PPS2 PPS3 PPS4 PPS5	0.025 0.021 0.025 0.027 0.025	85.131 80.392 73.775 83.824 68.627
SA	0.124	73.665	SA1 SA2 SA3 SA4	0.036 0.033 0.038 0.035	70.833 79.902 69.118 75.490
Mean	0.131	78.203	Mean	0.034	78.194

Notes: Abbreviation: Care Coordination for Cardiac Surgery Patients (CCP), Cross-Functional Teamwork (CFT), Electronic Medical Records Utilization (EMU), Evidence-Based Practice (EBP), Goal Alignment (GA), Mutual Communication (MC), Patient Centricity (PC), Promotion of Patient Safety (PPS), Shared

has not performed well for care coordination improvement. Therefore, it is necessary to take a crucial step as a priority on the part of the hospital management to improve effective communication for each unit team and each shift and facilitate a reporting system so that a good work environment can be established in the organization. The least important variable based on mapping is electronic medical records utilization (EMU), and the least performed variable is goal alignment (GA).

Meanwhile, "Figure 3." depicts the IPMA-Indicator analysis. The first part is the variable considered the most important by respondents and is in line with expectations (high importance-high performance), so it must be prioritized to be maintained. In this analysis, the indicators CFT4, EBP2, EBP 4, MC4, MC5, and MC6 are important indicators that already have high performance. Meanwhile, in section 2, the indicators SA1, SA3, SA4, EBP3, MC1, MC2, and MC3 were included in the high importance-

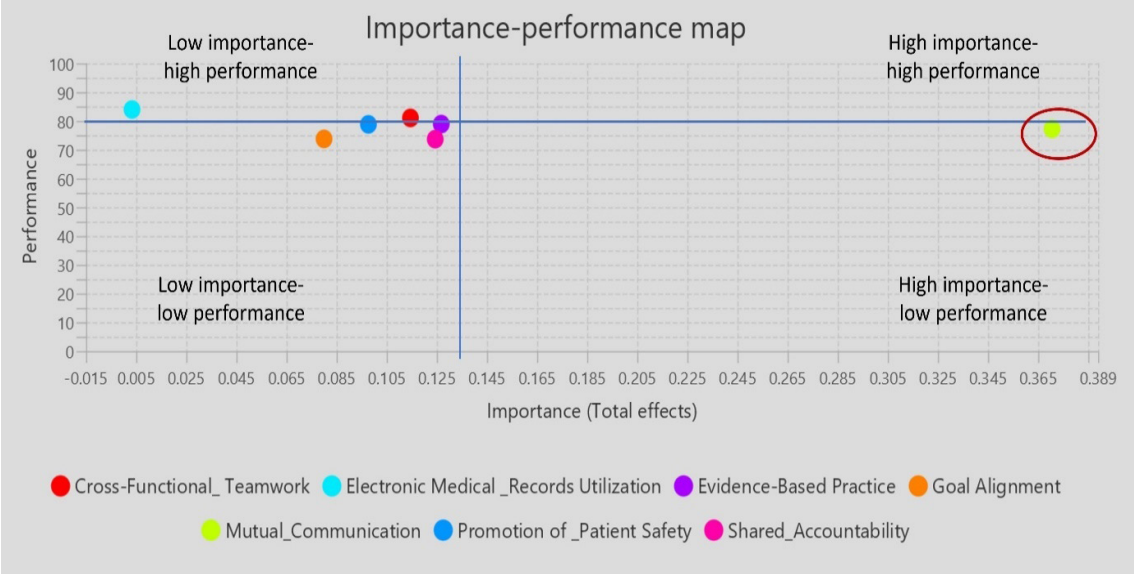

Figure 2. IPMA Variables Graph

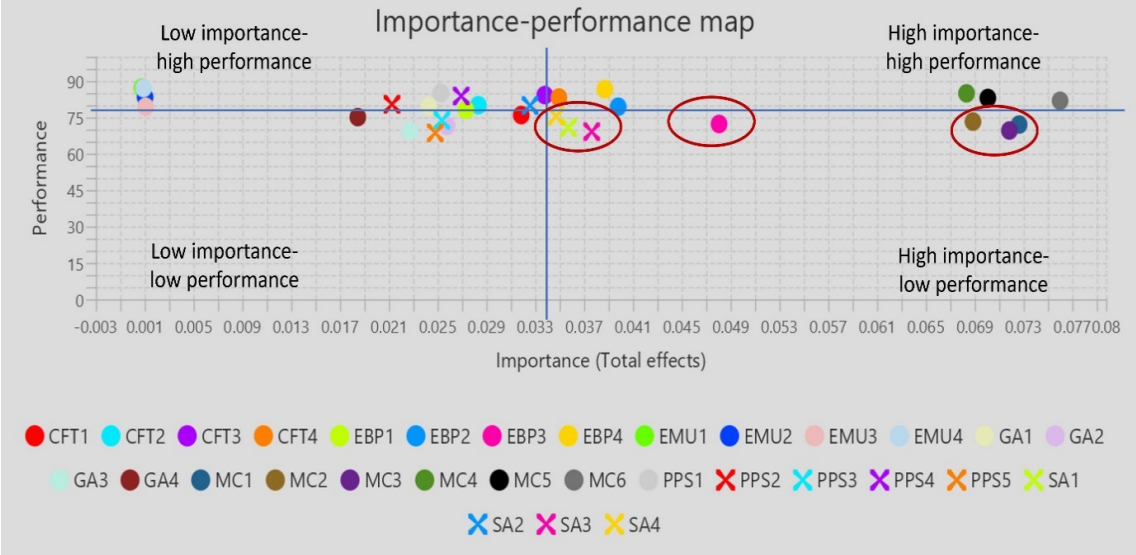

Figure 3. IPMA Indicators Graph

low performance category, so we concluded that respondents considered these indicators important. But performance was still low. Therefore, cardiac surgery services in teaching hospitals require improved performance from shared accountability, evidence-based practice, and mutual communication.

Organizations that have utilized Importance Performance Map Analysis (IPMA) have observed substantial enhancements in care coordination and service quality. Through prioritizing efforts based on the perceived importance and performance of key service attributes, healthcare managers can create more precise strategies for improvement (São João *et al.*, 2021). The previous research highlights the importance of effective communication between health professionals in ensuring smooth care coordination for patients (Miller *et al.*, 2007). The results show that when there is good mutual communication between the care team, overall care coordination improves, resulting in better patient outcomes and satisfaction. This highlights the importance

for healthcare institutions to prioritize and promote open and clear communication among their employees, to enhance care coordination and ultimately elevate the quality of service delivery (Palanisamy & Verville, 2015). We also noted that clear and regular communication between healthcare professionals helps prevent errors and minimizes risks to patient safety. These results from previous studies recognized communication challenges between physicians and nurses as a significant obstacle to advancing patient safety. This study also suggests that effective communication between academic coordinators and clinical facilitators in nursing programs is critical to managing multiple groups of students during clinical placements (Howard *et al.*, 2014). Overall, previous research provides strong evidence of a positive correlation between mutual communication and care coordination in various healthcare settings. This study shows that when health professionals are actively involved in mutual communication, this results in smoother care coordination and better for patients. It is by previous research which emphasizes the importance of communication in health services and its impact on patient satisfaction (Childress, 2015).

Evidence-based practice and care coordination are closely related to health services. The practice of evidence-based healthcare utilizes up-to-date research findings, clinical experience, and patient inclinations to influence and direct healthcare choices and treatments (Hunker *et al.*, 2014). Care coordination is a regulatory process that integrates care activities for patients across various health service settings and providers to ensure that health services are provided comprehensively and smoothly. When healthcare providers implement evidence-based practices, it can result in a more standardized and effective care process and improve care coordination performance. By combining the latest research findings and best practices, healthcare teams can align their efforts in coordinating patient care across settings and disciplines. It ultimately results in better patient results, higher patient contentment, and effective use of resources. Moreover, incorporating evidence-based guidelines and protocols into care coordination can minimize unnecessary differences in treatment and promote a more holistic approach to patient care. The synergy between evidence-based practice and care coordination highlights the importance of using current research evidence to inform and guide the coordination of care activities (Frank *et al.*, 2011). In short, evidence-based practice and care coordination are interconnected because the use of evidence-based practice can increase the effectiveness of care coordination efforts and ultimately improve patient outcomes (Phelps & Hyde, 2018).

In the healthcare sector, the importance of shared accountability and care coordination in improving patient outcomes and overall quality of care (Boddington, 2006). When healthcare providers and teams have shared accountability for patient care, there is a significant increase in care coordination. These improvements are seen in more efficient communication between healthcare professionals, increased collaboration and teamwork, and better patient outcomes. With strong shared accountability between health service providers, there will be increased care coordination in various environments and scientific disciplines. This study concludes that shared accountability contributes to improving service continuity, reducing treatment delays, and increasing patient satisfaction. These findings show that improving shared accountability in health services can result in better care coordination. Ultimately, results in better outcomes for patients (Page, 2004).

Conclusion

In conclusion, by the study's findings on the research model's constructs and indicators, it is important to incorporate shared accountability, evidence-based practice, and effective communication for enhancing care coordination and patient-centered care within the settings of cardiac surgery. These core principles are critical for achieving favorable results for patients undergoing cardiac surgery and should be emphasized in clinical settings.

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Serum Clusterin Level Associated with Post-ischemic Stroke Cognitive Dysfunction

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Abstract

The exploration of potential blood-based biomarkers that could be useful in the early detection of cognitive impairment associated with ischemic stroke is still being studied. The objective of this study was to examine the correlation between serum clusterin levels and the prevalence of cognitive impairment in individuals with ischemic stroke. Methods: A total of 86 outpatients with mild ischemic stroke within the first three months of its onset were recruited from three primary hospitals in Mataram, Indonesia. ELISA was used to measure the serum clusterin level. Patients' sociodemographic and clinical data were also collected as covariates. The Montreal Cognitive Assessment-Indonesian version (MoCA-INA) instrument was used to evaluate cognitive status. The study used multivariate logistic regression analysis to investigate the effect of clusterin on the occurrence of cognitive impairment associated with ischemic stroke while controlling for other variables. Results: The multivariate logistic regression analysis revealed a significant correlation between elevated serum clusterin levels and a higher prevalence of cognitive impairment in ischemic stroke patients (odds ratio [OR] 3.56, 95% confidence interval [CI] 1.04-12.16, p = 0.043). Conclusion: Elevated serum clusterin levels have been associated with a higher occurrence of cognitive impairment in ischemic stroke patients.

Introduction

One of the most serious outcomes of ischemic stroke is cognitive impairment. Post-stroke dementia (PSD) is a significant contributor to dependence in those who have survived a stroke and is the second most prevalent type of dementia, following Alzheimer's disease (Fawal *et al*., 2021). It is estimated that between 25% and 44% of people who have had an ischemic stroke will have cognitive problems (Kalaria *et al*., 2016). In Indonesia, there is a three times more higher prevalence of cognitive dysfunction after a stroke (Pinzon *et al*., 2018). The optimal therapy to prevent or treat post-stroke dementia (PSD) is still not optimal due to the unclear mechanisms of PSD (Fawal *et al*., 2021). The currently accepted theory suggests that disruptions in oxygen and blood supply to the brain tissues and chronic inflammation lead to damage and changes in cortical connectivity, axonal tracts, and the number of neurons (Fawal *et al*., 2021). This highlights other comorbidities, such as hypertension and diabetes mellitus, which impact vascular dysfunction in the brain and are crucial factors in worsening cognitive dysfunction in post-stroke patients (Rasmussen & Langerman, 2019). Early detection of PSD is important to implement

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intervention strategies aimed at altering several risk factors, including hypertension, smoking, obesity, and diabetes. This approach facilitates avoiding and minimizing the disease's progression (Rasmussen & Langerman, 2019). As a result, not all post-stroke individuals in the Mild Cognitive Impairment (MCI) stage, who have not yet experienced a decline in the quality of life, will develop dementia. In the form of dementia, this cognitive dysfunction will decrease patients' quality of life, making them a burden to their families (Sharma *et al*., 2020).

Imaging examinations, for example, advanced magnetic resonance imaging (MRI), play a crucial role in diagnosing and detecting cognitive impairment associated with stroke by providing more precise information about the anatomical structures affected. (Mijajlovic *et al*., 2017). Nevertheless, the accessibility of this evaluation for stroke patients is hindered by its restricted availability and relatively expensive cost. Current studies are being conducted to identify biomarkers that can be used to diagnose stroke-related cognitive dysfunction at an early stage. However, the findings have not been sufficient. Optimal biomarkers for this objective should possess exceptional reliability and accuracy, cost-effectiveness, minimal invasiveness, and simple procedures (Giau *et al*., 2019). Blood-based biomarkers have various characteristics that meet those criteria, including cost-effectiveness, minimal invasiveness, and simple procedures. Alzheimer's disease (AD) possesses adequate reliability and accuracy to establish the diagnosis of the disease (Zetterberg *et al*., 2013). At the same time, in stroke-related cognitive dysfunction, there remains a lack of evidence about the reliability and accuracy of blood-based biomarkers.

The levels of clusterin in the circulation, which have been observed to rise in individuals with Alzheimer's disease (AD) and are associated with the development of cognitive impairment (Jongbloed *et al*., 2015), have also been demonstrated to increase in patients with acute ischemic stroke (Romero *et al*., 2020; Song *et al*., 2019). Elevated clusterin levels in both brain tissue and blood circulation relate to the brain tissue's reaction to oxidative stress triggered by β-amyloid. (Woody & Zhao, 2016). The concentration of β-amyloid is elevated in the bloodstream of individuals experiencing acute ischemic stroke, hence playing a role in the development of cognitive impairment (Chi *et al*., 2019). Clusterin, functioning as a chaperone protein, is crucial in preventing brain β-amyloid accumulation and suppressing oxidative stress generated by β-amyloid. (Woody & Zhao, 2016). Nevertheless, the correlation between clusterin levels and the occurrence of cognitive impairment during the initial stage of ischemic stroke remains undetermined. The objective of this study was to examine the correlation between the occurrence of cognitive dysfunction-related ischemic stroke and serum clusterin levels in patients who have experienced ischemic stroke within three months. This study considered the clinical characteristics and socio-demographics of the participants.

Methods

This study used a cross-sectional design to investigate ischemic stroke patients who were consecutively recruited from a private hospital and two general hospitals in Mataram, West Nusa Tenggara Province, Indonesia, between January 2022 and December 2022. The subjects were included based on the following criteria: 1) had at least a 6-year education at the primary school level; 2) fully conscious; 3) between the ages of 40 and 70; 4) Individuals who have been diagnosed with a mild ischemic stroke within the initial three months following the onset of the stroke.; and 5) willingly participated. The exclusion criteria for participants were: 1) had aphasia; 2) had a hearing and visual impairment that could not be corrected; 3) had clinically significant depression; 4) a history of a diagnosis of psychiatric disorders and cognitive dysfunction before stroke; and 5) currently taking antipsychotic, antidepressant, and anti-anxiety medications before cognitive function test.

The diagnosis of ischemic stroke was established by analyzing the findings of a head CT scan, either during the initial three months following the stroke's onset or at the onset of the stroke. If an individual performed a second head CT scan that revealed a more obvious ischemic lesion, the second head CT

scan result was utilized. The minor ischemic stroke criteria for participants were based on the presence of a National Institutes of Health Stroke Scale (NIHSS) score of 8 or above during the cognitive function evaluation (Muchada *et al*., 2014). The participants' and their caregivers' information, as well as their medical records, were used to gather the history of a diagnosis of cognitive dysfunction or psychiatric illnesses before stroke. The medical records were utilized to gather data pertaining to the prior administration of antipsychotic, antidepressant, and anti-anxiety medications. Clinically severe depression was defined as the presence of a Beck Depression Inventory – II (BDI-II) score ranging from 14 to 63 among the participants (Wang & Gorenstein, 2013). The selection of participants based on the exclusion and inclusion criteria, as well as the evaluation of BDI-II and NIHSS scores, was conducted by a neurologist during the initial outpatient appointment. The study was carried out after acquiring written informed consent from the participants regarding their involvement. The Ethics Committee of Health Research at the University of Mataram approved this study (Register number: 387/UN18.F7/ETIK/2021).

The participants data were surveyed using a questionnaire to gather socio-demographic data, such as age, gender, education levels, and employment status. The variables used to measure the age of the subjects in this study were both continuous and categorical. As continuous variables, age was expressed in years, while as a categorical variable, it was classified into older (60-70 years) and young adult (40-59 years) groups. Gender was classified into female and male categories. The education level categorization included college graduates, high school, and elementary school. Employment status was categorized as employed and unemployed.

The clinical data, including the vascular risk factors (hypertension, diabetes mellitus, cigarette smoking, and body mass index (BMI) status) and stroke characteristics (infarct diameter and infarct side), were collected from the participants based on their medical records. Infarct diameter was classified into larger (≥15 mm in diameter) and small (<15 mm in diameter), while the infarct side was categorized into right, left, and bilateral hemispheres (Jaillard *et al*., 2009). Information regarding the infarct side and infarct size in the brain on a head CT scan of the participants was confirmed by a radiologist. Hypertension status was categorized as hypertensive and non-hypertensive. Diabetes mellitus status was categorized as diabetic and non-diabetic. The presence of hypertension and diabetes mellitus was confirmed based on information regarding the diagnosis documented in their medical records and/or information provided by the participants. The classification of cigarette smoking status was divided into two groups: smokers and non-smokers. To determine the BMI of the participants, the weight in kilograms (kg) was divided by the height in meters squared (m^2). The BMI status was classified as overweight/obesity (BMI ≥25 kg/m^2) and norm weight (BMI <25 kg/m^2)(Kauranen *et al*., 2014).

The serum clusterin levels were determined by analyzing serum samples from the subjects using the ELISA technique. Serum samples were collected from 5 ml blood samples and subjected to centrifugation at 3000 r/minute for 10 minutes. The tubes were then stored at -80°C in the Immunology Laboratory, Faculty of Mathematics and Natural Sciences, University of Mataram. The examination of serum clusterin levels using ELISA was carried out by BioTechnology Human CLU (Clusterin) ELISA Kit (Catalog No. E1189Hu). As a continuous variable, serum clusterin levels were expressed in mcg/ml, while as a categorical variable, the levels were categorized as higher and lower based on their cut-off point determined by a receiver operating characteristic (ROC) curve analysis.

The Montreal Cognitive Assessment-Indonesian version (MoCA-INA) test assesses the participants' cognitive function, which served as the outcome variable. The MoCA-INA is a validated instrument to assess global cognitive function among the Indonesian population. (Husein *et al*., 2010). This instrument examines several cognitive domains, including visuospatial/executive function, naming, attention, language, abstract thinking, delayed memory, and orientation. In this test, each participant was asked to do several structured tasks representing the cognitive domains

mentioned earlier on a printed instrument sheet guided by an examiner. During the acute phase of ischemic stroke, the presence of cerebral edema in patients leads to the occurrence of delirium, which subsequently influences the evaluation of cognitive function in these individuals (Balami *et al*., 2011; Dostovic *et al*., 2016). The edema process gradually subsides in the first few weeks, so to prevent bias due to post-ischemic stroke edema, optimal assessment of cognitive function is carried out during the sub-acute stage, which is three months after the onset of ischemic stroke (Lo Coco *et al*., 2016). Each task done correctly was given a score according to the scoring system provided in this instrument. This instrument has a total score of 30, and a score of 26 is used as a cutoff value to categorize participants as having normal cognitive status or cognitive dysfunction. Individuals with a MoCA-INA test score of 26 or higher were classified as having normal cognitive functioning, whereas those who obtained a MoCA-INA test score below 26 were classified as having cognitive impairment.

The neurologist evaluated the eligibility of patients who visited the neurology outpatient department of the hospital where the study took place. The assessment was based on predetermined inclusion and exclusion criteria. Eligible participants and their caregivers were then referred to a trained general practitioner to acquire details regarding the study protocol and get their consent to partake in the study. On a designated day, the participants engaged in an interview session with a trained general practitioner in order to gather data related to sociodemographic variables using structured questions. The medical records of the participants were also available for the collection of clinical characteristics of the participants, including hypertension, diabetes mellitus, cigarette smoking, and BMI status. Confirmation of the clinical data obtained from each participant was carried out through interviews and physical examination of the participant. Any data reported by the participant through interviews and obtained from the medical record is recorded carefully and in detail on the participant's case report form by the general practitioner who is responsible for the completeness of the participant's data. After the collection of sociodemographic and clinical characteristics was completed, the participants were directed by a general practitioner to a separate room for fasting venous blood sampling. Fasting venous blood sampling of the participants was carried out by well-trained laboratory staff using aseptic techniques. A total of 5 ml of fasting venous blood samples were drawn from each participant and then put into a serum tube by the laboratory staff.

After blood collection, the participants will undergo stroke characteristic data collection, including infarct diameter and infarct side in the brain and assessment of cognitive function. During the cognitive function assessment with the MoCA-INA instrument, each participant was given clear instructions to work on tasks representing various cognitive domains, including visuospatial/executive, naming, attention, abstract thinking, delayed memory, and orientation. Due to the complexity of the task, each participant was given the right to rest if necessary or even not to continue the cognitive function test if so desired for any reason. Sheets of cognitive function test results for each participant were given a complete identity and kept together with the patient's questionnaire sheet and case report form by the neurologist who collected the data. All blood samples taken on the examination day were brought by the laboratory staff to the Integrated Laboratory of the Faculty of Medicine, University of Mataram, for further processing to obtain a serum sample. The process of transporting blood samples from the research site to the Integrated Laboratory of the Faculty of Medicine, University of Mataram, uses bags containing ice packs to keep the sample temperature below 8°C before further processing. All serum samples obtained were put into Eppendorf tubes, each coded for each patient, and stored at -80°C. After all research data collection activities are completed in accordance with the previously prepared timeline, all serum samples stored at the Integrated Laboratory of the Faculty of Medicine, University of Mataram, West Nusa Tenggara Province, were then brought to the Immunology Laboratory, Faculty of Mathematics and Natural Sciences, University of Mataram, using dry ice transport media to maintain the sample temperature below -20°C.

After arriving at this laboratory, the serum samples were stored at -80°C until assay.

For normally distributed continuous variables, the data were provided as the mean value ± standard deviation (SD). For continuous variables with non-normal distribution, the median (minimum–maximum) was used. For categorical variables, the frequency (%) was provided. The analysis was conducted in two distinct stages. Initially, the study used independent t-test, Mann-Whitney test, or chi-square test to examine the notable disparities in mean, median, and/or frequency of sociodemographic, clinical, and serum clusterin levels between the groups with cognitive dysfunction and those with normal cognitive status. Additionally, the researchers performed multivariate logistic regression analysis to ascertain the relationship between serum clusterin levels and the occurrence of cognitive dysfunction while accounting for other confounders, such as sociodemographic characteristics (gender, age, education levels, and employment status) for Model 1; plus stroke characteristics (infarct side and infarct diameter) for Model 2; plus identified vascular risk factors (cigarette smoking, hypertension, diabetes, and overweight/obesity) for Model 3 and reported as adjusted odds ratio (OR) with 95% confidence interval (CI). The statistical significance was set at $p < 0.05$.

Results and Discussions

A sample of 86 individuals with ischemic stroke were enrolled. The results of a ROC analysis indicated that the cut-off point for serum clusterin level was determined to be 6.39 mcg/ml, with an AUC of 0.590 (FIGURE 1). Table 1 describes a summary of the clinical and socio-demographic characteristics of the participants. Sixty-one (70.9%) participants were assigned to the cognitive dysfunction group, and 25 (29.1%) participants were assigned to the normal cognitive group. The mean age of participants with and without postischemic stroke cognitive dysfunction was 54.6 ± 6.9 years and 52.5 ± 6.9, respectively ($p = 0.209$). However, the median of serum clusterin levels and the frequency of higher serum clusterin levels were not significantly different between cognitive dysfunction and normal cognitive groups. Between the cognitive dysfunction and normal cognitive groups, there were significant differences in the variables of employment status ($p = 0.049$), infarct diameter ($p = 0.044$), and MoCA-Ina scores ($p < 0.001$). There were no significant differences in age, gender, education level, infarct side, and vascular risk factors for

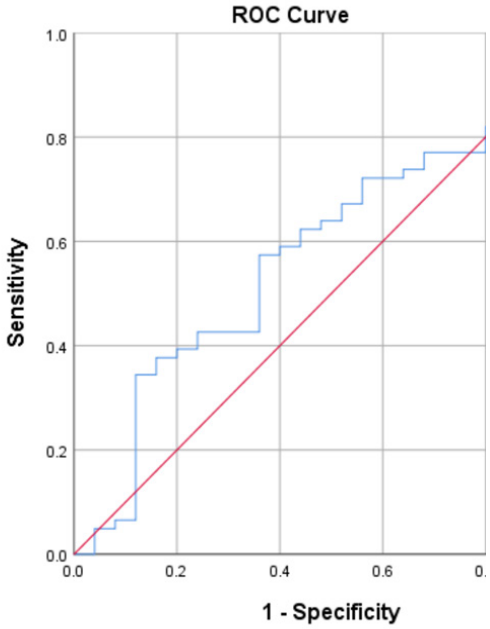

FIGURE 1. ROC Curve for the Discrimination Quality of Clusterin Level in Participants (Weak Categorization). Serum Levels of Clusterin at the Cut-Off Point of 6.39 mcg/ml with AUC 0.590 Were Used

TABLE 1. Socio-Demographic and Clinical Characteristics of the Participants (n = 86)

Characteristics	Cognitive Status		p-value
	Normal (n = 25)	Dysfunction (n = 61)	
Socio-Demographic Characteristics			
Age in years, mean±SD	52.5 ± 6.9	54.6 ± 6.9	0.209[a]
Age groups, n (%)			0.149[b]
Olders	3 (15.8)	16 (84.2)	
Young adults	22 (32.8)	45 (67.2)	
Gender, n (%)			0.366[b]
Female	5 (21.7)	18 (78.3)	
Male	20 (31.7)	43 (68.3	
Education levels, n (%)			0.217[b]
Elementary school	3 (15.8)	16 (84.2)	
High school	11 (28.2)	28 (71.8)	
College	11 (39.3)	17 (60.7)	
Employment status, n (%)			0.049[b]*
Unemployed	4 (14.8)	23 (85.2)	
Employed	21 (35.6)	38 (64.4)	
Clinical characteristics			
Infarct diameter, n (%)			0.044[b]*
Larger	2 (10.5)	17 (89.5)	
Small	23 (34.3)	44 (65.7)	
Infarct side, n (%)			0.996[b]
Bilateral hemisphere	5 (29.4)	12 (70.6)	
Left hemisphere	10 (28.6)	25 (71.4)	
Right hemisphere	10 (29.4)	24 (70.6)	
Hypertension, n (%)			0.581[b]
Yes	22 (28.2)	56 (71.8)	
No	3 (37.5)	5 (62.5)	
Diabetes mellitus, n %)			0.842[b]
Yes	10 (30.3)	23 (69.7)	
No	15 (28.3)	38 (71.7)	
Cigarette smoking, n (%)			0.955[b]
Yes	10 (29.4)	24 (70.6)	
No	15 (28.8)	37 (71.2)	
Overweight/obese, n (%)			0.240
Yes	12 (36.4)	21 (63.6)	
No	13 (24.5)	47 (75.5)	
Clusterin (mcg/ml), median (min-max)	6.1 (0.0 – 251.0)	7.1 (0.0 – 204.0)	0.334[c]
Clusterin level, n (%)			0.204[b]
Higher	11 (35.9)	36 (61.4)	

Low	14 (23.4)	25 (76.6)	
MoCA-Ina test score, median (min – max)	26.0 (25.0 – 29.0)	19.0 (10.0 – 24.0)	<0.001c*

MoCA-Ina = Indonesian version of Montreal Cognitive Assessment.

both groups.

The findings of a multivariate logistic regression study, specifically focusing on the relationship between clusterin and the frequency of cognitive dysfunction in participants with ischemic stroke, are presented in Table 2. This analysis was conducted after correcting for several factors. In Model 1 and Model 2, there was no significant association seen between elevated serum clusterin levels and cognitive deterioration in persons with ischemic stroke. Nevertheless, in Model 3, taking into account all independent variables such as stroke characteristics, vascular risk factors, and sociodemographic factors, it was observed that individuals with ischemic stroke who had elevated levels of serum clusterin were 3.56 times more likely to have cognitive dysfunction in comparison to those with lower levels of serum clusterin (OR 3.56, 95% CI 1.04 – 12.16, p = 0.043). In addition, larger infarct diameter was consistently associated with the frequency of cognitive dysfunction in ischemic stroke participants both in Model 2 (OR 7.39, 95% CI 1.36 – 40.14, p = 0.021) and Model 3 (OR 6.40, 95% CI 1.15 – 35.50, p = 0.034).

The objective of this study was to examine the correlation between serum clusterin levels and the occurrence of cognitive impairment in individuals with ischemic stroke within a three-month period following the onset of the stroke. This study revealed that ischemic stroke participants with higher serum clusterin levels were more likely to develop cognitive dysfunction. It was the first study demonstrating that higher serum clusterin levels contribute to the increased risk of cognitive dysfunction in ischemic stroke participants. In Alzheimer's disease, the relationship between the production of clusterin in the brain, cerebrospinal fluid, and circulating blood and the development of cognitive decline is relatively well understood. Increased levels of clusterin in the blood are significantly associated with an increased risk for the progression of Alzheimer's disease (Weinstein *et al.*, 2016), which is indicated by an increase in the rate of brain atrophy in patients with this disease (Thambisetty *et al.*, 2012). Clusterin is secreted in response to chronic oxidative stress-induced neuronal β-amyloid deposition, a pathological hallmark of AD (Woody & Zhao, 2016), and its peripheral concentrations appear to reflect those within brain regions susceptible to this pathology (Thambisetty *et al.*, 2012). Nevertheless, this protein is inherently neuroprotective since its secretion is intended to prevent further deposition of β-amyloid peptides in the brains of patients with AD. This fact indicates that the high production of clusterin actually represents the severity of the inflammatory response and oxidative stress triggered by beta-amyloid deposition in the brain, which is not successfully controlled by its neuroprotective effect (Woody & Zhao, 2016). Thus, increasing clusterin levels is more appropriate to be used as a predictor of worsening rather than improving the clinical outcome of Alzheimer's disease.

In contrast to Alzheimer's disease, the association between higher serum clusterin levels and an increased risk of cognitive dysfunction in the early phase of ischemic stroke, as found in this study, is elusive. Previous studies have shown that serum clusterin levels are also found to increase in acute ischemic stroke. But unfortunately, none of these studies have analyzed the relationship between increased clusterin levels and the frequency of post-acute ischemic stroke cognitive dysfunction. Some studies were aimed at investigating the role of clusterin levels in the blood as a predictor of the severity of acute ischemic stroke (Iłżecka *et al.*, 2019; Nguyen *et al.*, 2020; Song *et al.*, 2019). Since the pathology of Alzheimer's disease (AD) is also found in 15–30% of stroke patients, leading to overlapping diagnoses of poststroke cognitive impairment and Alzheimer's disease in clinical practice (Yang *et al.*, 2018), our findings suggest that elevated clusterin levels in the early stages of acute ischemic stroke may also be considered as a predictor of poststroke cognitive impairment. However, since the

TABLE 2. Multivariate Logistic Regression Analysis Examining the Association Between and Frequency of Post-Ischemic Stroke Cognitive Dysfunction After Adjustment for Covariates (n = 86)

Independent Variables	OR	95% CI	p-value
Model 1			
Higher serum clusterin level	2.06	0.71 – 6.01	0.185
Older age	2.62	0.54 – 12.65	0.230
Male gender	1.17	0.30 – 4.65	0.823
Unemployed	2.03	0.48 – 8.62	0.337
Elementary school vs. college (education level)	4.08	0.83 – 20.12	0.084
High school vs. college (education level)	2.74	0.57 – 13.10	0.207
Model 2			
Higher serum clusterin level	2.94	0.93 – 9.31	0.067
Older age	2.91	0.57 – 14.74	0.394
Male gender	0.90	0.19 – 4.34	0.894
Unemployed	2.39	0.51 – 11.26	0.269
College vs. elementary school (education level)	5.06	0.94 – 27.31	0.059
High school vs. elementary school (education level)	3.66	0.70 – 19.12	0.125
Larger infarct size	7.39	1.36 – 40.14	0.021*
Bilateral vs. right hemisphere (side of lesion)	1.38	0.29 – 6.51	0.683
Left vs. right hemisphere (side of lesion)	0.90	0.27 – 3.01	0.866
Model 3			
Higher serum clusterin level	3.56	1.04 – 12.16	0.043*
Older age	3.10	0.58 – 16.67	0.187
Female gender	1.47	0.25 – 8.75	0.670
Unemployed	2.53	0.47 – 13.75	0.281
Elementary school vs. college (education level)	5.33	0.93 – 30.98	0.062
High school vs. college (education level)	4.64	0.79 – 27.40	0.090
Larger infarct size	6.40	1.15 – 35.50	0.034*
Bilateral vs. right hemisphere (side of lesion)	1.63	0.33 – 8.18	0.551
Left vs. right hemisphere (side of lesion)	0.88	0.25 – 3.07	0.835
Hypertension	1.70	0.25 – 11.60	0.586
Diabetes	1.85	0.52 – 6.55	0.339
Cigarette smoking	1.87	0.45 – 7.75	0.389
Overweight/obesity	1.68	0.56 – 5.11	0.358

Model 1: adjusted for age, gender, employment, and education levels; Model 2: Model 1 plus stroke characteristics (infarct size and infarct side); Model 3: Model 2 plus identified vascular risk factors (hypertension, diabetes, cigarette smoking, and overweight/obesity).

presence of vascular risk factors, such as diabetes mellitus and obesity, is independently associated with increased clusterin production and the development of Alzheimer's disease (Bradley, 2020; Cai *et al*., 2016; Ha *et al*., 2020), the presence of these vascular risk factors before stroke may also have contributed to the significant findings in this study. However, this possibility still requires confirmation through further investigation.

This study demonstrated that infarct size was the stroke characteristic associated with the high frequency of cognitive dysfunction among participants in this study, whereas the lesion side in the brain was not. This finding was in line with the results of previous studies conducted

by Prodjohardjono *et al.* (Prodjohardjono *et al.*, 2020) and Sachdev *et al.* (Sachdev *et al.*, 2006). Since several consequences of stroke occur as a result of dysfunction of the anatomic structures with their complex functional networks for specific tasks, the larger size of the infarction contributes to the greater degree of damage to the anatomical structure and its consequences (Laredo *et al.*, 2018). Thus, considering that cognitive dysfunction is a consequence of ischemic stroke (El Husseini *et al.*, 2023), the extent of the degree of damage to the anatomical structures due to stroke will also increase the vulnerability of stroke patients to have this consequence. However, a previous study conducted by Nys *et al.* (Nys *et al.*, 2007) showed that stroke patients with a lesion side in the left hemisphere are more likely to have cognitive dysfunction than those with a lesion side in the right hemisphere. The finding of this previous study is supported by the results of other studies, which showed that stroke lesions involving structures in the left hemisphere, including the left frontotemporal region, left thalamus, left angular gyrus, and left basal ganglia, tend to increase the risk for cognitive dysfunction (Weaver *et al.*, 2021; Zhao *et al.*, 2018). The difference in results regarding the relationship between the site of the lesion and the incidence of ischemic stroke-associated cognitive dysfunction between this study and the previous studies is more likely due to differences in research methods. Since stroke patients with aphasia were excluded from this study, this may contribute to bias in the results of this study, particularly with regard to the relationship between the site of the lesion and the frequency of ischemic stroke-associated cognitive dysfunction.

This study also indicated that older age, male gender, low education level, unemployment, hypertension, diabetes mellitus, overweight/obesity, and smoking were not associated with the higher frequency of cognitive dysfunction in ischemic stroke patients. Prior studies have shown conflicting results regarding these associations. Prior studies conducted by Utomo and Pinzon (Utomo & Pinzon, 2023) and Kaddumukasa *et al.* (Kaddumukasa *et al.*, 2023) showed that older age and low educational level increased the risk of cognitive dysfunction among ischemic stroke patients. A multicenter study conducted by He *et al.* (He *et al.*, 2023) showed that, apart from older age and low education level, being unemployed and diabetes mellitus were risk factors for post-stroke cognitive dysfunction, whereas hypertension was not. A study conducted by Levine *et al.*(Levine *et al.*, 2018) showed that older age was a predictor of post-stroke cognitive dysfunction, while education level, gender, hypertension, diabetes mellitus, and smoking status were not. Similar to what has been stated in the discussion regarding stroke characteristics above, the differences in the results of this study and previous studies regarding the role of sociodemographic and vascular risk factors are more likely due to differences in research methods.

This research provides additional evidence that serum clusterin levels have a diagnostic value for detecting cognitive dysfunction associated with ischemic stroke in the early phases of the disease, specifically within the initial three months after the onset of the stroke. However, there are several limitations to this study. First, it is important to note that this study was conducted exclusively in a single location, representing a singular population, and utilized a relatively small sample size. Furthermore, the participants in our research were limited to patients who had suffered from minor strokes; our findings must be interpreted carefully upon generalization. Second, since biomarkers for Alzheimer's disease were not assessed in this study, patients with pathology for Alzheimer's disease may be found in this study. Third, the accuracy of determining the infarct diameter may be compromised by significant variability in the time of a head CT scan conducted for diagnostic purposes.

Conclusions

This study revealed a significant prevalence of cognitive dysfunction among individuals diagnosed with ischemic stroke. The findings indicated a positive correlation between elevated serum clusterin levels and the prevalence of cognitive impairment in these individuals. Furthermore, it was observed that a greater infarct diameter exhibited a positive correlation with the increased occurrence of

cognitive impairment in individuals diagnosed with ischemic stroke. These findings offer supplementary data for the development of early identification and intervention approaches for cognitive dysfunction associated with ischemic stroke.

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The Social Cognitive Theory Model in Predicting Maternal Behavior for Healthy Child Development in Yogyakarta Indonesia

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Abstract

Early childhood development determines the quality of future generations. A mother is crucial in encouraging a child's growth and development. This research aims to determine the influence of social psychological factors that influence maternal behavior on healthy child growth and development using the Social Cognitive Theory (SCT) model. This cross-sectional study was conducted from July to October 2023 in Yogyakarta, Indonesia. A sample of 400 mothers with children under five (12-59 months). The dependent variable is the maternal behavior in child development, and the independent variables are observational learning, outcome expectations, self-efficacy, and family support. All variables were measured by questionnaire, and the data were analyzed by path analysis using Stata 13 statistical software. A maternal's behavior is directly and positively related to observational learning (b= 0.28, p<0.001), outcome expectations (b= 0.24, p<0.001), self-efficacy (b= 0.37, p<0.001), and family support (b= 0.09, p=0.005). The goodness of fit path analysis indicates p > 0.05, RSME< 0.001, TFI= 1.00, TLI= 1.00, and SRMR< 0.001. A maternal's behavior is directly and positively related to observational learning, outcome expectations, self-efficacy, and family support. Interventions to improve mothers' healthy behavior in accelerated child development should prioritize efforts to increase self-efficacy.

Introduction

According to a 2019 report by the United Nations, the proportion of the children population worldwide has reached a quarter (25.6%). By 2050, the number of children will continue to increase. It will be mostly accounted for by developing countries, including Indonesia (United Nations, 2019). The early childhood population in Indonesia, according to the results of the 2020 National Socio-Economic Survey (SUSENAS), has reached 32.96 million or 12.19% of the total population; furthermore, 10.3% of children under five experience developmental delays (Saptarini *et al.*, 2021; The Central Bureau of Statistics, 2020). Children in low-middle human development index countries are at the highest risk of failing to reach their developmental potential (Tran, Luchters and Fisher, 2017). This condition was exacerbated by the Learning From Home policy implementation in 2019 to control the transmission of COVID-19 related to their social development problems (Anggorowati, Desty and Fauzi, 2022). Yogyakarta is one of the provinces in Indonesia that has implemented the PUSPAGA (Family Learning Center) program. This program aims to provide services to increase the capacity of parents/families

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to carry out the responsibilities of caring for and educating children through the skills of stimulating children's growth and development (Ministry of Women's Empowerment and Child Protection, 2020). The implementation of this program's services is integrated with primary health services at Community Health Centers (Puskesmas), which makes it easy for families to access (Office of Women's Empowerment, Child Protection, Population Control Yogyakarta, 2021). The implementation of classes for mothers of toddlers has been proven to increase their knowledge about parenting patterns for toddlers (Meliati and Ekayani, 2018)

The World Health Organization (WHO) recommends the promotion of health to increase children's development through positive parenting by providing developmental stimulation from an early age (WHO, 2020). Developmental stimulation carried out by the family can improve children's cognitive, language, social, and emotional abilities. (Ma *et al.*, 2016; Barreto *et al.*, 2017). Providing stimulation to children depends on the role of a mother. According to reports from several studies, in general, mothers are considered to be the primary person responsible for caring for children under five (Fikree and Pasha, 2004; Ministry of Women's Empowerment and Child Protection, 2020). However, still many have limitations in stimulating their children's development because of their lack of knowledge and because they experience stress in their busy households (Emmers *et al.*, 2021). Another factor that influences mothers' behavior in caring for toddlers is the level of education and number of children (Simatupang *et al.*, 2022).

Extensive research on interventions that influence maternal behavior to improve toddler development has been carried out; however, research that analyzes the relationship between social psychological factors and maternal behavior to improve toddler development within a conceptual framework is still limited. Psychosocial factors include childcare quality at home, is a vital determinant of early childhood development (Tran, Luchters and Fisher, 2017). One crucial step in developing interventions to change maternal behavior to promote effective child development is understanding the relationships and interactions between all the factors that influence maternal behavior within a conceptual framework. The SCT model developed by Albert Bandura emphasizes reciprocal determinism, namely the reciprocal relationship between behavioral factors, personal factors, and environmental influences (triadic reciprocality). Human behavior comes from reciprocal interactions between external events and individual factors such as genetic abilities, learned competencies, reflective thinking, and initiative. Mindfulness factors include observational learning, hope, and self-efficacy (Bandura, 1998). The relationships between the constructs in the SCT model are considered capable of explaining maternal behavior that improves the development of children under five, both directly and indirectly. This research aims to analyze the factors that influence maternal behavior in the development of children under five using SCT modeling.

Method

This research was an analytical observational study with a cross-sectional design. It was conducted in the Special Region of Yogyakarta Province, Indonesia, from July to September 2023. The study's population comprised mothers with toddlers aged 12-59 months. The sample size was 400 mothers of toddlers from areas covered by 20 community health centers (*Puskesmas*) selected using a cluster random sampling technique. The mothers of toddlers were selected according to predetermined criteria. The criteria for mothers of toddlers were those (1) able to read/write fluently; (2) who lived at home with their partner (husband); and (3) who had healthy toddlers. Data collection was by home visits; each mother of a toddler signed a letter of consent to become a respondent before completing the survey. If the respondents had more than one child in this age group then they were asked to respond to survey questions with the youngest child in mind. The research was carried out after obtaining ethical feasibility approval from the research ethics committee and permission from the regional heads of Yogyakarta and Bantul Regency.

The research instrument is a questionnaire to measure the influence of

the five variables observational learning, outcome expectations, self-efficacy, family support, and maternal behavior on improving the development of children under five. The indicators for measuring observational learning consist of seven statements with a 3-point Likert scale (0= no, 1= undecided, and 2= yes). The indicators for measuring outcome expectations consist of five statements with a 3-point Likert scale (0= no, 1= undecided, and 2= yes). The indicators for measuring self-efficacy consist of five statements with a 3-point Likert scale (0= no, 1= not sure, and 2= yes). The indicators for measuring family support consist of 11 statements of support with the answers "yes" and "no" (0=no 1=yes). The indicators for measuring maternal behavior consist of 10 statements with a 3-point Likert scale (0= no, 1= sometimes, and 2= always). The analysis used in this research was path analysis. The data analysis was conducted using the Stata 13 statistical software application. The benefit of using path analysis is that it allows testing the mediation between variables and provides estimates of the magnitude of influence, significance, and direction of relationships between variables as suggested by the hypothesized model (Ayuningrum and Murti, 2019).

The path analysis carried out by the researchers went through the following stages: first, creating a path diagram based on the SCT model (model specifications). The path diagram of the variables to be measured is in Figure 1. The next step was identifying the model by determining the degree of freedom. To determine the suitability of the model, the researchers checked the influence between variables according to the SCT model. Based on these relationships, a model was obtained consisting of direct relationships and indirect relationships. The estimated interaction parameters between variables are shown by the regression coefficient (b). The parameters in the structural model were estimated using goodness of fit and path coefficients. The model is suitable (good fit) by looking at the Chi2 between the model compared to the saturated model, the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI), and the Standardized Root Mean Square Residual (SRMR).

Result And Discussion

A total of 400 respondents completed

Table 1. Characteristics of Mothers of Toddlers

Characteristic Variables	Frequency	
	N=400	%
Age (years)		
20-30	142	35.50
>30	258	64.50
Education		
Junior High School	91	22.75
Junior High School/Equivalent	202	50.50
Higher Education	107	26.75
Employment Status		
Unemployed	220	55.00
Employed	180	45.00
Parity		
Primipara	139	34.75
Multipara	261	65.25
Another Caregiver		
No	178	44.50
Yes	222	55.50

Source: Primary Data, 2023

the survey. The characteristics of respondents, mothers of toddlers, are in Table 1. The majority (64.50%) of the mothers of toddlers were aged 30-40 years, and those with low education accounted for 22.75%. Most of the mothers did not work (55.00%), had more than one child (65.25%), and most were assisted by other caregiver (55.50%).

Most mothers are middle-aged, have less than one education, already have more than one child, and are not working. According to previous researchers, these maternal characteristics are the reason for the mother's limitation in parenting. Low levels of education will reduce parental involvement in stimulating activities for their children due to lack of information and skills (Britto *et al*., 2017). Having more children to take care of will also reduce the mother's capacity to provide good stimulation (Price & Kalil, 2019).

Table 2 shows the results of univariate analysis for each variable. The average value of maternal behavior is a mean of 14.44 (SD ±3.21), with a minimum score of 7 and a maximum of 20. The value of the observational learning variable is a mean of 9.71 (SD ±2.34) with a minimum score of 3 and 14 for the maximum score. The results of measuring the outcome expectancy variable showed a mean of 7.67 (SD ± 1.14) with a minimum score of 5 and a maximum of 10. The mother's self-efficacy variable obtained a value of a mean of 7.28 (SD ± 1.36), with a minimum score of 4 and a maximum of 10. The family support variable obtained a value of a mean of 7.27 (SD ±1.78), with a minimum score 3 and a maximum of 11.

Each statement item to measure the variables studied has been tested for validity and reliability on 20 respondents; the alpha coefficient results for the observational learning variable is 0.88, the outcome expectations variable is 0.86, the self-efficacy variable is 0.83, the family support variable is 0.85, and the maternal behavior variable is 0.91. All variables have a Cronbach's alpha value > 0.70, which confirms internal consistency and reliability. The value df=1 indicates that path analysis can be carried out. The structural model was tested with all the paths depicted in Figure 1. The results of the path analysis of the SCT model to predict healthy maternal behavior to improve the development of children under five are in

Table 2. Results of Univariate Analysis of the SCT Construct

Variables	Mean	SD	Min	Max
Observational Learning	9.71	2.34	3	14
Outcome Expectancies	7.67	1.14	5	10
Self-Efficacy	7.28	1.36	4	10
Family Support	7.27	1.78	3	11
Maternal Behavior	14.44	3.21	7	20

Source: Primary Data

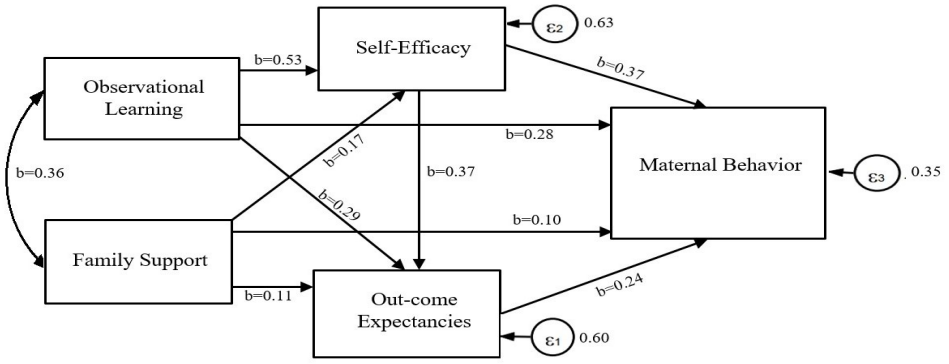

Figure 1. Path Analysis of Observational Learning Variables, Outcome Expectations, Self-Efficacy, Family Support, and Mother's Behavior to Improve the Development of Children with standardized path coefficients.

Table 3. The Direct and Indirect Effects of Social Cognitive Theory Model on Maternal Behavior for Healthy Child Development

Dependent Variables	Independent Variables	Path Coeff. (b)	CI (95%)		p
			Lower Limit	Upper Limit	
Direct Effect					
Maternal Behavior	Self-Efficacy	0.38	0. 291	0.444	< 0.001
	Out-come Expectancies	0.24	0.169	0.318	< 0.001
	Observational Learning	0.28	0.209	0.359	< 0.001
	Family Support	0.10	0.040	0.167	0.001
Indirect Effect					
Self-Efficacy	Observational Learning	0.53	0.452	0.598	< 0.001
	Family Support	0.17	0.090	0.255	< 0.001
Out-come Expectancies	Observational Learning	0.29	0.195	0.382	< 0.001
	Self-Efficacy	0.37	0.273	0.457	< 0.001
	Family Support	0.11	0.024	0.189	0.011
p > 0.05 RMSEA<0.001 CFI= 1.00 TLI= 1.00 SRMR< 0.001					

Source: Primary Data

Table 3.

Direct relationships: The independent variables that are positively and significantly related to maternal behavior are observational learning (b= 0.28, p< 0.001), outcome expectations (b= 0.24, p< 0.001), self-efficacy (b= 0.38, p< 0.001), and family support (b= 0.10, p= 0.001). Indirect relationships: There is an indirect relationship between the observational learning and family support variables and maternal behavior through the self-efficacy variable. Both are positively and significantly related, namely observational learning (b=0.53, p<0.001) and family support (b= 0.17, p< 0.001). There is an indirect relationship between observational learning, self-efficacy, and family support variables and the mother's behavior through the outcome expectancy variable. The three are positively and significantly related, namely observational learning (b= 0.29, p< 0.001), self-efficacy (b= 0.37, p< 0.001), and family support (b= 0.11, p= 0.011). The model suitability values (goodness of fit) are p> 0.05, RMSEA< 0.001, CFI= 1.00, TLI= 1.00, and SRMR< 0.001.

There has not been much research on health promotion models for changing maternal behavior to improve child development in Indonesia. In Indonesia, research priorities are on nutrition programs and preventing stunting (Lawn *et al*., 2014). This research explores the relationship between individual factors, social environmental support, and maternal behavior that improves the development of children under five in Yogyakarta, Indonesia. Maternal behavior that improves child development comes from reciprocal interactions between external events and personal factors (Bandura,

2004). By exploring and developing an understanding of the interactions between constructs according to the SCT model, it is hoped that researchers will find opportunities for health promotion interventions that focus on efforts to improve the development of children under five.

The results of path analysis conducted on the direct and indirect relationships in the construction of the SCT model and maternal behavior in the development of children under five yield several key findings: The findings in this study show that mothers with more observational learning have a greater possibility of exhibiting healthy behavior that improves the development of their toddlers. Most of a person's behavior and cognitive skills are learned through observing models (observational learning). Behavior is more likely to be adopted if the behavior is valued positively, it produces external rewards, and it is beneficial to the model itself (Bandura, 1998). The findings in this study follow previous research that showed that mothers of toddlers who received exposure to information about parenting from professionals, health cadres, and visits from family and peers had better knowledge and demonstrated higher quality parenting practices; mothers interact more often with children and provide an environment providing developmental stimulation for children under five (Bandura, 1998, 2004; Pitchik *et al*., 2018; Singla *et al*., 2015; Zhong *et al*., 2020).

The findings in this study indicate that mothers who have high self-efficacy have a greater possibility of adopting healthy behavior that improves children's development. Self-efficacy in parenting refers to parents' self-confidence about how well they can carry out their responsibilities. Parents who feel more confident in caring for children will take more role in caring for them (Merrifield *et al*., 2015). Mothers who have high self-efficacy are likely to have lower levels of anxiety/stress/depression and exhibit quality parenting outcomes and better child development (Albanese *et al*., 2019). This finding follows the results of previous research that showed that mothers who have high self-efficacy are more active in stimulating development and providing better childcare (Albanese *et al*., 2019; Hamadani *et al*., 2019; Luo *et al*., 2019).

The findings in this study show that mothers with expectations of better outcomes have more opportunity to engage in behavior that improves child development. Outcome expectations are a person's beliefs regarding the effectiveness of an action, even though they do not necessarily consider themselves capable of carrying out that action. Outcome expectations include social, physical, and self-evaluation outcomes (Hajal *et al*., 2019). The findings in this study are in accordance with previous research that showed that mothers of toddlers who have assessed their children's developmental outcomes as better after participating in an early childhood education (PAUD) program exhibit an increase in their responsiveness in interacting with their children. It demonstrates that the hope for positive child development results influences the mother's desire to carry out developmental stimulation activities, such as those carried out by caregivers in PAUD programs (Yazejian *et al*., 2017).

The findings in this study show that mothers with better family support have more opportunity to exhibit healthy behaviors that improve the development of their toddlers. Family support includes information, facilities, costs, and emotional support. Support can come from husbands, grandmothers, or other relatives. Family support behavior can be realized by providing play equipment, playing with children, inviting children to play outside the house, and teaching such as reading books, telling stories, singing, counting songs, and drawing with children (Frongillo *et al*., 2017). This finding follows previous research that showed that the support provided by the family (father) in child care reduces stress levels and the risk of maternal depression, thereby enabling mothers to provide more effective and quality care(Angley *et al*., 2015; Merrifield *et al*., 2015; Saptarini *et al*., 2021). The availability of funds and facilities provided by the family has been proven to increase the mother's activity in practicing stimulating a child's development (Cuartas *et al*., 2020; Yu *et al*., 2023).

The findings in this study show that self-efficacy is a mediating variable between observational learning, family support, and maternal healthy behavior in improving the

development of children under five. The findings in this study follow previous research that showed that mothers who received exposure to information and family support (fathers) exhibited positive changes in attitudes and self-efficacy, reduced anxiety in caring for children. Therefore, the quality of interactions with children was increased (Cuartas *et al*., 2020; Yu *et al*., 2023). More support from a partner can increase a mother's self-efficacy in parenting (Angley *et al*., 2015). Maternal education and previous parenting experience increase maternal self-efficacy regarding their ability to successfully implement parenting strategies (Merrifield *et al*., 2015). Mothers whose families have a higher socioeconomic status have been proven to be in a better psychological condition, so they can carry out responsive parenting practices (Scherer *et al*., 2019).

The findings in this study show that outcome expectations are mediating variables between observational learning, self-efficacy, and family support and maternal healthy behavior improving child development. These findings follow previous research that showed that mothers who receive more observational learning (information) higher social/family support, and increased self-efficacy have the opportunity to have higher outcome expectations, which ultimately shows higher quality parenting behavior for children. (Angley *et al*., 2015). A mother's achievement of expected outcomes in caring for a child is influenced by previous experience, knowledge gained from the family, and self-efficacy. Social support for prospective parents is needed as early as possible to increase the mother's and partner's self-efficacy as well as parenting competence (Angley *et al*., 2015).

This research is interesting because it explores the relationship between the three constructs of the SCT model and family support with maternal behavior in improving the development of children under five in one of the provinces that have good access to education and health services in Indonesia. Some limitations need to be considered from the results of cross-sectional analysis, namely that they limit causal inference. This study had a fairly large sample size (N=400), although it did have sufficient power to detect the effects required in the statistical analysis (Cohen, 1992). The multivariate analysis carried out did not take into account variables outside the SCT model's construction which could have contributed to the analysis results, such as family income, family support, mother's education level, and others; this is because this research phase aimed to explore the model's goodness of fit. This research is only based on the mother's answers and not accompanied by observations of the mother's behavior, so there may be information bias influenced by recall bias. Our study was conducted in children aged 12–59 months, so the findings may not be generalizable to other age groups.

Conclusion

The SCT model can be used to explain the complex relationship between the construction of social psychological factors and maternal behavior that improves the development of children under five in Yogyakarta, Indonesia. This model can aid in understanding the predictors of maternal behavior and future programs to improve the development of children under five. This research provides important insights into variables associated with maternal behavior in the population of Yogyakarta, Indonesia. Future research should utilize these findings to develop healthy behavior change programs for mothers to improve the development of children under five through interventions that focus on addressing self-efficacy and outcome expectations.

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The Social Cognitive Theory Model in Predicting Maternal Behavior for Healthy Child Development in Yogyakarta Indonesia

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Abstract

Early childhood development determines the quality of future generations. A mother is crucial in encouraging a child's growth and development. This research aims to determine the influence of social psychological factors that influence maternal behavior on healthy child growth and development using the Social Cognitive Theory (SCT) model. This cross-sectional study was conducted from July to October 2023 in Yogyakarta, Indonesia. A sample of 400 mothers with children under five (12-59 months). The dependent variable is the maternal behavior in child development, and the independent variables are observational learning, outcome expectations, self-efficacy, and family support. All variables were measured by questionnaire, and the data were analyzed by path analysis using Stata 13 statistical software. A maternal's behavior is directly and positively related to observational learning (b= 0.28, p<0.001), outcome expectations (b= 0.24, p<0.001), self-efficacy (b= 0.37, p<0.001), and family support (b= 0.09, p=0.005). The goodness of fit path analysis indicates p > 0.05, RSME< 0.001, TFI= 1.00, TLI= 1.00, and SRMR< 0.001. A maternal's behavior is directly and positively related to observational learning, outcome expectations, self-efficacy, and family support. Interventions to improve mothers' healthy behavior in accelerated child development should prioritize efforts to increase self-efficacy.

Introduction

According to a 2019 report by the United Nations, the proportion of the children population worldwide has reached a quarter (25.6%). By 2050, the number of children will continue to increase. It will be mostly accounted for by developing countries, including Indonesia (United Nations, 2019). The early childhood population in Indonesia, according to the results of the 2020 National Socio-Economic Survey (SUSENAS), has reached 32.96 million or 12.19% of the total population; furthermore, 10.3% of children under five experience developmental delays (Saptarini *et al.*, 2021; The Central Bureau of Statistics, 2020). Children in low-middle human development index countries are at the highest risk of failing to reach their developmental potential (Tran, Luchters and Fisher, 2017). This condition was exacerbated by the Learning From Home policy implementation in 2019 to control the transmission of COVID-19 related to their social development problems (Anggorowati, Desty and Fauzi, 2022). Yogyakarta is one of the provinces in Indonesia that has implemented the PUSPAGA (Family Learning Center) program. This program aims to provide services to increase the capacity of parents/families

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to carry out the responsibilities of caring for and educating children through the skills of stimulating children's growth and development (Ministry of Women's Empowerment and Child Protection, 2020). The implementation of this program's services is integrated with primary health services at Community Health Centers (Puskesmas), which makes it easy for families to access (Office of Women's Empowerment, Child Protection, Population Control Yogyakarta, 2021). The implementation of classes for mothers of toddlers has been proven to increase their knowledge about parenting patterns for toddlers (Meliati and Ekayani, 2018)

The World Health Organization (WHO) recommends the promotion of health to increase children's development through positive parenting by providing developmental stimulation from an early age (WHO, 2020). Developmental stimulation carried out by the family can improve children's cognitive, language, social, and emotional abilities. (Ma *et al.*, 2016; Barreto *et al.*, 2017). Providing stimulation to children depends on the role of a mother. According to reports from several studies, in general, mothers are considered to be the primary person responsible for caring for children under five (Fikree and Pasha, 2004; Ministry of Women's Empowerment and Child Protection, 2020). However, still many have limitations in stimulating their children's development because of their lack of knowledge and because they experience stress in their busy households (Emmers *et al.*, 2021). Another factor that influences mothers' behavior in caring for toddlers is the level of education and number of children (Simatupang *et al.*, 2022).

Extensive research on interventions that influence maternal behavior to improve toddler development has been carried out; however, research that analyzes the relationship between social psychological factors and maternal behavior to improve toddler development within a conceptual framework is still limited. Psychosocial factors include childcare quality at home, is a vital determinant of early childhood development (Tran, Luchters and Fisher, 2017). One crucial step in developing interventions to change maternal behavior to promote effective child development is understanding the relationships and interactions between all the factors that influence maternal behavior within a conceptual framework. The SCT model developed by Albert Bandura emphasizes reciprocal determinism, namely the reciprocal relationship between behavioral factors, personal factors, and environmental influences (triadic reciprocality). Human behavior comes from reciprocal interactions between external events and individual factors such as genetic abilities, learned competencies, reflective thinking, and initiative. Mindfulness factors include observational learning, hope, and self-efficacy (Bandura, 1998). The relationships between the constructs in the SCT model are considered capable of explaining maternal behavior that improves the development of children under five, both directly and indirectly. This research aims to analyze the factors that influence maternal behavior in the development of children under five using SCT modeling.

Method

This research was an analytical observational study with a cross-sectional design. It was conducted in the Special Region of Yogyakarta Province, Indonesia, from July to September 2023. The study's population comprised mothers with toddlers aged 12-59 months. The sample size was 400 mothers of toddlers from areas covered by 20 community health centers (*Puskesmas*) selected using a cluster random sampling technique. The mothers of toddlers were selected according to predetermined criteria. The criteria for mothers of toddlers were those (1) able to read/write fluently; (2) who lived at home with their partner (husband); and (3) who had healthy toddlers. Data collection was by home visits; each mother of a toddler signed a letter of consent to become a respondent before completing the survey. If the respondents had more than one child in this age group then they were asked to respond to survey questions with the youngest child in mind. The research was carried out after obtaining ethical feasibility approval from the research ethics committee and permission from the regional heads of Yogyakarta and Bantul Regency.

The research instrument is a questionnaire to measure the influence of

the five variables observational learning, outcome expectations, self-efficacy, family support, and maternal behavior on improving the development of children under five. The indicators for measuring observational learning consist of seven statements with a 3-point Likert scale (0= no, 1= undecided, and 2= yes). The indicators for measuring outcome expectations consist of five statements with a 3-point Likert scale (0= no, 1= undecided, and 2= yes). The indicators for measuring self-efficacy consist of five statements with a 3-point Likert scale (0= no, 1= not sure, and 2= yes). The indicators for measuring family support consist of 11 statements of support with the answers "yes" and "no" (0=no 1=yes). The indicators for measuring maternal behavior consist of 10 statements with a 3-point Likert scale (0= no, 1= sometimes, and 2= always). The analysis used in this research was path analysis. The data analysis was conducted using the Stata 13 statistical software application. The benefit of using path analysis is that it allows testing the mediation between variables and provides estimates of the magnitude of influence, significance, and direction of relationships between variables as suggested by the hypothesized model (Ayuningrum and Murti, 2019).

The path analysis carried out by the researchers went through the following stages: first, creating a path diagram based on the SCT model (model specifications). The path diagram of the variables to be measured is in Figure 1. The next step was identifying the model by determining the degree of freedom. To determine the suitability of the model, the researchers checked the influence between variables according to the SCT model. Based on these relationships, a model was obtained consisting of direct relationships and indirect relationships. The estimated interaction parameters between variables are shown by the regression coefficient (b). The parameters in the structural model were estimated using goodness of fit and path coefficients. The model is suitable (good fit) by looking at the Chi2 between the model compared to the saturated model, the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI), and the Standardized Root Mean Square Residual (SRMR).

Result And Discussion

A total of 400 respondents completed

Table 1. Characteristics of Mothers of Toddlers

Characteristic Variables	Frequency	
	N=400	%
Age (years)		
20-30	142	35.50
>30	258	64.50
Education		
Junior High School	91	22.75
Junior High School/Equivalent	202	50.50
Higher Education	107	26.75
Employment Status		
Unemployed	220	55.00
Employed	180	45.00
Parity		
Primipara	139	34.75
Multipara	261	65.25
Another Caregiver		
No	178	44.50
Yes	222	55.50

Source: Primary Data, 2023

the survey. The characteristics of respondents, mothers of toddlers, are in Table 1. The majority (64.50%) of the mothers of toddlers were aged 30-40 years, and those with low education accounted for 22.75%. Most of the mothers did not work (55.00%), had more than one child (65.25%), and most were assisted by other caregiver (55.50%).

Most mothers are middle-aged, have less than one education, already have more than one child, and are not working. According to previous researchers, these maternal characteristics are the reason for the mother's limitation in parenting. Low levels of education will reduce parental involvement in stimulating activities for their children due to lack of information and skills (Britto *et al*., 2017). Having more children to take care of will also reduce the mother's capacity to provide good stimulation (Price & Kalil, 2019).

Table 2 shows the results of univariate analysis for each variable. The average value of maternal behavior is a mean of 14.44 (SD ±3.21), with a minimum score of 7 and a maximum of 20. The value of the observational learning variable is a mean of 9.71 (SD ±2.34) with a minimum score of 3 and 14 for the maximum score. The results of measuring the outcome expectancy variable showed a mean of 7.67 (SD ± 1.14) with a minimum score of 5 and a maximum of 10. The mother's self-efficacy variable obtained a value of a mean of 7.28 (SD ± 1.36), with a minimum score of 4 and a maximum of 10. The family support variable obtained a value of a mean of 7.27 (SD ±1.78), with a minimum score 3 and a maximum of 11.

Each statement item to measure the variables studied has been tested for validity and reliability on 20 respondents; the alpha coefficient results for the observational learning variable is 0.88, the outcome expectations variable is 0.86, the self-efficacy variable is 0.83, the family support variable is 0.85, and the maternal behavior variable is 0.91. All variables have a Cronbach's alpha value > 0.70, which confirms internal consistency and reliability. The value df=1 indicates that path analysis can be carried out. The structural model was tested with all the paths depicted in Figure 1. The results of the path analysis of the SCT model to predict healthy maternal behavior to improve the development of children under five are in

Table 2. Results of Univariate Analysis of the SCT Construct

Variables	Mean	SD	Min	Max
Observational Learning	9.71	2.34	3	14
Outcome Expectancies	7.67	1.14	5	10
Self-Efficacy	7.28	1.36	4	10
Family Support	7.27	1.78	3	11
Maternal Behavior	14.44	3.21	7	20

Source: Primary Data

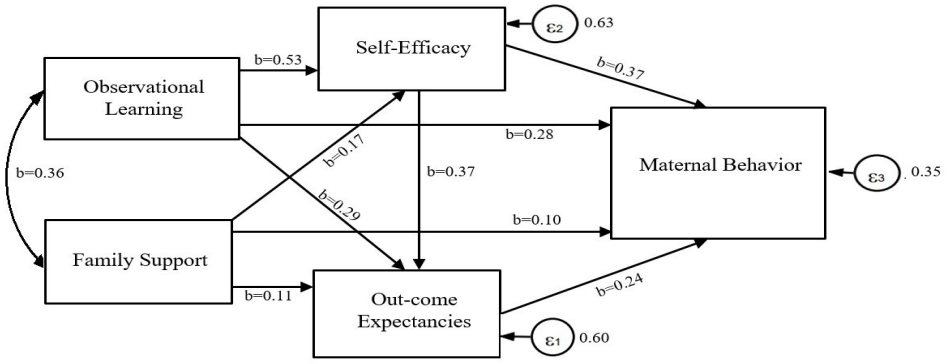

Figure 1. Path Analysis of Observational Learning Variables, Outcome Expectations, Self-Efficacy, Family Support, and Mother's Behavior to Improve the Development of Children with standardized path coefficients.

Table 3. The Direct and Indirect Effects of Social Cognitive Theory Model on Maternal Behavior for Healthy Child Development

Dependent Variables	Independent Variables	Path Coeff. (b)	CI (95%)		p
			Lower Limit	Upper Limit	
Direct Effect					
Maternal Behavior	Self-Efficacy	0.38	0. 291	0.444	< 0.001
	Out-come Expectancies	0.24	0.169	0.318	< 0.001
	Observational Learning	0.28	0.209	0.359	< 0.001
	Family Support	0.10	0.040	0.167	0.001
Indirect Effect					
Self-Efficacy	Observational Learning	0.53	0.452	0.598	< 0.001
	Family Support	0.17	0.090	0.255	< 0.001
Out-come Expectancies	Observational Learning	0.29	0.195	0.382	< 0.001
	Self-Efficacy	0.37	0.273	0.457	< 0.001
	Family Support	0.11	0.024	0.189	0.011
p > 0.05 RMSEA<0.001 CFI= 1.00 TLI= 1.00 SRMR< 0.001					

Source: Primary Data

Table 3.

Direct relationships: The independent variables that are positively and significantly related to maternal behavior are observational learning (b= 0.28, p< 0.001), outcome expectations (b= 0.24, p< 0.001), self-efficacy (b= 0.38, p< 0.001), and family support (b= 0.10, p= 0.001). Indirect relationships: There is an indirect relationship between the observational learning and family support variables and maternal behavior through the self-efficacy variable. Both are positively and significantly related, namely observational learning (b=0.53, p<0.001) and family support (b= 0.17, p< 0.001). There is an indirect relationship between observational learning, self-efficacy, and family support variables and the mother's behavior through the outcome expectancy variable. The three are positively and significantly related, namely observational learning (b= 0.29, p< 0.001), self-efficacy (b= 0.37, p< 0.001), and family support (b= 0.11, p= 0.011). The model suitability values (goodness of fit) are p> 0.05, RMSEA< 0.001, CFI= 1.00, TLI= 1.00, and SRMR< 0.001.

There has not been much research on health promotion models for changing maternal behavior to improve child development in Indonesia. In Indonesia, research priorities are on nutrition programs and preventing stunting (Lawn *et al*., 2014). This research explores the relationship between individual factors, social environmental support, and maternal behavior that improves the development of children under five in Yogyakarta, Indonesia. Maternal behavior that improves child development comes from reciprocal interactions between external events and personal factors (Bandura,

2004). By exploring and developing an understanding of the interactions between constructs according to the SCT model, it is hoped that researchers will find opportunities for health promotion interventions that focus on efforts to improve the development of children under five.

The results of path analysis conducted on the direct and indirect relationships in the construction of the SCT model and maternal behavior in the development of children under five yield several key findings: The findings in this study show that mothers with more observational learning have a greater possibility of exhibiting healthy behavior that improves the development of their toddlers. Most of a person's behavior and cognitive skills are learned through observing models (observational learning). Behavior is more likely to be adopted if the behavior is valued positively, it produces external rewards, and it is beneficial to the model itself (Bandura, 1998). The findings in this study follow previous research that showed that mothers of toddlers who received exposure to information about parenting from professionals, health cadres, and visits from family and peers had better knowledge and demonstrated higher quality parenting practices; mothers interact more often with children and provide an environment providing developmental stimulation for children under five (Bandura, 1998, 2004; Pitchik *et al*., 2018; Singla *et al*., 2015; Zhong *et al*., 2020).

The findings in this study indicate that mothers who have high self-efficacy have a greater possibility of adopting healthy behavior that improves children's development. Self-efficacy in parenting refers to parents' self-confidence about how well they can carry out their responsibilities. Parents who feel more confident in caring for children will take more role in caring for them (Merrifield *et al*., 2015). Mothers who have high self-efficacy are likely to have lower levels of anxiety/stress/depression and exhibit quality parenting outcomes and better child development (Albanese *et al*., 2019). This finding follows the results of previous research that showed that mothers who have high self-efficacy are more active in stimulating development and providing better childcare (Albanese *et al*., 2019; Hamadani *et al*., 2019; Luo *et al*., 2019).

The findings in this study show that mothers with expectations of better outcomes have more opportunity to engage in behavior that improves child development. Outcome expectations are a person's beliefs regarding the effectiveness of an action, even though they do not necessarily consider themselves capable of carrying out that action. Outcome expectations include social, physical, and self-evaluation outcomes (Hajal *et al*., 2019). The findings in this study are in accordance with previous research that showed that mothers of toddlers who have assessed their children's developmental outcomes as better after participating in an early childhood education (PAUD) program exhibit an increase in their responsiveness in interacting with their children. It demonstrates that the hope for positive child development results influences the mother's desire to carry out developmental stimulation activities, such as those carried out by caregivers in PAUD programs (Yazejian *et al*., 2017).

The findings in this study show that mothers with better family support have more opportunity to exhibit healthy behaviors that improve the development of their toddlers. Family support includes information, facilities, costs, and emotional support. Support can come from husbands, grandmothers, or other relatives. Family support behavior can be realized by providing play equipment, playing with children, inviting children to play outside the house, and teaching such as reading books, telling stories, singing, counting songs, and drawing with children (Frongillo *et al*., 2017). This finding follows previous research that showed that the support provided by the family (father) in child care reduces stress levels and the risk of maternal depression, thereby enabling mothers to provide more effective and quality care(Angley *et al*., 2015; Merrifield *et al*., 2015; Saptarini *et al*., 2021). The availability of funds and facilities provided by the family has been proven to increase the mother's activity in practicing stimulating a child's development (Cuartas *et al*., 2020; Yu *et al*., 2023).

The findings in this study show that self-efficacy is a mediating variable between observational learning, family support, and maternal healthy behavior in improving the

development of children under five. The findings in this study follow previous research that showed that mothers who received exposure to information and family support (fathers) exhibited positive changes in attitudes and self-efficacy, reduced anxiety in caring for children. Therefore, the quality of interactions with children was increased (Cuartas *et al*., 2020; Yu *et al*., 2023). More support from a partner can increase a mother's self-efficacy in parenting (Angley *et al*., 2015). Maternal education and previous parenting experience increase maternal self-efficacy regarding their ability to successfully implement parenting strategies (Merrifield *et al*., 2015). Mothers whose families have a higher socioeconomic status have been proven to be in a better psychological condition, so they can carry out responsive parenting practices (Scherer *et al*., 2019).

The findings in this study show that outcome expectations are mediating variables between observational learning, self-efficacy, and family support and maternal healthy behavior improving child development. These findings follow previous research that showed that mothers who receive more observational learning (information) higher social/family support, and increased self-efficacy have the opportunity to have higher outcome expectations, which ultimately shows higher quality parenting behavior for children. (Angley *et al*., 2015). A mother's achievement of expected outcomes in caring for a child is influenced by previous experience, knowledge gained from the family, and self-efficacy. Social support for prospective parents is needed as early as possible to increase the mother's and partner's self-efficacy as well as parenting competence (Angley *et al*., 2015).

This research is interesting because it explores the relationship between the three constructs of the SCT model and family support with maternal behavior in improving the development of children under five in one of the provinces that have good access to education and health services in Indonesia. Some limitations need to be considered from the results of cross-sectional analysis, namely that they limit causal inference. This study had a fairly large sample size (N=400), although it did have sufficient power to detect the effects required in the statistical analysis (Cohen, 1992). The multivariate analysis carried out did not take into account variables outside the SCT model's construction which could have contributed to the analysis results, such as family income, family support, mother's education level, and others; this is because this research phase aimed to explore the model's goodness of fit. This research is only based on the mother's answers and not accompanied by observations of the mother's behavior, so there may be information bias influenced by recall bias. Our study was conducted in children aged 12–59 months, so the findings may not be generalizable to other age groups.

Conclusion

The SCT model can be used to explain the complex relationship between the construction of social psychological factors and maternal behavior that improves the development of children under five in Yogyakarta, Indonesia. This model can aid in understanding the predictors of maternal behavior and future programs to improve the development of children under five. This research provides important insights into variables associated with maternal behavior in the population of Yogyakarta, Indonesia. Future research should utilize these findings to develop healthy behavior change programs for mothers to improve the development of children under five through interventions that focus on addressing self-efficacy and outcome expectations.

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Exhaustive Analysis of the Study of Antiretroviral Adherence Factor From HIV/AIDS Patients

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Abstract

Adherence of HIV/AIDS patients in ARV therapy is an important factor in the success of HIV/AIDS treatment because continuous ARVs can suppress the development of the virus, reduce viral resistance, improve the HIV/AIDS patient's quality of life, and improve their health in general. This study aimed to review the literature that has researched factors related to the non-adherence of HIV/AIDS patients in taking ARV therapy. The research conducted an empirical analysis related to the aspects of adherence of HIV/AIDS patients to antiretroviral therapy (ART). A total of 71 kinds of literature discusses the adherence of patients with HIV/AIDS to treatment with ARVs. Literature was obtained based on searches on the Scopus website for the year 2019-2023. The literature is dominant in 2019 and has decreased over time. The publication is predominantly in Q1-indexed journals, with the first author coming from the USA. General factors that become ART adherence based on the literature include finance, mental health, alcohol consumption, drug abuse, belief, self-efficacy, knowledge, homeless, support, and tobacco/smoking. The most commonly encountered factors are support and mental health. The further suggestions for medical personnel or patients with HIV/AIDS and their families to be more synergistic in carrying out medical therapy.

Introduction

HIV/AIDS is still a serious threat in many countries (Conroy *et al*., 2022; Nakimuli-Mpungu *et al*., 2022; Parro-Torres *et al*., 2022; Toska *et al*., 2023). HIV/AIDS is considered dangerous because it attacks the human immune system (Kemigisha, *et al*., 2019). In the case of HIV AIDS, no medicine can cure it, so the consumption of antiretroviral (ARV) drugs plays an important role in the condition of HIV/AIDS patients because it can suppress the amount of virus present. Monitoring viral load and monitoring CD4 counts can provide information that can be used to significantly increase the life expectancy of patients living with HIV (Shoko & Chikobvu, 2019). ARVs are declared useful for AIDS therapy and are given in the form of antiretroviral therapy (ART). ART significantly improves immune health and survival rates in HIV, but these results are dependent on near-perfect adherence (Harrison *et al*., 2021). According to the 2012 universal ART guidelines, as part of "treatment as prevention" (TasP), all people living with HIV (PLWHA) should immediately start antiretroviral therapy post-diagnosis to facilitate viral suppression (Paschen-Wolffa *et al*., 2020). ARV drugs must be consumed throughout the life of HIV/AIDS patients, so adherence to drug consumption is important so that resistance does not occur, which leads to therapy failure. The benefits of ARVs include

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reducing the death rate for patients with HIV/AIDS infection, reducing the number of hospitalizations, reducing the amount of the HIV/AIDS virus in the blood, and restoring decreased immunity (Kamal *et al*., 2021).

Adherence of HIV/AIDS patients in ARV therapy is an important factor in the success of HIV/AIDS treatment because continuous ARVs can suppress the development of the virus, reduce viral resistance, improve the HIV/AIDS patient's quality of life, and improve their health in general. Conversely, patient non-adherence can be a cause of the failure of ARV therapy. Besides causing drug resistance, patients will need second or third-line ARVs at great expense due to their limitations. The complexity of the treatment procedure determines the degree of non-adherence, the degree of lifestyle changes required, the length of time for which the patient has to comply with the advice, whether the disease is diseased, whether the treatment appears to have the potential to save a life, and the severity of the disease as perceived by the patient rather than a healthcare professional (Mi *et al*., 2020; Saravolatz *et al*., 2019; Wen *et al*., 2020). Patient adherence to HIV/AIDS can occur by involving social support, family, and other support systems to prevent wider transmission of HIV/AIDS. The more people who are treated, the more lives will be saved, and the transmission of HIV will decrease.

ARV therapy can be carried out properly and correctly, so social and community support is needed so that HIV/AIDS patients can reduce the negative impact of infection with this disease. Social support is one of the factors that influence adherence to care. Social support can be provided through family, or the closest person can provide information to patients or as a provider of funds for patients (Bradley *et al*., 2019). Support can also take the form of providing a safe and peaceful place to rest. Theoretically, it is said that family support can influence patients' attitudes and behavior in following the treatment process. Subsequent support from the environment around patients with HIV/AIDS is in the form of emotional support, such as appreciation, love and affection, trust, concern, and a willingness to hear about any problems related to patients (Dinaj-Koci *et al*., 2019). It can also be in the form of motivation so that the patient can still adapt to changes in his lifestyle.

It is a challenge for health services to know the factors that influence and increase patient adherence to HIV/AIDS in carrying out ARV therapy. Many things sometimes cause non-adherence in patients with HIV/AIDS. Several psychosocial barriers, such as depression and mental disorders, low knowledge about health, low social support, and even the patient's age, can affect adherence (Mesic *et al*., 2019). Patient non-adherence can be influenced by age, education, economic problems, fear of side effects, lack of knowledge about the disease, ease of access to services, family support, and medical personnel (Burger *et al*., 2023). The lack of research that examines in detail the study of factors that contribute to patient non-adherence, including the trend of its publications over the last five years, caught the attention of these researchers. This study aimed to review the literature that has researched factors related to the non-adherence of HIV/AIDS patients in taking ARV therapy. The author conducted an empirical study related to the factors of adherence of HIV/AIDS patients to antiretroviral therapy (ART). This study is a valuable discourse for medical personnel in providing HIV/AIDS ART based on conditions that can affect their adherence to therapy. The results are a valuable consideration for medical staff, nurses, and counselors in carrying out their obligations to support and treat patients with HIV/AIDS.

Method

The author examined in-depth empirical literature studies from Scopus-indexed journals. The systematic literature review consists of formulating problems, collecting literature, evaluating literature, and analyzing and interpreting the findings. The five stages are the process of finding answers to research questions. The research questions were structured to facilitate the literature review. The following is research on this literature review: What are the general characteristics of the literature, what factors influence the adherence of HIV/AIDS patients taking ART, based on the current research, and what are the recommendations for future research?

The authors compiled the literature included in this review from two primary sources. First, the first author did a manual search of articles published between 2019 and 2023 by searching metadata on the Scopus website with the keywords "HIV/AIDS," "ART," and "adherence." The search includes criteria for journal articles that specifically address the psychology of HIV/AIDS patients. Second, the list of identified study references is valid. Hundreds of documents were found. However, only 71 articles met the criteria, as explained in the following section. Authors sift through hundreds of search results to find potentially relevant studies by reading their titles and abstracts. After that, several studies examined the entire content for its application. Two of our main criteria in selecting articles for review were studies of HIV/AIDS patients who demonstrated a response to ART adherence. As a result, only 71 studies were selected as data for review. Information extracted from the literature was organized to identify characteristics, including information on the author of each literature, year of publication, journal name, author's region, specific patient characteristics, and factors for adherence to ART.

Result And Discussion

Studies on the use of ARVs in treating patients with HIV/AIDS and the factors influencing patient adherence to ART have been published in health journals and health

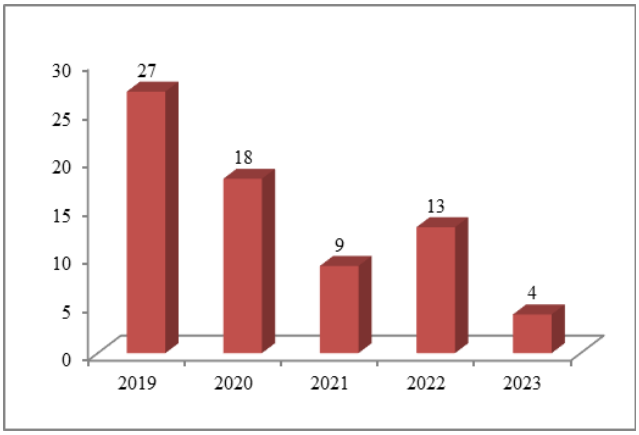

FIGURE 1. Number of Publications per Year

TABLE 1. The Distribution of Research on HIV/AIDS Adherence with ART

Country	f	First Author
India	1	Subramanian (2020)
Africa	1	Nakimuli-Mpungu (2022)
Brazil	1	Costa (2022)
Canada	3	Barker (2019), Ickowicz (2020), Erickson (2022)
China	5	Hana (2020), Mi (2020), Wen (2021), Jiang (2019), Peng (2021)
Israel	1	Chemtob (2022)
Japan	1	Nguyen (2020)
Korea	1	Lee (2020)
Nigeria	1	Onu (2021)
South Africa	8	Knettela (2019), Toska (2023), Jeffrey (2019), Sileo, (2019), Umar (2019), Kemigisha (2019), Minja (2019), Okonji (2023)
Spain	2	Parro-Torres (2022), Valencia (2022)

Country	f	First Author
Switzerland	1	Kamal (2020)
Ukraina	1	Harrison (2021)

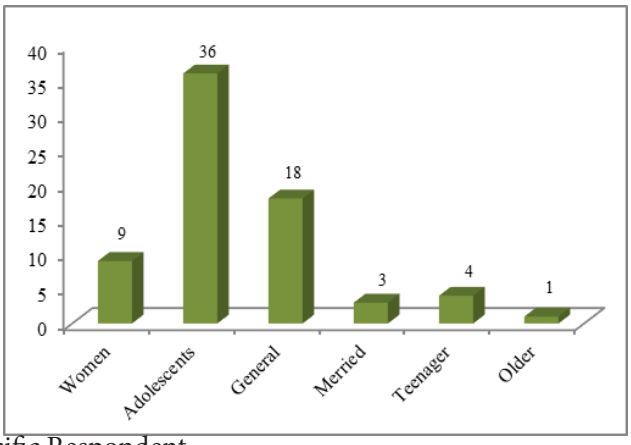

FIGURE 2. The Specific Respondent

psychology journals for a long time. This research review activity was carried out for one month, from mid-June to mid-July 2023. Patients with HIV/AIDS have generally dominated the design of the conceptual change study through surveys and interviews. The findings presented below support the statements made above. To find out what factors influence the adherence of HIV/AIDS patients during ART, researchers used NVivo software to map the relationship between the literature and factors influencing ARV adherence. Literature is labeled with the year, type of respondent, and number sequence.

The research selected for review spanned from 2019 to 2023 (as shown in **FIGURE 1**). Most of the research was conducted in the USA, South Africa, and China. **TABLE 1** shows the entire data set. Most research is published in leading medical and scientific journals such as AIDS and Behavior (see **TABLE 2**). Health psychology journals have also published research on adherence of PLWHA to ART. The number of publications has fluctuated over the last five years, as shown in **FIGURE 1**. The highest number of publications appeared in 2019 and decreased gradually going forward. As a result of the COVID-19 pandemic, academics and researchers have faced unexpected and ongoing disruptions in research activities on the adherence of PLHIV to ART. Medical personnel and patients face several obstacles in the treatment process, especially during the social distancing period during the COVID-19 pandemic. Therefore, this study contributes to future studies of treating patients with HIV/AIDS on ART.

The distribution of participants is shown in Figure 2. Most studies were conducted on patients with HIV/AIDS without age or gender disaggregation. Furthermore, some studies have specific respondent criteria, including female gender, adolescent, and older.

Adherence means orderly self-administered ART medication (Holstad *et al.*, 2019). Figure 2 shows that researchers in ARV adherence studies take more samples from adults because adults tend to have more complex problems that cause non-adherence, likewise, in exceptional cases that are simultaneously experienced by patients with the female gender or in married couples. Specific factors in women patients are during

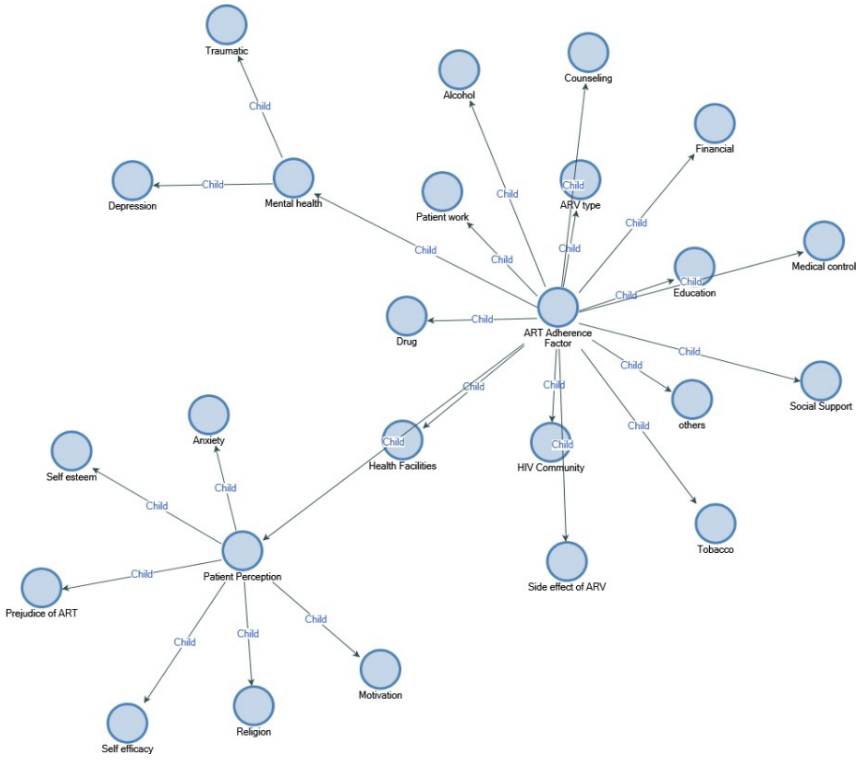

FIGURE 3. The Factor of ART Adherence

pregnancy and the postpartum period needed to prevent vertical transmission of HIV and to secure the long-term health of a woman living with HIV/AIDS (Minja *et al.*, 2019). Counseling interventions are needed to help HIV-infected women accept their status and reduce feelings of embarrassment. Another solution is the Long-acting injectable (LAI) treatment process, providing ease of treatment for patients with conditions of youth and women with child-rearing responsibilities (Philbin *et al.*, 2022).

Stigma related to HIV/AIDS and stressful life events are directly related to depression, and depression is directly related to health. Although antiretroviral treatment (ART) is a potent treatment for HIV, it makes it a chronic nonterminal disease. However, it is still not optimal if the patient has life pressures that can affect the functional health of PLHIV (Glynn *et al.*, 2019). The most dominant factor in patient compliance with HIV/AIDS is support from family or closest people, followed by mental health. Factors that should also be considered are the patient's condition, who constantly consumes alcohol, and knowledge about patients with HIV/AIDS (see **FIGURE 3**). A small amount of literature also considers economic conditions, including living and financial conditions, as a factor of compliance.

Patients with HIV/AIDS are more non-adherent to combination antiretroviral therapy (ART) and experience worse HIV treatment outcomes when accompanied by injecting drug use (Ickowicz *et al.*, 2020). One solution is given Maximally-assisted therapy (MAT). The MAT is an interdisciplinary treatment intervention that includes the dispensation of ART to support individuals with a history of addiction. MAT-based programs can become part of a new evidence base for increasing rates of morbidity, mortality, and transmission of viruses related to HIV/AIDS (Barker *et al.*, 2019). Compliance in patients with drug use disorders can be supported by motivational reinforcement, as evidenced through interviews. Research findings support MI as the behavioral therapy for broad dissemination to HIV care settings to increase ART adherence in patients with drug use disorders (Hartzler *et al.*, 2019). Furthermore, the co-location of drug therapy and HIV services can improve the optimization of patient care (Paschen-Wolff *et al.*, 2022).

This research will broaden our knowledge of risk factors for disease development beyond

ART adherence, which is essential as a follow-up can provide additional interventions, especially as treatment means that people living with HIV/AIDS have markedly increased life expectancy. The author provides further suggestions for medical personnel or patients with HIV/AIDS and their families to be more synergistic in carrying out medical therapy. For medical personnel to optimize patients' needs or complaints, this also includes knowledge, availability of clinics, and technology that can support patients to communicate or consult more easily (Padilla *et al*., 2021; Sullivan *et al*., 2021). Ultimately, patients and their families can support each other to plan and anticipate the future (Davis *et al*., 2019; Takada *et al*., 2021).

Conclusion

A total of 71 kinds of literature discusses the adherence of patients with HIV/AIDS to therapy with ARVs. Literature was obtained based on searches on the Scopus website for the year 2019-2023. The literature is dominant in 2019 and has decreased over time. The publication is predominantly in Q1-indexed journals, with the first author from the USA. General factors that become ART adherence based on the literature include finance, mental health, alcohol consumption, drug abuse, belief, self-efficacy, knowledge, homeless, support, and tobacco/smoking. The most commonly encountered factors are support and mental health. The further suggestions for medical personnel or patients with HIV/AIDS and their families to be more synergistic in carrying out medical therapy. For medical personnel to optimize the needs or complaints that patients feel, this also includes knowledge, availability of clinics, and technology that can support patients to communicate or consult more efficiently, and both patients and their families can support each other to plan and anticipate the future.

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Electronic-Module Range of Motion on Family Caregivers in Increasing Muscle Strength in Stroke Sufferers

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Abstract

The level of dependence of stroke sufferers on family caregivers will increase along with the complications experienced by stroke sufferers. The role of the family is to contribute to the rehabilitation process at home in the form of physical and psychosocial benefits. One effort can be made by providing Range of Motion exercises to stroke sufferers. Different family backgrounds and the importance of empowering the role of family caregivers require media that is informative and can be accessed anywhere. This study aimed to test the effectiveness of the Electronic-Module Range of Motion (E-ROM) for family caregivers in carrying out ROM and assessing muscle strength in stroke sufferers—a quasi-experimental research design with a pretest-posttest control group design. Research analysis used the Wilcoxon Test and Mann-Whitney Test. The sample consisted of 46 respondents for the treatment group and control group. The intervention provided E-Module ROM exercises were given to family caregivers, and assistance was provided. ROM exercises for stroke sufferers are carried out twice daily for two weeks. Health education with Electronic-Module Range of Motion (E-ROM) can increase muscle strength in stroke sufferers.

Introduction

Sensory and motor disabilities are the main complications of stroke, which cause varying degrees of dependency in patients. These complications make it difficult, or even impossible for stroke patients to carry out daily activities (Ashghali Farahani *et al*., 2021). Spasticity is a sequel of stroke. Stroke sufferers experience motor disorders such as decreased muscle strength and muscle atrophy (Adeel *et al*., 2023). This disorder causes limitations in performing range of motion, where the joints cannot rotate optimally, which hinders carrying out daily activities. Stroke sufferers with spasticity will increase medical costs, reduce quality of life, and increase the burden on caregivers (Pop *et al*., 2021; Wafa *et al*., 2020). The medical team involved in treating stroke patients is currently less than optimal in preventing neurological complications. It is due to several things, including ineffective management protocols for stroke patients, lagging behind recommended guidelines, lack of skilled human resources, inappropriate treatment methods, and diagnostics (Fekadu *et al*., 2019).

Family caregivers are family members who provide physical, emotional, and instrumental support or assistance to individuals with illnesses that limit their lives (Van Driel *et al*., 2021). Family caregivers providing care experience disturbances in emotions, physical health, social life, disruption of social relationships, spiritual stress, and tension. Role and financial crisis (Ashghali Farahani *et al*., 2021); (Azizi *et al*., 2020); (Choi & Seo, 2019). The role of the family as caregivers in the home care process is often carried out independently without any support from health workers, whether from nurses, doctors, physiotherapists, and other health workers (Azali *et al*., 2021). This is the family caregiver burden, which is a multidimensional response and negative assessment in providing care to

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stroke patients. Therefore, the role of family members as caregivers is vital in reducing mortality and morbidity (Pedersen *et al*., 2021).

Families can provide care to stroke sufferers at home by helping with ROM (Range of Motion) exercises. Range of motion training can be done actively, where the patient trains their range of motion independently, or passively, where the patient trains their range of motion with assistance. In a literature review regarding the effect of ROM exercise on muscle strength in stroke sufferers, it was also concluded that ROM exercise can increase muscle strength and joint movement ability in stroke sufferers. The level of dependence of stroke sufferers on family caregivers will increase along with the complications experienced by stroke sufferers (Hamre *et al*., 2021; Tosun & Temel, 2017). The role of the family is to contribute to the rehabilitation process at home in the form of physical and psychosocial benefits that can be achieved by providing Range of Motion exercises to stroke sufferers. Besides that, family involvement requires policies and a supportive environment (Lawler *et al*., 2019). Different family backgrounds and the absence of standard treatment given to stroke sufferers after hospital treatment. Such as assistance with Range of Motion exercises for family caregivers and empowering the role of other family caregivers. So, we need informative media that can be accessed anywhere.

Method

The population of this study were all stroke sufferers in the Yogyakarta City area. The sampling technique in this research is concecutive sampling. The inclusion criteria are family caregivers who live in the same house as stroke sufferers and family caregivers as members of the nuclear family. The exclusion criteria for this study were stroke sufferers who received health care at home from professional health workers and stroke sufferers with normal dependency. These stroke sufferers received inpatient care at health services and family caregivers with a health education background. The analysis used the Wilcoxon test for the difference between two paired samples and the Mann-Whitney test for unpaired samples. All groups measured muscle strength using the Manual Muscle Test (MMT) method. Then, the intervention group was given an intervention by providing the E-ROM Module and was assisted by researchers to carry out ROM exercises. ROM exercises were carried out twice a day for two weeks. After two weeks, the intervention group and the control group had muscle strength measured. This study was approved by the ethical commission of The Faculty of Health, University of Jenderal Achmad Yani Yogyakarta, with letter number SKep/431/KEP/VIII/2023.

Table 1. Characteristics of Family Caregivers Based on Gender, Education, Occupation, and Relationship with Sufferers

Characteristics of Family Caregivers	Treatment Group (n=23)		Control Group (n=23)	
	n	%	n	%
Gender				
Male	5	21.7	7	30.4
Female	18	78.3	16	69.6
Education				
Illiterate	0	0	2	8.7
Elementary school	4	17.4	6	26.1
Junior High School	6	26.1	7	30.4
Senior High School	11	47.8	5	21.7
Bachelor	2	8.7	3	13
Occupation				
Unemployment	3	13	6	26.1

Laborer	9	39.1	7	30.4
Farmer	1	4.3	6	26.1
Enterprenur	3	13	3	13
Private employe	7	30.4	1	4.3
Relation to patient				
Husband	13	56.5	14	60.9
Wife	4	17.4	6	26.1
Children	5	21.7	1	4.3
Son in law	1	4.3	2	8.7

Table 2 Characteristics of Family Caregivers Based on Age and Length of Time Caring for Stroke Sufferers

Characteristics of Family Caregivers	Treatment Group (n=23)			Control Group (n=23)		
	Min	Max	Median ± SD	Min	Max	Median ± SD
Age	35	79	53.09 ± 9.534	30	69	53.52 ± 10.937
Length of time caring	1	120	33.61 ± 30.714	1	60	25.11 ± 18.695

Table 3 Differences in Muscle Strength in Stroke Sufferers

Variabel	Treatment Group (n=23)			Control Group (n=23)			P
Muscle strength	Min	Max	Median ± SD	**Min**	**Max**	**Median ± SD**	
Before	1	4	3.22 ± 0.902	1	5	3.3 ±0.876	0.707b
After	1	4	3.43 ± 0.945	2	5	3.35 ± 0.885	0.499b
P	0.025a			0.317a			

***a Wilcoxon**

b Mann-Whitney U

Result And Discussion

Based on Table 1 regarding the characteristics of respondents, most of the respondents were female (treatment group 78.3% and control group 69.6%), labor occupation (treatment group 39.1% and control group 30.4%), and relationship with sufferers. as husband (treatment group 56.5% and control group 60.9%). For educational characteristics, the highest number was high school at 47.8% in the treatment group and junior high school at 30.4% in the control group.

Based on Table 2, the average age was higher in the control group at 53.52 years, and the average length of care in the treatment group was 33.61 months. Based on Table 3, the muscle strength of stroke sufferers shows that in the treatment group, there was a difference in mean muscle strength before treatment and after treatment with a p-value of 0.025; however, muscle strength in the control group showed no difference in mean with a P value of 0.317. There was no difference in mean muscle strength before the treatment and control groups with a P value of 0.707, and muscle strength after treatment was found to have no difference with a P value of 0.499. However, based on the data, the difference between the mean in the control and treatment groups is more significant in the treatment group (0.21) than in the control group (0.05). Range of Motion (ROM) shows that it is easier for patients and families to learn

and remember with digital and video facilities. Still, for older family caregivers, sometimes attached poster media must be included. This is due to a need for more exposure to technology. The characteristics of the respondents in this study were that the average age was 53 years, so an extraordinary approach was needed to assist.

Electronic-Module Range of Motion (E-ROM) is an external resource as a medium that is expected to reduce the workload of family caregivers and increase efficiency in caring for stroke patients. This finding is consistent with previous research, which revealed that supportive educational group interventions can reduce the burden (Deepradit *et al*., 2023). Apart from that, this electronic digital media will reduce obstacles in terms of travel, time, and costs, although it is considered lacking in terms of closeness of communication with health workers (Appireddy *et al*., 2019; Chan-Nguyen *et al*., 2022). However, there is research in critical care that shows no difference in satisfaction or decision-making between virtual and face-to-face family meetings (De Havenon *et al*., 2015). This research could be an alternative to stroke rehabilitation at the family level. Our analysis provides positive values regarding the feasibility and effectiveness of Electronic-Module Range of Motion (E-ROM) media in stroke care.

The media used in this research is digital module media, which contains the basic concepts of ROM, leaflets on how to do ROM, and ROM help videos. Electronic digital media helps family caregivers remember what they have learned in the range of motion training program so that, in the long term, these skills can become media that can be opened at any time. This measure has the potential to alleviate the challenges experienced by family caregivers. This finding aligns with the research conducted by Wu *et al*., (2020), showing the provision of healthcare education, knowledge, and psychological support potentially mitigates stress levels and enhances the overall well-being of individuals affected by stroke and their family caregivers. ROM is a low-cost nursing intervention that can be implemented by stroke sufferers and the families who care for them. ROM can increase joint flexibility and range of motion in stroke sufferers by increasing neuromuscular and muscle chemical activity. Neuromuscular stimulation increases the excitability of parasympathetic fibers, which then produce acetylcholine, which causes contractions. The muscle mechanism in the smooth muscles of the extremities will increase mitochondrial metabolism to create ATP, which will be utilized by the extremity muscles to contract and increase smooth muscle tone. ROM can increase blood circulation and oxygen supply, thereby optimizing metabolism (Nissa & Sari, 2022).

The muscle strength of stroke sufferers showed that in the treatment group, there was a difference in the average muscle strength before treatment and after treatment, with a p-value of 0.025. However, muscle strength in the control group did not show a mean difference with a P value of 0.317. It can be confirmed because the control group did not receive optimal and regular ROM training, so there was no increase in flexibility. Weak muscles exhibit alterations in mechanical characteristics associated with muscle fiber dimensions due to sarcomere depletion, differences in collagen content, and distribution of tendon fibers. The structural alterations lead to contractures and shortening, which disrupt muscle function and cause functional impairments in individuals who have experienced a stroke (Galvão *et al*., 2024). Apart from that, there are other influencing factors, namely lesions and the size of the lesions in the brain of stroke sufferers (Pradines *et al*., 2022).

The application of ROM exercises needs to be adapted to the condition of stroke sufferers, using either passive ROM or active ROM. ROM exercises must be done twice daily, and each movement must be repeated eight times. Repeated therapy sessions are necessary to restore lost movement regarding range and joint strength (Hussain *et al*., 2017). This focused ROM exercise will increase chemical, muscle, and neuromuscular activity in the recovery of stroke sufferers (Syahrim *et al*., 2019). However, when this exercise is not carried out routinely on limbs that experience paresis, it will result in a decrease in the number of motor units recruited in spastic muscles during voluntary movements. After the first attack, muscle strength can be lost by up to 73%, leading to

a poor prognosis in the chronic phase (Galvão *et al*., 2024). Several respondents in the study stated that they felt pain in areas experiencing weakness. This could be due to increased lactate concentration in the blood compared to healthy individuals (Klaer *et al*., 2017). Anaerobic glycolysis produces lactic acid, which is the result of spastic muscles' incapacity to keep oxidative function in their muscle fibers. This results in an accumulation of hydrogen ions and increased muscular acidosis, which causes tiredness. It is caused by a decrease in the recruitment of type I fibers and an increase in the recruitment of type II fibers. According to research, baseline lactate levels in people who have had a stroke are 18.5% higher than in people in the same age group who are in good health (Dos Santos *et al*., 2017). In addition, inflammatory alterations resulting from spastic muscles and the glenohumeral joint, as well as muscle exhaustion, can also induce discomfort (Das Neves *et al*., 2024).

ROM exercises can also improve primary muscle coordination. A stroke rehabilitation program in the first three months after a stroke can increase the chance of more optimal motor recovery than the expected natural recovery process. This period is considered a favorable time to carry out rehabilitation (Pallarés *et al*., 2021). If weakness on one side of the body is not treated correctly, it can cause complications such as muscle tone disorders, deep vein thrombosis, and contractures. Stroke sufferers experience paralysis due to loss of nerve supply to muscles due to disturbances in the lobes of the brain. So, the muscle does not receive contraction signals to maintain standard muscle size. Muscle fibers will be damaged and replaced by fibrous tissue and fatty tissue. The fibrous tissue that functions as a replacement tends to shorten, resulting in decreased joint activity and ending in joint stiffness. Lack of activity over a long period causes muscle atrophy and decreased joint range of motion (Hall & Hall, 2020).

Limited local blood supply and the build-up of free fatty acids due to a restricted range of motion in the joint can also lead to discomfort, early tiredness, muscular weakness, and decreased muscle flexibility (Das Neves *et al*., 2016). Contractures manifest in individuals who have experienced a stroke as a result of a confluence of vascular and metabolic alterations, alongside modifications in the structural properties of spastic muscles. These alterations encompass the presence of collagen fibers and the build-up of fibrous tissue, accompanied by a gradual decline in muscle fibers (Lee *et al*., 2015). A vicious cycle of alterations, including modifications to peripheral soft tissues that lessen the potentiation of reflex mechanisms and spasticity, can be triggered by immobility. In the end, muscle fibrosis and a reduced range of motion and function are caused by these peripheral alterations (Rao *et al*., 2021). To maximize recovery and prevent stroke complications and repeated stroke attacks, early stroke care management is essential (Darussalam *et al*., 2022), because 20%–40% of stroke survivors develop spasticity, which can raise treatment costs to four times, range of motion training is therefore necessary (Sankaran & Raj, 2022).

Conclusion

Health education with E-Module Range of Motion (E-ROM) can increase muscle strength in stroke sufferers. The study suggests implementing ROM exercises is very important to optimize recovery and avoid stroke complications.

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Implementation Of Pillar 1 And Pillar III Community-Led Total Sanitation (CLTS) in Reducing the Incident of Stunting in Pangkep District

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Abstract

Community-Led Total Sanitation (CLTS) is an approach to changing hygiene and sanitation behavior through community empowerment activities by triggering. The purpose of this study was to determine the application of pillars 1 and 3 of CLTS in reducing the incidence of stunting in the Pangkep Regency. The research method used an observational study with a cross-sectional approach. The study was conducted in 2023 and the population of this study were all heads of families in the subdistrict that have stunting incidence in Pangkep Regency. Sampling using accidental sampling technique was taken in Taraweang Village, Labakkang District as many as 63 heads of families, and in Buwong Cindea Village, Bungoro District as many as 78 heads of families. The research instrument used a questionnaire based on the guidelines of the Ministry of Health of the Republic of Indonesia. The results showed that there was a relationship between the implementation of Pillar 1 and Pillar 3 of Community-Led Total Sanitation (CLTS) in reducing the incidence of stunting in Taraweang Village, Labakkang District, and Buwong Cindea Village, Bungoro District, Pangkep Regency with the results of statistical tests obtained at (0.05 < 0.05) and (0.002 < 0.05). It is necessary to implement CLTS comprehensively so that the results of public health achievements can be maximized and the incidence of stunting can be prevented.

Introduction

Children's nutritional status is a key aspect of their development as it determines their mental health, physical growth and maturity, and future academic performance. Globally, stunting is responsible for more than one-third of under-five deaths. One in every five children under five years old is stunted (Abdulahi *et al.*, 2017). Children's body growth especially abnormal is irreversible in human resource development (Victora *et al.*, 2008). Stunting (low height for age) is a chronic restriction of a child's growth potential. Stunting refers to children from 24 to 59 months of age who have a height below 2 standard deviations of the mean height-for-age as determined by the World Health Organization (WHO) child growth standards (Nutrition, 2013). WHO and UNICEF (2017) reported that in 2015 there were 2.3 billion people in the world without adequate basic sanitation services, and of these, 892 million were still practicing open defecation. WHO/UNICEF also pointed out that almost all inability to obtain basic sanitation services is experienced by vulnerable and poor communities, who generally live in rural areas or urban slums. Access to proper sanitation services is very important and fundamental to the life of every human being, so water and sanitation are part of human rights that must be facilitated (WHO & UNICEF, 2017).

The use of improved sanitation and excreta disposal were significantly associated with lower odds of diarrhea (Hurliman *et al.*, 2018). An estimated 85% of diarrhea mortality is attributed to unsafe drinking water, inadequate

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sanitation, and substandard hygiene practices (Dreibelbis *et al.*, 2014). The practice of open defecation is thought to be a major cause of the persistent worldwide burden of diarrhea and enteric parasite infection among children less than 5 years old. Reducing open defecation requires access to and use of improved sanitation facilities, which are defined as facilities that prevent human feces from re-entering the environment (Patil *et al.*, 2014). Indonesia has problems in the fields of sanitation, nutrition, and the condition of children and pregnant women. Stunting in children has a chronic impact. Environmental problems and infectious diseases contribute to the emergence of stunting cases. Poor hygiene practices can cause toddlers to suffer from diarrhea which in turn can cause children to lose nutrients that are important for growth. Community health and nutrition development 2015 – 2019 is directed at supporting the Healthy Indonesia Program by improving the health and nutritional status of the community through health and community empowerment efforts. One of the main target indicators of the 2015-2019 National Medium Long-Term Plan is to improve the nutritional status of the community, including reducing the prevalence of stunting. The target for reducing the prevalence of stunting (short and very short) in children under two years old (under two years) is 28% (RJPMN, 2019).

In 2017, 22.2% or around 150.8 million children under five in the world experienced stunting, of which more than half of the stunted children in the world came from Asia (55%) and another third lived in Africa (39%). Of the 86.3 million stunted children under five in Asia, the largest proportion comes from South Asia (58.7%), and the least comes from Central Asia (0.9%). When compared with the stunting rate in 2000 which was 32.6%, it can be said that there has been a reduction in stunting because the stunting rate in 2017 was 22.2% (Dietz, 2017). Stunting will have an impact on the quality of human resources (HR). In the short term, stunting causes failure to grow, obstacles to cognitive and motor development, and suboptimal physical body size and metabolic disorders. In the long term, stunting causes a decrease in intellectual capacity. Disorders and functions of nerves and brain cells that are permanent cause a decrease in the ability to absorb lessons at school and will affect productivity in adulthood. Apart from that, stunting also increases the risk of non-communicable diseases such as diabetes mellitus, hypertension, coronary heart disease, and stroke (Ministry of National Development Planning/Bappenas, 2018).

Good sanitation correlates with human and environmental health. Previous studies have reported that poor hygiene and sanitation are associated with poor health outcomes. Lawrence, Yeboah-Antwi, Biemba *et al.* (2016) reported that high mortality rates in adults and infants are influenced by the poor quality of health and environmental hygiene. Bacterial contamination of food and drinking water and unsanitary human behavior contribute to the spread of viruses, bacteria, and parasites that cause diarrhea (Mara *et al.*, 2010; Walker *et al.*, 2011; Carlton *et al.*, 2012; Adane *et al.*, 2017). Water quality, nutrition, sanitation, and handwashing habits play an important role in supporting child growth and development such as stunting, anemia, and diarrhea (Larsen *et al.*, 2017). Long and repetitive experiences of diarrhea are likely to affect children's cognition (Tofail *et al.*, 2018).

Community-Led Total Sanitation (CLTS) is an approach that focuses on sustained behavioral change through motivation and mobilization to facilitate and enhance community knowledge and understanding of the risks associated with open defecation. In Ethiopia, CLTS was

the precursor to CLTSH (Community Led Total Sanitation and Hygiene), a modified version that has an added hygiene component. As with its predecessor, CLTSH functions without subsidies and has as its primary goal the achievement of Open Defecation Free (ODF) status in all villages of the country. The approach is aimed at empowering the community to analyze the extent and risks of environmental pollution caused by open defecation and to construct and use toilets with their resources. (Unicef, 2016). research by Ajisukmo and Lustitiani (2020) with a qualitative method through a focus group discussion approach found that the implementation of pillars and pillar 3 is very important to prevent the occurrence of environment-based diseases such as diarrhea, cholera and even the risk of stunting in children. Based on the results of initial observations carried out, researchers saw that the sanitation conditions in Labakkang District and Buwong Ciodea District were still very minimal regarding basic sanitation facilities such as owning a latrine, apart from that, the culture of the people in the village was defecating in any place such as gardens, rivers. , rice fields, and others which are still being implemented, although there are a small number who have latrines but do not use these healthy latrines according to the provisions, thus causing the emergence of infectious diseases that often attack toddlers, such as Diarrhea, ISPA, Worms and so on which are caused by Personal hygiene still really needs to be paid attention.

Methods

Pangkajene and Islands Regency is located in the western part of South Sulawesi Province, with the capital Pangkajene as the regional service center for Pangkajene and Islands Regency, in addition to its very strategic location with the capital of South Sulawesi Province. Based on astronomical location, Pangkajene and Islands Regency are located at 11,000 East Longitude and 040,400 and 080,000 South Latitude. Administratively, the area of Pangkajene and Islands Regency is 12,362.73 Km2 for a sea area of 11,464.44 Km2, with a land area of 898.29 Km2 and the length of the coastline in Pangkajene and Islands Regency

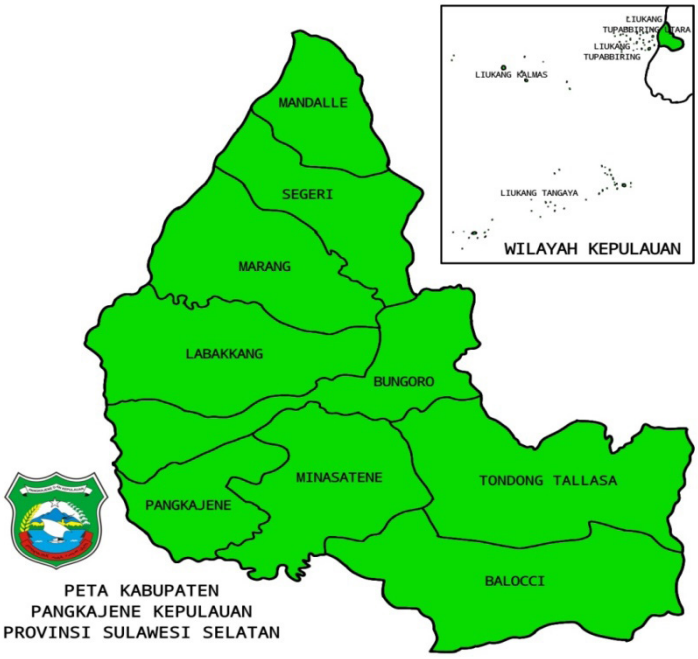

Figure 1. Map of Pangkajene Kepulauan City, South of Sulawesi

is 250 Km, which stretches from west to east. Where Pangkajene and Islands Regency consists of 13 sub-districts, of which 9 sub-districts are located in the mainland area and 4 sub-districts are located in the archipelago area.

The type of research used in this research is descriptive with a survey / going directly to the field with a cross-sectional approach which aims to find out how the implementation of Community Led Total Sanitation pillars 1 and 3 reduces the incidence of stunting in Pangkep Regency. The population in this study were all sub-districts in Pangkep Regency that have implemented the CLTS program and there is stunting in the sub-district. The samples in this study were villages in Pangkep Regency, namely Taraweang Village, Labakkang District, and Buwong Cindea Village, Bungoro District, which had stunting incidents. The sampling technique in this research is to use accidental sampling, as a sampling technique based on chance so that researchers can take samples from anyone they meet without prior planning.

Results and Discussion

Table 1. Distribution of Respondents Based on Age in Pangkep Regency in 2023

Age Group	Stunting	Not Stunting	Total
Taraweang Village, Labakkang District			
1 – 2	16 (43%)	20 (77%)	36 (57%)
3 – 5	21 (57%)	6 (23%)	27 (43%)
Total	37 (100%)	26 (100%)	63 (100%)
Buwong Cindea Village, Bungoro District			
1 – 2	22 (65%)	20 (49%)	42 (54%)
3 – 5	15 (35%)	21 (51%)	36 (46%)
Total	37 (100%)	41 (100%)	78 (100%)

Source: Primary Data, 2023

Table 2. Distribution of Communities Who Have Implemented Pillar I and Pillar III in Pangkep Regency in 2023

Implementation Pillar CLTS	Frequency (n)	Percentage (%)
Taraweang Village, Labakkang District		
Pillar I Stop BABs	58	51
Pillar III PMM-RT	56	49
Total	114	100
Buwong Cindea Village, Bungoro District		
Pillar I Stop BABs	67	49
Pillar III PMM-RT	70	51
Total	137	100

Source: Primary Data, 2023

Based on Table 1 above, it can be seen that the research results obtained show that 16 respondents, or 16% of respondents aged 1 - 2 years experienced stunting, and 20 respondents or 77% did not experience stunting. For ages 3 - 5, there were 21 respondents (57%) who experienced stunting and 6 respondents (23%) who did not experience stunting. It can be seen that the research results obtained show that 22 respondents, or 65% of respondents aged 1 - 2 years experienced stunting, and 20 respondents, or 49% did not experience stunting. For ages 3 - 5, there were 15 respondents (53%) who experienced stunting and 41 respondents (51%) who did not experience stunting.

Based on Table 2 above, it can be seen that the research results obtained show that as many as 58 communities have implemented CLTS Pillar I (51%), while 56 communities have implemented CLTS Pillar III (49%). It can be seen that the research results obtained show that as many as 67 communities have implemented CLTS Pillar I (49%), while 70 communities have implemented CLTS Pillar III (51%).

Based on Table 3, shows that the implementation of CLTS pillar 1 with a reduction in stunting incidents in Taraweang Village, Labakkang District, Pangkep Regency, obtained a p-value of 0.05 < 0.05, which means that there is a significant relationship between the implementation of CLTS pillar 1 and a reduction in stunting incidents in Pangkep Regency. Meanwhile, the implementation of CLTS pillar 3 with a reduction in stunting incidents in Taraweang Village, Labakkang District, Pangkep Regency, obtained a p-value of 0.124 > 0.05, which means that there is no significant relationship between the implementation of CLTS pillar 3 and the reduction in stunting incidents in Pangkep Regency.

Table 3. The Relationship Between the Implementation of CLTS Pillar 1 and Pillar III with Stunting Incidents in Taraweang Village, Labakkang District, Pangkep Regency in 2023

Variable	Incidents Stunting		Total	
	Not Experiencing Stunting	Experiencing Stunting		
Not Implementing Pillar 1 of CLTS	0 (0%)	5 (100%)	5 (100%)	0.05
Implementing Pillar 1 of CLTS	26 (44.8%)	32 (55.2%)	58 (100%)	
Not implementing Pillar II1 of CLTS	1 (14.3%)	6 (85.7%)	7 (100%)	0.124
Implementing Pillar 1II of CLTS	25 (44.6%)	3 (55.4%)	56 (100%)	

Source: Primary Data, 2023

Table 4 The Relationship between the Implementation of CLTS Pillar 1 and Pillar III with Stunting Incidents in Buwong Cindea Village, Bungoro District, Pangkep Regency in 2023

Variable	Incidents Stunting		Total	
	Not Experiencing Stunting	Experiencing Stunting		
Not Implementing Pillar 1 of CLTS	3 (27.3%)	8 (72.7%)	11 (100%)	
Implementing Pillar 1 of CLTS	38 (56.7%)	29 (43.3%)	67 (100%)	0.07
Not Implementing Pillar II1 of CLTS	0 (0.0%)	8 (100%)	8 (100%)	
Implementing Pillar 1II of CLTS	41 (58.6%)	29 (41.4%)	70 (100%)	

Source: Primary Data, 2023

Based on Table 4, shows that the implementation of CLTS pillar 1 with a reduction in stunting incidents in Buwong Cindea Village, Bungoro District, Pangkep Regency, obtained a p-value of 0.07 > 0.05, which means that there is no significant relationship between the implementation of CLTS pillar 1 and the reduction in stunting incidents in Pangkep Regency. Meanwhile, the implementation of CLTS pillar 3 with a reduction in stunting incidents in Buwong Cindea Village, Bungoro District, Pangkep Regency, obtained a p-value of 0.002 < 0.05, which means that there is a significant relationship between the implementation of CLTS pillar 3 and the reduction in stunting incidents in Pangkep Regency. Based on the research results, show that the implementation of CLTS pillar 1 with a reduction in stunting incidents in Taraweang Village, Labakkang District, Pangkep Regency, obtained a p-value of 0.05 < 0.05, which means that there is a significant relationship between the implementation of CLTS pillar 1 and the reduction in stunting incidents in Pangkep Regency.

Globally, community-based platforms are a promising channel through which to deliver these types of interventions to poor and remote populations (Bhutta et al., 2013). These platforms, which often rely on community health providers operating in the existing local health system, are conducive to delivering nutrition-related interventions as a package, an approach that has the greatest potential to reduce stunting (Bhutta et al., 2013; Dewey, 2016; Hossain et al., 2017). At the same time, broader investments in population health, education, and social development are crucial in providing a supportive context for improvements in stunting and other nutrition-related outcome (Bhutta et al., 2013, 2020; Hossain et al., 2017).

The results of this study show a strong correlation between stunting and pilar 1 and 3. Stunting is more prevalent as people get older. This result is in line with research from Aferwork (2017) and Irenso (2020). Inappropriate food supplementation during the weaning stage, when infants should move from exclusively breastfeeding to supplementary meals in their diet, can be the cause of the steady increase in stunting among children aged 24 to 59 months (Ashebir & Yimer, 2021; Njuguna, 2016). Open defecation behavior and ownership of healthy toilets with the incidence of stunting among toddlers in Labuan District, it can be explained that open defecation behavior (BABS) is due to not having healthy toilet facilities, which is closely related to the high incidence of diarrhea which can affect the growth and development of toddlers. Therefore, every family needs to have a healthy toilet. This is because open defecation behavior can result in the emergence of environmental enteropathy, which is the main cause of child malnutrition in the form of subclinical conditions of the small intestine. Environmental enteropathy causes damage to the protrusions or villi of the large intestine, making it difficult to absorb nutrients. Then, chronic diarrhea is prone to occur, which can cause a lack of nutritional intake. This is what causes malnutrition for a long time, namely stunting (Crocker et al., 2017; Spears et al., 2013).

Implementation of Pillar II1 Community-Based Total Sanitation (CLTS) in reducing the incidence of stunting in Pangkep Regency. Based on the research results, show that the implementation of CLTS pillar 3 with a reduction in stunting incidents in Buwong Cindea Village, Bungoro District, Pangkep Regency, obtained a p-value of 0.002 < 0.05, which means that there is a significant relationship between the implementation of CLTS pillar 3 and the reduction in stunting incidents in Pangkep Regency. The research results show that there is a relationship because the average respondent when interviewed had implemented a community-based total sanitation program (CLTS), especially pillar 3, namely household food and drink management (PAMM-RT). For example, when managing food, the food ingredients are washed first and for drinking water, the average respondent cooks/boils the water first before consuming it and some use bottled water.

This research is also in line with research by Berhe et al. (2019), who found that many risk factors lead to stunting, such as maternal parenting and adequate sanitation facilities. This is in line with (Dake et al., 2019) that the management of drinking water and food is

carried out to obtain water with drinking water quality, water that has been processed into drinking water which is used and consumed regularly every day 80 and stored in closed containers to avoid from disease problems due to untreated and unsecured water, as well as food that has been cooked and served always covered and the containers used are always clean, which are important indicators in serving household food and drinks. People use well water for daily needs such as cooking, washing clothes, dishes, and cleaning the house, while for drinking, they use boiled water., water used as drinking water must be safe and meet various health requirements. Good drinking water must meet physical requirements, bacteriological requirements, and chemical requirements. The physical requirements used as standards to determine healthy drinking water are colorless, tasteless, odorless and the temperature is below the temperature of the surrounding environment. Bacteriologically, healthy drinking water must be free from all bacteria, especially bacteria that have pathogenic properties and are dangerous for drinkers. Informants stated that contaminated drinking water and food would cause diarrhea, especially in children. (Wolf et al., 2014)

Aspects of personal hygiene and environmental sanitation have an important role in the problem of malnutrition, including stunting. Sanitation is related to environmental health which influences the level of public health. Poor sanitation conditions will harm many aspects of life, starting from the decline in the quality of the community's living environment, contamination of drinking water sources for the community, and the emergence of several diseases (Ministry of Health of the Republic of Indonesia, 2018). Aspects of environmental sanitation and personal hygiene play an important role in the incidence of stunting, such as the frequency of children being exposed to infectious diseases, and the low habit of washing hands properly with soap which can increase the incidence of diarrhea. Things that are considered minor, such as open defecation, can have a broad impact on health (Mushda et al., 2018).

Based on research results, the availability of clean drinking water determines the health status of the family. Even though the source of drinking water consumed comes from a gallon or spring and the physical quality of the water is good, it is best to boil the water before consuming it to ensure that the water to be consumed is free from bacteria that can cause disease for children under five and their families. The correlation between the incidence of stunting and poor sanitation management in the community is mediated by the increasing incidence of infections in children under five, such as diarrhea, cholera, typhoid fever and paratyphoid fever, dysentery, hookworm disease, ascariasis, hepatitis A and E, skin diseases, trachoma, schistosomiasis, cryptosporidiosis, malnutrition, and diseases related to malnutrition. Many factors affect the degree of human health such as poor water, soil, and air conditions (Suryadi *et al*., 2022).

Conclusion

There is a significant relationship between the implementation of CLTS pillar I and a reduction in the incidence of stunting in Taraweang Village, Labakkang District, and Pangkajene and Islands Regency**.** There is no significant relationship between the implementation of CLTS pillar I and the reduction in stunting incidents in Taraweang Village, Labakkang District, and Pangkajene and Islands Regency. There is no significant relationship between the implementation of CLTS pillar I and the reduction in stunting incidents in Buwong Cindea Village, Bungoro District, and Pangkajene and Islands Regency. There is a significant relationship between the implementation of CLTS pillar III and a reduction in the incidence of stunting in Buwong Cindea Village, Bungoro District, and Pangkajene and Islands Regency.

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Changes Physical Activities of Daily Living Elderly Individuals Involved in Interdisciplinary Care

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Abstract

The populations of all countries, including Indonesia, are aging, leading to an increasing elderly population with a greater number of health issues and comorbidities. The aim was to determine whether involvement in an interdisciplinary care program can help elderly individuals maintain physical activities of daily living. It was a quantitative longitudinal study with a quasi-experimental one-group pretest–posttest design. Fifteen participants were included, and one participant died before the 6-month follow-up. The Indonesian version of the Barthel Index was used to measure physical activities of daily living (PADLs) before and at one, three, and six months after the intervention. Linear regression models using the generalized estimating equation approach were used to determine significant PADLs changes and predictive factors. The mean total PADL score at T1, T2, and T3 increased significantly compared to that at T0 ($p<.001$). Age ($\beta=-0.33$; $p=.001$), diabetes mellitus ($\beta=-2.16$; $p=.001$), stroke ($\beta=-5.78$; $p=.001$) and congestive heart failure ($\beta=-10.68$; $p=.001$) were the strongest predictors of PADLs. Interdisciplinary team care may help elderly individuals maintain PADLs. The risk factors for PADLs deterioration were old age and comorbidities, including diabetes mellitus, stroke, and heart failure. A subsequent investigation of homogeneous participants with a control group is suggested for future studies.

Introduction

The Aging phenomena and degenerative health problems are increasing worldwide (Maresova *et al*., 2019). Studies have reported that age-related declines in physical function are associated with complex health problems in old age (Saadeh *et al*., 2020). Age-related physiological changes include reduced acuity of the senses (vision and hearing), a high risk for hypertension, a slow reaction time, impaired balance, loss of bone density, functional deterioration, cognitive impairment, and multiple chronic conditions (Jaul & Barron, 2017). Elderly patients with multiple health problems often experience disease complications and functional failure and perceive health services as complex and challenging to understand; therefore, they need support from healthcare professionals to ensure the continuity of services (Kumlin *et al*., 2020).

Long-term services, including those providing help with bathing, eating, dressing, and other everyday tasks, are needed for the old. Long-term services and support are provided in nursing homes, assisted living facilities, people's homes, and other settings (Heiks & Sabine, 2022). Aging people can have complex health problems involving physical and mental degeneration. Thus, interdisciplinary care is suggested for this vulnerable population. Interdisciplinary care involves a professional health team that processes, shares, and works together to solve health problems (Codispoti *et al*., 2004). Long-term care with a

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comprehensive approach is recommended for the elderly with complex health problems. A study showed that long-term interdisciplinary care is recommended as a method to enhance patient and family support systems concerning chronic healthcare management (Wantonoro *et al*., 2023).

Studies have shown that multidimensional health care for frail elderly patients is most effectively provided by interdisciplinary health care teams (Wieland *et al*., 1996). In addition, long-term interdisciplinary care has improved the health of patients with chronic diseases (Wantonoro *et al*., 2023). Considerable regional disparities exist in terms of health status; the quality, availability, and capacity of health services; and demographic and cultural characteristics in Indonesia. Therefore, an investigation of home-based interdisciplinary care approaches for elderly individuals is needed. The objective of the present study was to determine the effect of interdisciplinary home care on the trend of physical activities of daily living (PADLs) among elderly individuals.

Method

It was a quantitative longitudinal study (6 months) with a quasi-experimental one-group pretest–posttest design. Participants were recruited using a convenience sampling approach between April and May 2023 and followed up until October 2023; this approach was recommended by nurses in the hospital home care unit. Fifteen elderly patients with physical activity problems in Yogyakarta, Indonesia, were included and followed for 6 months to evaluate the effect of interdisciplinary team involvement.

The inclusion criteria were as follows: 1) elderly patients (60 years old or older); 2) patients with physical activity problems (including *stroke patients in the rehabilitation phase, diabetes mellitus patients, severe hypertension patients, and congestive heart failure patients);* and 3) patients living in a rural area. Elderly patients with long-term care needs who were dependent and had cognitive impairments (dementia) based on their medical records were excluded from this study. This study was approved by the Health Research Ethics Committee at Universitas 'Aisyiyah in Yogyakarta, Indonesia (No. 2748/KEP-UNISA/IV/2023). All participants provided written informed consent before receiving interdisciplinary home care.

All participants received 6 months of interdisciplinary care and education regarding their daily needs. Specific individual help and education were provided by professional nurses, physiotherapists, and nutritionists via face-to-face demonstrations. All professionals participated in the intervention for 6 months, and education was provided for each patient via face-to-face home care interactions twice a week. We screened each patient to assess their individual needs and determined interventions based on these needs. The professional nurses, physiotherapists, and nutritionists collaborated and discussed the care needed. The description of the intervention was based on individual patient needs. The professional nurses, physiotherapists, and nutritionists discussed and collaborated regarding the following: diabetes care, including foot exercises, exercises for *congestive heart failure*, exercises for stroke, range of motion exercises, decubitus prevention, blood pressure, and glucose control; endurance exercises, including walking and working with balls or balloons; strength exercises, including 10 repetitions in 3 sets; arm exercises, including push-ups in chairs, weight lifting, and water bottle and pulley exercises; hip and leg exercises, including ordinary knee flexion/extension, walking stairs, and steps; leg and feet exercises, including toe and heel rises on the floor and steps; and nutritional needs based on patient needs. All education and any necessary equipment were provided free of charge.

Data were collected using the self-reported Indonesian version of the Barthel Index before, at one, three, and six months after the intervention (T0, T1, T2, and T3, respectively). The Indonesian version of the Barthel Index is a weighted ordinal scale assessing 10 items: bathing and grooming (scores of 0 and 1); eating, dressing, bowel control, bladder control, toileting, and climbing stairs (scores of 0, 1, and 2); and transferring and walking (scores of 0, 1, 2 and 3). The total score (0 to 20) was obtained for the overall scale, with a higher score indicating better function. The reliability and validity of

the Barthel Index in Bahasa, Indonesia, have been tested; the internal consistency was found to have a Cronbach's alpha of 0.938 (Agung, 2006).

The data were analyzed using SPSS for Windows Version 18.0 (SPSS, Inc., Chicago, IL, USA). Linear regression models using the generalized estimating equation (GEE) approach (Liang & Zeger, 1993) were used to determine significant outcomes of trends in physical activities of daily living (PADLs) among elderly individuals before the intervention (T0=baseline) and at 1 month (T1), 3 months (T2), and 6 months (T3) after the intervention. In Model 1, the influence of time on outcomes was assessed by entering PADL scores for the four-time points (T0, T1, T2, and T3). In Model 2, the influence of time and personal variables as predictors of the functional status of PADLs was evaluated; the variables included age, sex, education level, and types of comorbidities.

Result And Discussion

Fifteen participants were included in this research, and one participant died before the 6-month follow-up. Ultimately, 14 participants with a mean age of 66.21 years (SD: 4.72) completed the questionnaires at T3. There were 4 male participants (26.7%) and 11 female participants (73.3%). Regarding education level, most participants had an elementary school education (7 participants; 46.7%), followed by a high school education (6 participants; 40%), junior high school education (1 participant; 6.7%), and a bachelor's degree (1 participant; 6.7%). Regarding comorbidities, 4 people had DM (26.6%), 3 people had had a stroke (20%), 5 people had hypertension (33.3%), and 3 people had congestive *heart failure* (20%) (Table 1).

The PADL subscale scores at T0, T1, T2, and T3 are shown in Table 2. The mean total PADL scores at T1, T2, and T3 increased significantly compared to those at T0 ($p<.001$), as shown in Table 3. In addition, all the mean PADL subscale scores increased; the lowest was for the climbing stairs subscale (Figures 1a and 1b). Variables that significantly affect changes in total PADL scores were examined using GEE analysis (Table 3). Age (β=-0.33; $p=.001$), diabetes mellitus status (β=-2.16; $p=.001$), stroke status (β=-5.78; $p=.001$), *and congestive heart failure* status (β=-10.68; $p=.001$) significantly affect PADLs, with hypertension as the baseline for comorbidities. Education level and sex did not significantly influence PADLs.

The world's population is aging,

Table 1. Sample Characteristics

Characteristics	Frequency (f) Mean (SD)	Percentage (%)
Age	66.21 (4.72)	
60-69 years	10	66.6
>70 years	5	33.3
Sex		
Male	4	26.7
Female	11	73.3
Education		
Elementary School	7	46.7
Junior High School	1	6.7
Senior High School	6	40.0
Diploma/Bachelor's degree	1	6.7
Disease		
Diabetes mellitus	4	26.6
Stroke	3	20
Hypertension	5	33.3
Congestive heart failure	3	20
Total	15	100.0

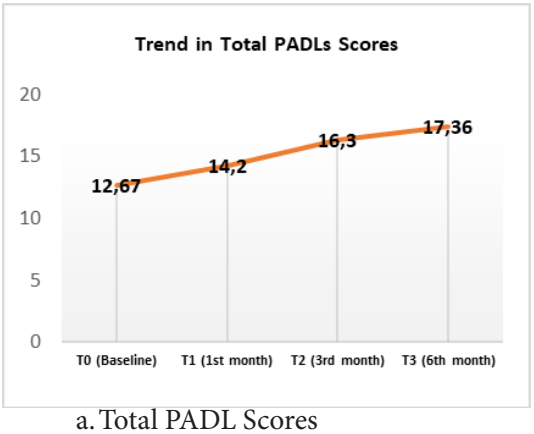
Table 2. Mean Total and Subscale Scores for PADL Status Before (T0=baseline) and 1 Month (T1), 3 Months (T2), and 6 Months (T3) Following Interdisciplinary Care and Changes in Scores from T0 by GEE Analysis

Functional Status	T0 (n=15) Mean (SD)	T1 (n=15) (mean, SD)	T2 (n=14) (mean, SD)	T3 (n=14) (mean, SD)
Total PADL score (range: 0-20)	12.67 (6.10)	14.20 (5.79)	16.3 (4.71)	17.36 (3.24)
Subscales				
Eating	1.53 (0.74)	1.60 (0.73)	1.64 (0.74)	1.85 (0.36)
Bathing	0.60 (0.50)	0.80 (0.41)	1.00 (0.00)	1.00 (0.00)
Grooming	0.86 (0.35)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Dressing	1.40 (0.82)	1.53 (0.63)	1.64 (0.49)	1.64 (0.00)
Bowel control	1.53 (0.74)	1.66 (0.61)	1.85 (0.36)	1.85 (0.36)
Bladder control	1.53 (0.74)	1.66 (0.48)	1.85 (0.36)	1.85 (0.36)
Toileting	0.86 (0.63)	1.73 (1.16)	1.64 (0.63)	1.78 (0.42)
Transfer	1.40 (1.12)	1.73 (1.16)	2.00 (1.30)	2.28 (0.91)
Mobility	1.80 (1.27)	2.00 (1.13)	2.50 (0.85)	2.50 (0.85)
Climbing stairs	1.13 (0.74)	0.93 (0.70)	1.21 (0.80)	1.57 (0.64)

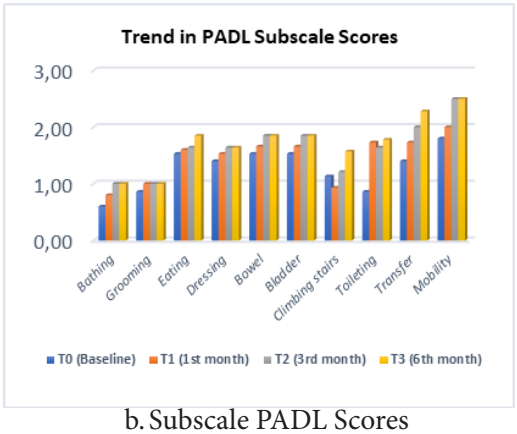
Table 3. Linear Regression with GEE for Models with Significant Predictors of Changes in PADL Functional Status

Variables	PADLs			
	β	95% CI		*p*
		Lower	Upper	
Model 1 (time)				
T0 vs. T1	1.53	0.61	2.45	.001
T0 vs. T2	3.33	2.26	4.39	.001
T0 vs. T3	4.36	2.68	6.04	.001
T1 vs. T2	1.85	1.05	2.64	.001
T2 vs. T3	1.00	0.13	1.86	.02
Model 2 (time x personal variables)				
Age	-0.33	-0.60	-0.07	.01
Sex	0.35	-1.10	1.80	.63
Education	-0.52	-2.69	1.63	.63
Comorbidities				
Diabetes mellitus	-2.16	-3.26	-1.07	.001
Stroke	-5.78	-8.51	-3.04	.001
Congestive heart failure	-10.68	-12.37	-8.99	.001

Note. GEE = generalized estimating equation; PADLs = physical activities of daily living; CI = confidence interval; T0 = before the intervention (n= 15); T1=1 month (n=15); T2 = 3 months (n=14); T = 6 months (n=14); hypertension as baseline for comorbidities



a. Total PADL Scores



b. Subscale PADL Scores

Figure 1. Total Scores and Subscale Scores for Physical Activities of Daily Living

and the incidence of chronic diseases and comorbidities is increasing. The functional, psychosocial, and nutritional status of older adults should be prioritized by healthcare providers (Canaslan *et al*., 2022). To evaluate long-term interdisciplinary care, this study included professional nurses, physiotherapists, and nutritionists who performed home visits during a 6-month follow-up. This study showed that home-based interdisciplinary team care may improve the overall PADLs of elderly individuals (elderly individuals with hypertension, stroke, diabetes, and *congestive heart failure*). This study included several professionals (nurses, physiotherapists, and nutritionists). Whereas a previous study reported that an integrated multidisciplinary program did not affect the daily activities of older stroke patients; however, the program in the present study showed some benefit of providing adequate care, although the difference was not statistically significant. An adaptation of the program is recommended to increase its feasibility and improve its effects (Vluggen *et al*., 2021). Home-based therapy can slow deterioration and improve the performance of activities of daily living among stroke patients; this might be an alternative approach for stroke patients who require long-term management (Pui Kei *et al*., 2020). Another study confirmed that a multidisciplinary intervention approach was effective in controlling blood pressure in elderly hypertensive patients (Woodham *et al*., 2020), and another study confirmed that family-based intervention programs were effective in improving glycemic control and wound healing, including in older people (Wuri Kartika *et al*., 2021).

This study confirmed the predictive factors for deterioration in physical activities of daily living for elderly individuals. Age, diabetes mellitus status, stroke status, *and congestive heart failure status* significantly influenced PADLs. This study showed that age and comorbidities were predictive factors for deterioration in PADLs among the elderly. Older age and an increasing number of comorbidities are independent predictors of in-hospital mortality for affected patients (Imam *et al*., 2020). Older age reduces physical and psychological competency and increases the risk for worse cognitive impairment and multiple chronic conditions (Jaul & Barron, 2017), increasing the complexity of healthcare provision and interventions (Singh et al., 2018). Elderly individuals become partially or fully dependent on other people (caregivers) and their physical and social environment. Moreover, PADL impairment is common among older patients with *congestive heart failure* and is associated with an increased risk of hospital readmission (Nguyen *et al*., 2021). Impairments in the physical dimension, especially fatigue and shortness of breath, were most common (Franzén *et al*., 2006). Elderly patients with *congestive heart failure* often complain of greater limitations when performing activities of daily living (Paneroni *et al*., 2021).

Education regarding long-term interdisciplinary care for family caregivers has been recommended to improve patient and

caregiver performance across sex, age, education level, and chronic disease status (Wantonoro *et al*., 2023). The key interdisciplinary feature of such a team is that members work together in the assessment and treatment of patients, including joint decision-making and goal-setting (Singh *et al*., 2018). Successful interdisciplinary long-term care for patients with multimorbidity requires the integration, understanding, and recognition of the interdependency of all individuals involved, including patients and family caregivers (Doornebosch *et al*., 2022). One study reported the need to revitalize long-term interdisciplinary care through interdisciplinary care practices, the clarification of role descriptions, optimized staffing, capacity building for all staff members, and commitment from all participants (Vellani *et al*., 2022). The sustainability of long-term interdisciplinary care requires innovation in individual, professional, patient, social, organizational, economic, and political contexts (De Coninck *et al*., 2023). Limitations of this study**:** This was an interdisciplinary home-based longitudinal study; thus, several limitations, such as the limited number of participants with normality distribution issues, the heterogeneous long-term care patients included in this study, and the lack of a comparison group, must be considered when interpreting the results.

Conclusions

Home-based interdisciplinary team care may maintain help elderly individuals maintain PADLs. Older age and the presence of comorbidities such as diabetes mellitus, stroke, *and congestive heart failure* were predictive of a worse prognosis regarding PADLs in elderly patients. Based on these limited results, the interdisciplinary team approach seems to help to prevent PADL deterioration. A subsequent investigation with homogeneous participants and a control group is suggested for future studies.

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Community Participation in Urban Sanitation Programs at Koja, Jakarta, Indonesia

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Abstract

Urban sanitation remains a critical public health issue, with community participation recognized as a key factor in the success of sanitation programs. This study explores the multidimensional factors influencing community participation in the urban setting of Koja. Through a mixed-methods approach, including surveys, interviews, and observational studies, we investigated how socio-demographic factors such as age, gender, income, occupation, and aspects of sanitation governance, infrastructure, and educational interventions affect community engagement. The study revealed that while infrastructure and access are crucial, socioeconomic and gender-related barriers significantly impact participation. Educational level emerged as a strong predictor of engagement, indicating that awareness and knowledge play a critical role in motivating community involvement. Furthermore, sanitation governance and the quality of policies and monitoring were instrumental in shaping public attitudes towards participation. The research highlights the necessity for integrated and inclusive sanitation policies that address urban populations' local context and socioeconomic diversity. The findings underscore the importance of targeted educational campaigns and the fostering of collaborative community relationships to enhance participation in sanitation programs. This study contributes to the discourse on urban sanitation by providing a nuanced understanding of the complex factors in community-based sanitation efforts, offering insights for policymakers to improve public health outcomes.

Introduction

In the contemporary urban landscape, providing and managing sanitation services remains a critical challenge, particularly in rapidly developing regions. With its diverse and densely populated environment, Jakarta epitomizes the complexities inherent in urban sanitation management (Rosdiana and Sardjono 2020). Despite significant advancements in public health practices, disparities in access to sanitation facilities and varying levels of community engagement persist (Osborne *et al*., 2021), essential for maintaining public health standards and environmental sustainability. Historically, the development of sanitation infrastructure has been closely tied to reducing diseases and improving urban living conditions (Isunju *et al*., 2011). However, the efficacy of these infrastructural developments is often contingent upon the active participation of the community they serve (Barrios 2008). Understanding the factors that motivate or dissuade community involvement in sanitation practices is essential for designing effective public health interventions (Malima *et al*., 2022).

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In Jakarta, as in many urban areas, sanitation is not merely a technical matter but also a social one, influenced by governance, socioeconomic factors, and cultural norms (Anthonj *et al*., 2020; Rosdiana and Sardjono 2020; Daniel *et al*., 2021; Suryawan and Lee 2023). The governance of sanitation services, including policy formulation, regulation, and enforcement, plays a pivotal role in shaping public attitudes and behaviors towards sanitation practices (Mensah 2020; Mensah *et al*., 2023). Operational sanitation practices at the individual and household levels further define the sanitation landscape of a community. They are influenced by the ease of access to sanitation facilities (Kabir *et al*., 2021), the level of sanitation education provided (Ssemugabo *et al*., 2021), and the prevailing social norms regarding hygiene (Dickin *et al*., 2021). Furthermore, the infrastructure for sanitation and the collaborative efforts of communities are vital for sustaining sanitation systems and fostering a culture of sanitation (Pugel *et al*., 2022). The degree of infrastructure development can significantly impact both the feasibility of practicing good sanitation and the willingness of community members to participate in sanitation programs (Wu *et al*., 2022).

Demographic factors, including gender, age, education, occupation, and income, are also influential in determining the levels of community engagement in sanitation initiatives. Gender roles and responsibilities can affect participation, with women often facing greater barriers due to socio-cultural norms and safety concerns in accessing sanitation facilities (Akpabio *et al*., 2021; Vogel *et al*., 2022). Age-related factors may influence individuals' physical ability and willingness to engage in sanitation-related activities, while education can enhance understanding and compliance with sanitation practices (Ahmed *et al*., 2020; Dwipayanti *et al*., 2021). Occupational and income levels have been associated with differences in access to sanitation services (Omotayo *et al*., 2021; Sitotaw *et al*., 2021), where formal employment and higher income levels may be linked to greater access to resources and, consequently, higher participation in sanitation programs. Conversely, those in informal employment or with lower incomes may experience more significant challenges accessing and investing in proper sanitation (Moussié 2021).

The existing research corpus on sanitation and public health is extensive (Anthonj *et al*., 2020; Rosdiana and Sardjono 2020; Daniel *et al*., 2021; Suryawan and Lee 2023)., yet it does not fully capture the nuanced drivers of community engagement in sanitation programs within the varied tapestry of urban settings, such as those found in Jakarta. This shortfall manifests across several critical domains. Firstly, a broader global focus often overshadows the local contextual understanding. Koja represents an urban area that is growing rapidly and evolving demographically. Such dynamics necessitate a deeper grasp of the cultural, economic, and social intricacies of designing sanitation interventions that resonate with the community's needs. Secondly, while individual factors like infrastructure and education have been the subject of much research, their integration with socio-demographic variables has not been sufficiently explored. This integration is crucial to comprehend how these variables collectively influence community participation in sanitation practices. Moreover, the impact of sanitation governance on community participation is another area neglected. There is a pressing need for studies investigating how governance quality can impact the success of sanitation programs. The community collaboration and participation domain has been acknowledged but not deeply understood. Research is needed to elucidate how such collaboration can be enhanced to improve participation rates and determine how community-based approaches can be effectively implemented to foster a sense of ownership and ensure the sustainability of sanitation programs.

This study aims to conduct an exhaustive investigation into the various factors that influence community participation in sanitation programs within the urban context of Koja. The research seeks to uncover the extent to which local cultural, economic, and social dynamics shape engagement with sanitation initiatives. It integrates multiple socio-demographic variables such as age, gender, income, and occupation, examining

their collective impact on sanitation practices. A pivotal objective is to enhance understanding of the barriers women face in participating in sanitation programs and how gender intersects with other socioeconomic factors to influence participation rates. The study also sets out to assess the role of sanitation governance and investigate how policy enforcement, regular monitoring, and community engagement contribute to the effectiveness of sanitation programs. Economic motivations and constraints across different income groups will be analyzed to understand their influence on participation in sanitation practices.

Additionally, the study aims to evaluate the efficacy of educational interventions in promoting participation in sanitation programs, especially among diverse urban populations. Finally, the research intends to explore mechanisms for fostering community collaboration, aiming to identify strategies to improve participation rates and ensure the sustainability of sanitation programs in Koja. Through these objectives, the research aspires to provide actionable insights that can aid in developing inclusive and context-sensitive sanitation policies, ultimately enhancing public health and well-being in Koja.

Method

The research was conducted in Koja, a region known for its vibrant community and urban dynamics. It is an ideal location for investigating factors influencing community participation in sanitation programs in Jakarta,

FIGURE 1. Study Location

Indonesia (Figure 1). The choice of Koja as a study site stems from its unique blend of residential, commercial, and industrial activities, which present varied sanitation challenges and opportunities for community engagement.

The study's methodological framework in Koja included a blend of survey instruments, statistical analysis software, and educational outreach materials. Survey instruments, such as structured questionnaires, were meticulously crafted to gauge residents' attitudes toward sanitation practices, their understanding of sanitation governance, and their willingness to participate in local sanitation initiatives. For the data analysis, software like SPSS played a crucial role in executing logistic regression and Exploratory Factor Analysis (EFA), which were essential in discerning the connections between the identified factors and the community's engagement with sanitation practices (Nguyen *et al*., 2023; Suryawan *et al*., 2023).

The study's approach was both quantitative and qualitative. Quantitative data were gathered via surveys distributed to a representative sample of Koja's population, including a diverse cross-section of residents, business owners, and community organization members. It helped to collect a wide range of demographic data and insights into behavioral patterns concerning sanitation. Qualitative insights were obtained through semi-structured interviews with key stakeholders such as local leaders, public health officials, and representatives from non-governmental organizations involved in sanitation efforts. These interviews aimed to uncover deeper contextual factors influencing community participation. Observational methods, including field visits and visual inspections of sanitation facilities, complemented the data collection process, providing a tangible assessment of the sanitation landscape in Koja. Figure 2 outlines the study's conceptual framework, illustrating the hypothesized relationships between various factors and the willingness to participate in community-based sanitation programs. This visual representation delineates how different elements derived from sanitation governance, practices, infrastructure, collaboration, and demographic variables are theorized to influence participation levels. Figure 2 suggests eight hypotheses (H1 through H8), each representing a predicted association:

H1: Sanitation Governance and Willingness to Participate

This hypothesis posits that effective sanitation governance, characterized by regular monitoring and consideration of aesthetic factors, positively affects the willingness of citizens to participate in sanitation programs. The hypothesis suggests that when governance is strong, with clear rules and consistent oversight, it can enhance community trust and encourage active engagement in sanitation efforts.

H2: Operational Sanitation Practices and Willingness to Participate

H2 hypothesizes that the presence of operational sanitation practices, such as defecation practices and waste disposal, has a significant impact on the willingness to participate. It implies that practical, day-to-day sanitation activities if carried out effectively, can motivate individuals to participate in broader community-based sanitation initiatives.

H3: Sanitation Infrastructure and Collaboration and Willingness to Participate

The third hypothesis suggests that the availability of sanitation infrastructure and collaborative community efforts is crucial for fostering a willingness to participate. Access to facilities and cooperative socialization around treatment processes are expected to empower residents to contribute to communal sanitation programs.

H4: Gender and Willingness to Participate

H4 explores the gender dynamics within sanitation participation, proposing that females may have different levels of willingness to participate compared to males, potentially due to gender-specific barriers or motivators.

H5: Age and Willingness to Participate

This hypothesis considers age as a factor, predicting that younger individuals (under 29 years) may have different participation rates than older individuals, possibly due to generational differences in attitudes or physical ability to engage in sanitation-related activities.

H6: Education and Willingness to Participate

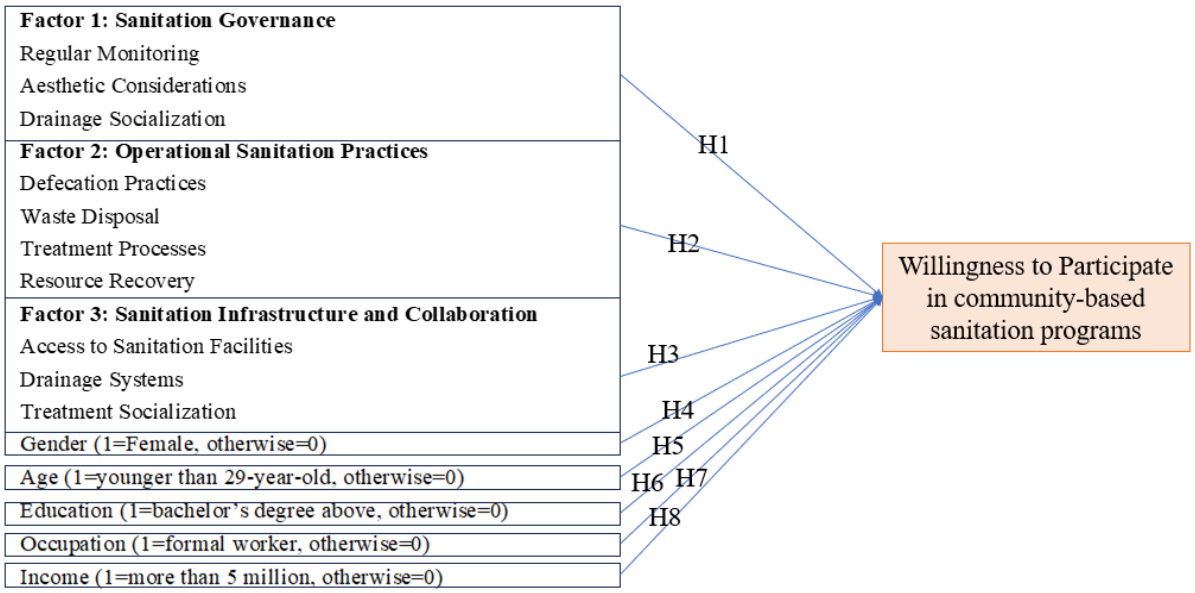

FIGURE 2. Hypothesis Developmen

H6 asserts that educational attainment, particularly at the bachelor's degree level or higher, influences the willingness to participate. It is based on the notion that education can increase awareness and understanding of the importance of sanitation, leading to higher engagement.

H7: Occupation and Willingness to Participate

The hypothesis examines the role of occupation, speculating that formal workers may exhibit different levels of willingness to participate in community-based sanitation programs compared to those in informal sectors or unemployed, possibly due to time constraints or exposure to different work environments.

H8: Income and Willingness to Participate

H8 suggests that income level, specifically earning more than 5 million, may be associated with a greater willingness to participate. This could be because higher income provides the resources needed to engage more fully in sanitation initiatives or reflects a higher stake in maintaining community standards.

The core of the research involved the meticulous analysis of the data collected, using SPSS for logistic regression and EFA. The statistical analyses aimed to explore the intricate relationships between variables. Such as awareness of sanitation issues, the efficacy of sanitation governance, the state of infrastructure, and the willingness of the community to engage in sanitation programs. Logistic regression was instrumental in identifying key predictors that could influence participation levels, thereby informing strategic interventions to enhance community involvement (Nguyen *et al.*, 2023; Suryawan *et al.*, 2023). An integral component of the research was the implementation of educational campaigns designed to heighten the community's understanding of the importance of effective sanitation and to foster greater participation in sanitation programs. The effectiveness of these educational campaigns was also evaluated, offering insights into the most impactful methods for mobilizing community action.

Result And Discussion

Table 1 presents a detailed Exploratory Factor Analysis result that organizes various items into three distinct sanitation-related factors. The first factor is labeled "Sanitation Governance," which encompasses items such as Regular Monitoring with a substantial factor loading of 0.836, indicating a strong relationship with this factor. Aesthetic Considerations are also included under this factor with a notable loading of 0.736, followed by Drainage Socialization with a loading of 0.525. The reliability of this factor is measured

TABLE 1. EFA Analysis Result

Factors and Items	Factor Loading					% of Variance
	1	2	3			
Factor 1: Sanitation Governance				0.631	3.375	19.680
Regular Monitoring	0.836					
Aesthetic Considerations	0.760					
Drainage Socialization	0.525					
Factor 2: Operational Sanitation Practices				0.671	1.165	39.315
Defecation Practices		0.777				
Waste Disposal		0.711				
Treatment Processes		0.532				
Resource Recovery		0.518				
Factor 3: Sanitation Infrastructure and Collaboration				0.541	1.047	55.867
Access to Sanitation Facilities			0.825			
Drainage Systems			0.671			
Treatment Socialization			0.510			

by Cronbach's Alpha of 0.631, and its Eigenvalue of 3.375 suggests a significant contribution to the explained variance, which is 19.680% for this factor. The second factor, "Operational Sanitation Practices," covers practical aspects, with Defecation Practices showing a high factor loading of 0.777, Waste Disposal with 0.711, and Treatment Processes and Resource Recovery with lower loadings of 0.532 and 0.518, respectively. This factor's Cronbach's Alpha stands at 0.671, which indicates a reasonably high internal consistency. The Eigenvalue here is 1.165, and this factor accounts for a larger portion of the variance, specifically 39.315%. The third factor is "Sanitation Infrastructure and Collaboration," which seems to be the most influential, with the highest explained variance of 55.867%. This factor includes Access to Sanitation Facilities, which has the highest factor loading among all items at 0.825, suggesting a strong association with the factor. Drainage Systems also relate strongly to this factor, with a loading of 0.671. Treatment Socialization has the lowest loading in this factor at 0.510. The factor is supported by a Cronbach's Alpha of 0.541 and an Eigenvalue of 1.047.

Sanitation governance encompasses the regulatory and monitoring aspects that ensure the effective management of sanitation services. High factor loadings for regular monitoring underscore its perceived importance, suggesting that citizens recognize the need for continuous oversight to maintain sanitation standards. It aligns with the broader literature that emphasizes the role of governance in achieving sustainable sanitation outcomes, where regular monitoring is often correlated with improved service delivery and compliance with health standards (Kayser *et al.* 2013; Hutton and Chase 2016; Hollander *et al.* 2020). Operational Sanitation Practices relate to the day-to-day activities and behaviors that impact sanitation, such as defecation practices. The significant factor loadings here reflect the direct impact that individual behaviors have on public health and the environment. This factor is critical because it encapsulates the personal responsibility and habits that can either support or undermine sanitation efforts. Previous studies have highlighted the importance of improving operational sanitation practices to reduce disease transmission and promote public health (Goh *et al.* 2020; Ellwanger *et al.* 2021; Sojobi and Zayed 2022). Sanitation infrastructure and collaboration are characterized by the physical availability of sanitation facilities and the collective action within communities to manage and improve these facilities. The high percentage of variance explained by this factor suggests that citizens are acutely aware of the need for adequate infrastructure, which is supported by research demonstrating that access to sanitation facilities is a key determinant of sanitation-related

behaviors (Tumwebaze *et al*. 2013; Dreibelbis *et al*. 2015; Novotný *et al*. 2018). Moreover, collaboration emphasizes the social dimension of sanitation, where community involvement and cooperative efforts are critical for the sustainability of sanitation systems (Hollander *et al*. 2020).

The factor with the highest percentage of variance, sanitation infrastructure, and collaboration, indicates that citizens may view the presence of infrastructure as a foundational element that enables good sanitation practices. The emphasis on collaboration reflects an understanding that adequate sanitation is not solely the responsibility of individuals or governments but requires community engagement and partnership (Pugel *et al*. 2022). This recognition is pivotal, as studies have shown that community-led sanitation initiatives can improve health outcomes and community empowerment (Prabhakaran *et al*. 2016).

Table 2 shows a cluster analysis of citizen attitudes toward sanitation, examining three different factors and their association with two clusters: 'Adequate health standards citizen' and 'Public health risk areas'. Factor 1, Sanitation Governance, has a near-zero score for citizens in areas with adequate health standards and a slight negative score for those in public health risk areas, indicating a slight variance in attitude between the two clusters with an F value of 0.071 and a high significance level of 0.790, suggesting the difference is not statistically significant. Factor 2, Operational Sanitation Practices, shows a positive score in areas with adequate health standards and a more negative score in public health risk areas. The mean square for this factor is 9.266 and an F value of 9.464, which is statistically significant with a significance level of 0.002, indicating a meaningful difference in attitude between the two clusters for this factor. Finally, Factor 3, Sanitation Infrastructure and Collaboration, presents the most significant scores among the factors, with a substantially positive score for adequate health standards areas and a highly negative score for public health risk areas. The mean square for this factor is very high at 219.567, with a high F value of 493.119 and a significance level of 0.000. This indicates a significant difference in attitudes towards this factor between the two clusters, suggesting that attitudes toward sanitation infrastructure and collaboration are markedly different between citizens in areas with adequate health standards and those in public health risk areas.

The 'Adequate health standards citizens' cluster may symbolize a segment of the population with better access to sanitation facilities and services, positively influencing their attitudes and practices towards sanitation. In contrast, the 'Public health risk areas' cluster likely represents individuals in settings with less access to sanitation, possibly leading to worse or indifferent attitudes and practices due to the lack of infrastructure and resources. The significant attitudinal differences in operational sanitation practices and sanitation infrastructure and collaboration between these clusters highlight the impact of environmental and infrastructural factors on public perception and behavior. Those with adequate sanitation may exhibit more favorable attitudes due to the direct benefits they experience, such as improved health and well-being. At the same time, those in high-risk areas may feel disenfranchised or less empowered to engage in positive sanitation practices due to the lack of facilities and support.

TABLE 2. Cluster of Citizen Attitude Toward Sanitation

Factors	Cluster Adequate health standards citizen'	Public health risk areas	Mean Square	F	Sig.
Factor 1: Sanitation Governance	0.00779	-0.02307	0.071	0.071	0.790
Factor 2: Operational Sanitation Practices	0.08891	-0.26317	9.266	9.464	0.002
Factor 3: Sanitation Infrastructure and Collaboration	0.43280	-1.28110		493.119	0.000

TABLE 3. Segmentation of Each Cluster

Variables	Adequate health standards citizen'		Public health risk areas		Pearson Chi-Square	Asymptotic significance (2-sided)
Gender					1.535	0.215
Male	124	31.31%	49	12.37%		
Female	172	43.43%	51	12.88%		
Age						
20-29	83	20.96%	17	4.29%	8.241	0.083
30-39	124	31.31%	42	10.61%		
40-49	59	14.90%	23	5.81%		
50-59	24	6.06%	13	3.28%		
>60	6	1.52%	5	1.26%		
Education					4.704	0.319
Elementary School	17	4.29%	7	1.77%		
Junior High School	13	3.28%	8	2.02%		
High School	184	46.46%	66	16.67%		
Bachelor	69	17.42%	17	4.29%		
Master	13	3.28%	2	0.51%		
Occupancy						
Formal	94	23.74%	25	6.31%	4.704	0.319
Non-formal	202	51.01%	75	18.94%		
Income					9.632	0.022
< 5 million	197	49.75%	81	20.45%		
5 - 10 million	70	17.68%	17	4.29%		
10,1 - 15 million	25	6.31%	2	0.51%		
> 15 million	4	1.01%	0	0.00%		

Table 3 provides a demographic and socioeconomic profile of two distinct clusters: 'Adequate health standards citizen' and 'Public health risk areas'. It summarizes these populations by several variables: Gender, Age, Education, Occupancy, and Income. Additionally, it reports the results of a Pearson Chi-Square test to assess the statistical significance of the differences between the clusters for each variable. For gender, the 'Adequate health standards citizen' cluster comprises more females (43.43%) than males (31.31%), while the 'Public health risk areas' cluster has a relatively balanced gender distribution with a slightly lower percentage of females (12.88%) compared to males (12.37%). In terms of Age distribution, the 'Adequate health standards citizen' cluster has its largest group in the 30-39 range (31.31%), whereas the same age group is also the largest in the 'Public health risk areas' cluster (10.61%). The least represented age group in both clusters is those over 60, with only 1.52% in the 'Adequate health standards citizen' cluster and 1.26% in the 'Public health risk areas'.

Regarding education, the majority in the 'Adequate health standards citizen' cluster have a high school education (46.46%), which is also the highest proportion in the 'Public health risk areas' cluster (16.67%). The least represented educational attainment in both clusters is a master's degree, accounting for 3.28% in the 'Adequate health standards citizen' cluster and 0.51% in the 'Public health risk

TABLE 4. Logistic Model for Citizen Willingness to Participate in Community-Based Sanitation Programs

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Factor 1: Sanitation Governance	0.087	0.138	0.394	1	0.530	1.091
Factor 2: Operational Sanitation Practices	0.103	0.141	0.526	1	0.468	1.108
Factor 3: Sanitation Infrastructure and Collaboration	0.408	0.142	8.293	1	0.004	1.503
Gender (1=Female, otherwise=0)	-0.776	0.319	5.894	1	0.015	0.460
Age (1=younger than 29-year-old, otherwise=0)	-0.424	0.301	1.991	1	0.158	0.654
Education (1=bachelor's degree above, otherwise=0)	1.229	0.551	4.982	1	0.026	3.419
Occupation (1=formal worker, otherwise=0)	-0.328	0.489	0.450	1	0.502	0.720
Income (1=more than 5 million, otherwise=0)	0.106	0.508	0.043	1	0.835	1.112
Constant	2.213	0.328	45.603	1	0.000	9.146
-2 Log likelihood	315.916					
Cox & Snell R Square	0.076					
Nagelkerke R Square	0.129					
Overall percentage	85.60%					

areas'. Occupancy types are divided into Formal and Non-formal, with non-formal being more prevalent in both clusters (51.01% in 'Adequate health standards citizen' and 18.94% in 'Public health risk areas'). Income segmentation reveals that most individuals in the 'Adequate health standards citizen' cluster earn less than 5 million (49.75%). The same income bracket is the largest in the 'Public health risk areas' cluster (20.45%). Notably, no individuals earn more than 15 million in the 'Public health risk areas' cluster.

Further segmentation within each cluster, as detailed in Table 3, reveals how demographic and socioeconomic factors intersect with sanitation attitudes. The table shows that younger individuals, possibly more exposed to modern health and environmental discourses, and those with higher education levels are more willing to participate in sanitation initiatives. It could be attributed to more significant health awareness and knowledge about the benefits of sanitation, as well as a higher capacity to engage with and implement best practices (Hutton and Chase 2016; Dickin et al. 2021). Income emerges as a particularly significant factor, with the Chi-Square tests indicating a substantial economic divide in attitudes toward sanitation. Individuals with higher incomes are likely better positioned to invest in and maintain proper sanitation facilities, which can lead to more positive attitudes and behaviors regarding sanitation. This is consistent with literature suggesting that financial capacity can significantly influence one's ability to engage with sanitation services (Hollander et al. 2020; Schrecongost et al. 2020), where financial resources are a barrier to accessing sanitation infrastructure and can lead to adverse health outcomes. The relationship between socioeconomic status and sanitation attitudes may also reflect broader social inequalities. In areas where public health risks are prevalent, the lack of income can reinforce a cycle of poor sanitation practices due to the inability to afford necessary infrastructure or partake in community-led sanitation efforts.

Table 4 presents a logistic regression analysis that models the likelihood of citizens' willingness to participate in community-based sanitation programs. The analysis includes a variety of predictors, such as factors related to sanitation governance, practices, and infrastructure, along with demographic and socioeconomic variables. The model's constant, representing the log odds of willingness to participate when all other variables are zero, is 2.213 and highly significant (Sig. = 0.000). The model's fit to the data is measured by the -2 Log likelihood (315.916) and the pseudo-R-squared values: Cox & Snell (0.076) and Nagelkerke (0.129), indicating a moderate fit. Finally, the

overall percentage of 85.60% suggests that the model is quite effective at predicting whether a citizen is willing to participate in community-based sanitation programs based on the variables included.

The model includes three factors directly related to sanitation: Sanitation Governance, Operational Sanitation Practices, and Sanitation Infrastructure and Collaboration. The coefficients for these factors suggest the extent to which each is associated with the willingness to participate. Factor 1, Sanitation Governance, has a *low* positive coefficient of 0.087, but with a significance value of 0.530, it does not show a statistically significant effect on participation. Similarly, Factor 2, Operational Sanitation Practices, with a coefficient of 0.103 and a significance value of 0.468, also does not significantly impact according to the model. In contrast, Factor 3, Sanitation Infrastructure and Collaboration, has a larger positive coefficient of 0.408 and is statistically significant with a significance value of 0.004, indicating a strong positive influence on participation willingness.

The model also assesses the impact of demographic factors such as gender and age. Gender has been coded with females as 1 and males as 0, and the analysis reveals that being female is associated with a reduced likelihood of participation, as indicated by a negative coefficient of -0.776, which is statistically significant (Sig. = 0.015). Age is coded as 1 for those younger than 29 and 0 otherwise; here, the negative coefficient of -0.424 suggests a lower likelihood of participation among the younger age group, though this result is not statistically significant (Sig. = 0.158). Regarding socioeconomic factors, education is a significant variable. Individuals with at least a bachelor's degree (coded as 1) show a much higher likelihood of participation, with a coefficient of 1.229 and a significance value of 0.026. Occupation (coded as 1 for formal workers) and income (coded as 1 for those earning more than 5 million) do not appear to have a significant impact, with coefficients of -0.328 (Sig. = 0.502) and 0.106 (Sig. = 0.835) respectively.

A standout result is the positive coefficient associated with Sanitation Infrastructure and Collaboration, indicating a strong link between the quality of sanitation infrastructure, community collaborative efforts, and the likelihood of citizens participating in sanitation programs. This finding has far-reaching implications. Participation can be logistically challenging in communities where sanitation infrastructure is either poorly developed or non-existent. Without access to proper facilities, or if existing facilities are inadequate, efforts to encourage community involvement can be fundamentally undermined. It is consistent with research suggesting that investment in sanitation infrastructure can catalyze community engagement and public health improvements (Xinhui and Guoping 2021; Abramovsky *et al*. 2023). Furthermore, the collaboration component suggests that participatory approaches, where community members are actively involved in the planning and management of sanitation facilities (Willetts *et al*. 2020; Suryawan and Lee 2023), can enhance a sense of ownership and responsibility, leading to sustained use and maintenance of these facilities.

The regression analysis also reveals a negative coefficient for gender, suggesting that women are less likely than men to participate in sanitation programs. It is a significant finding, as it hints at underlying gender disparities that may affect participation rates. Cultural norms, social roles, and even the design of sanitation facilities themselves can create barriers that disproportionately affect women. For instance, the lack of gender-segregated facilities can deter women from using community sanitation resources due to privacy and safety concerns (Chaplin 2017). Additionally, women often bear the brunt of caregiving responsibilities, which can limit their availability to engage in community activities.

Education emerges as another significant predictor of participation. The positive coefficient for individuals with a bachelor's degree or higher suggests that educational attainment is correlated with increased willingness to participate in sanitation initiatives. Education likely equips individuals with a better understanding of the health implications of poor sanitation and the benefits of improved sanitation practices, thus

fostering a more proactive attitude toward participation. It also empowers individuals with the knowledge and skills required to contribute to community sanitation efforts effectively (Anderson *et al*. 2021; Dickin *et al*. 2021; Malolo *et al*. 2021). It underscores the need for educational interventions that raise awareness about the importance of sanitation and equip individuals with practical knowledge on maintaining hygiene standards and manage sanitation facilities.

Although not found to be a significant predictor in the logistic model, income level is, nonetheless, a vital factor to consider in the broader context of sanitation participation. The lack of significance in the model may be attributed to the complex ways income interacts with other socioeconomic and cultural factors. However, the literature suggests that lower-income individuals may face financial barriers that limit their access to sanitation facilities and resources, affecting their ability to participate in sanitation programs (Malima *et al*. 2022; Cavoli *et al*. 2023; Vicario *et al*. 2023). Hence, policies aimed at improving sanitation should consider economic incentives or support mechanisms that enable the participation of lower-income groups.

The logistic model's high predictive accuracy (85.60%) reinforces the importance of these variables as reliable indicators of willingness to participate in sanitation programs. This level of predictability provides a strong foundation for policymakers and public health officials to design and implement targeted interventions that address the specific needs and barriers identified by the model. By prioritizing infrastructure development, gender inclusivity, and educational outreach, sanitation programs can be tailored to effectively mobilize community participation and achieve sustainable improvements in public health (Pouramin *et al*. 2020; Assefa *et al*. 2021). The synthesis of findings from the EFA, cluster analysis, and logistic regression paints a complex picture of the dynamics influencing sanitation participation. It highlights the interplay between personal beliefs, community infrastructure, social norms, educational background, and economic conditions. Addressing the multifaceted nature of these dynamics is essential for successfully implementing community-based sanitation programs. The evidence calls for integrated strategies that not only build and maintain physical sanitation infrastructure but also foster community solidarity, empower women, and elevate the role of education as a tool for promoting public health and hygiene practices.

Conclusion

The conclusion of this research encapsulates the multifaceted nature of citizen participation in community-based sanitation programs, as revealed through Exploratory Factor Analysis (EFA), cluster analysis, and logistic regression modeling. The investigation has provided valuable insights into the factors influencing an individual's decision to engage in sanitation initiatives, illuminating the complexities of public health behaviors. The EFA has elucidated three critical factors: sanitation governance, operational sanitation practices, infrastructure, and collaboration, which underpin sanitation concerns. These factors represent the perceptual dimensions through which citizens evaluate and engage with sanitation issues. The importance of robust sanitation governance and effective operational practices has been underscored, highlighting the need for consistent and structured approaches to sanitation management.

Through cluster analysis, we have identified distinct groups within the population, categorized by their attitudes toward sanitation, termed 'Adequate health standards citizens' and 'Public health risk areas'. This segmentation is pivotal, as it reflects the disparity in sanitation attitudes and suggests that contextual factors such as location and access to infrastructure significantly shape public sentiment and behavior towards sanitation. As indicated by further analysis, the demographic and socioeconomic segmentation within these clusters, have revealed that factors such as age, education, and income play significant roles in shaping attitudes towards sanitation. Younger and more educated individuals have demonstrated a greater willingness to participate in sanitation initiatives, pointing to the potential of these demographics as catalysts for change and advocates for improved sanitation

practices. The logistic regression model has been instrumental in quantifying the impact of these factors on the willingness to participate. The significant positive influence of sanitation infrastructure and collaboration suggests that enhancing physical sanitation facilities and promoting collaborative community efforts will likely increase engagement. Conversely, the negative coefficient for gender indicates potential barriers to female participation, necessitating gender-sensitive approaches to program design and implementation.

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