



Are You Using fFN Testing Correctly?

[Take the Quiz](#)

RapidfFN[®]

Volume 67, Number 1, January/February 2022

www.jmwh.org

Journal of Midwifery & Women's Health



The Official Journal of the American College of Nurse-Midwives



Editor-In-Chief

Melissa D. Avery, CNM, PhD, FACNM, FAAN
Minneapolis, MN

Deputy Editors

Linda A. Hunter, CNM, EdD, FACNM
Providence, RI

Ira Kantrowitz-Gordon, CNM, PhD, FACNM
Seattle, WA

Associate Editors

Lauren Arrington, CNM, MSN, DNP
Baltimore, MD

Mary K. Barger, CNM, PhD, MPH, FACNM
San Diego, CA

Sharon Bond, CNM, PhD, FACNM
Charleston, SC

Robyn T. Churchill, CNM, MSN, FACNM
Cambridge, MA

Ali S. Cocco, CNM, MSN, MDiv
Nashville, TN

Simon Adriane Ellis, CNM, ARNP, FACNM
Seattle, WA

Julia C. Phillippi, CNM, PhD, FACNM, FAAN
Nashville, TN

Pamela J. Reis, CNM, PhD, NNP-BC, FACNM
Raleigh, NC

Contributing Editors

Amy Alspaugh, CNM, MSN, PhD
Research and Professional Literature to Inform Practice

Rebecca R. S. Clark, CNM, PhD, MSN, RN, WHNP-BC
Research and Professional Literature to Inform Practice

Martha Barry, CNM, MS
Clinical Rounds

Nancy A. Niemczyk, CNM, PhD, FACNM
Research and Professional Literature to Inform Practice

Lindsey D. Wilson, CNM, DNP
Share with Women

Consulting Editors

Marit L. Bovbjerg, PhD, MS *Statistics*

Michelle Dynes, CNM, PhD, MPH, MSN, FACNM *Public Health*

Barbara Hackley, CNM, PhD, FACNM *Quality Improvement*

Nena R. Harris, CNM, FNP-BC, CNE, PhD *Health Disparities*

Abigail Howe-Heyman, CNM, PhD, RN *Health and Public Policy*

Jenna LoGiudice, CNM, PhD, FACNM *Education*

Maureen Shannon, CNM, FNP, PhD, FACNM, FAAN *Ethics*

Karline Wilson-Mitchell, CNM, DNP, MSN, RM, RN, FACNM *International Midwifery*

Editors Emeriti

Mary Ann Shah, CNM, MS, FACNM

Frances E. Likis, CNM, DrPH, NP, FACNM, FAAN

Wiley Editor

Lydia Charles
lcharles@wiley.com

Managing Editor

Laura Bolte
jmwh@acnm.org

Aims & Scope

The *Journal of Midwifery & Women's Health (JMWH)* is the official journal of the American College of Nurse-Midwives. This peer-reviewed journal includes new research and current knowledge across a broad range of clinical and interprofessional topics including perinatal care, gynecology, sexual and reproductive health, primary care, public health, health care policy, and global health. With a focus on evidence-based practice, *JMWH* promotes health equity and excellence in midwifery.



AMERICAN COLLEGE of NURSE-MIDWIVES

8403 Colesville Road, Suite 1230 Tel: 240-485-1800
Silver Spring, Maryland 20910-6374 Fax: 240-485-1818

www.midwife.org

Board of Directors

Cathy Collins-Fulea, CNM, DNP, MSN, FACNM
Saint Petersburg, Florida
President

Heather Clarke, DNP, LM, CNM, APRN, FACNM
Philadelphia, PA
President-Elect

Jessica Brumley, CNM, PhD, FACNM <i>Tampa, Florida</i> Vice President	Carrie Neerland, PhD, APRN, CNM, FACNM <i>Minneapolis, MN</i> Region V Representative
Bridget Howard, CNM, MSN <i>Erial, New Jersey</i> Secretary	Jessica Anderson, CNM, DNP, WHNP-BC, FACNM <i>Aurora, Colorado</i> Region VI Representative
Cara Krulewicz, CNM, PhD, FACNM, FAAN <i>Derwood, Maryland</i> Treasurer	Theresa Coley-Kouadio, CNM, MSN <i>Kotzebue, Alaska</i> Region VII Representative
Michelle Palmer, CNM, MSN, FACNM <i>Charlestown, Rhode Island</i> Region I Representative	Felina M. Ortiz, CNM, RN, DNP <i>Albuquerque, New Mexico</i> Midwives of Color Committee Representative
Nichole Wardlaw, CNM, FACNM <i>Chesapeake, Virginia</i> Region II Representative	Selena Wells, RN, BSN <i>Columbus, Ohio</i> Student Representative
Elois Edge, CNM, CLC, DNP, MSN <i>Albany, Georgia</i> Region III Representative	Charlotte Morris, DNP, CNM, FACNM <i>Eagleville, Pennsylvania</i> At-Large Midwives of Color Committee Representative
Kathleen Lavery, CNM, MS <i>Jackson, Michigan</i> Region IV Representative	Jaye Clement, MPH, MPP <i>Detroit, Michigan</i> Public Member

National Office

General ACNM Information

Web: www.midwife.org
Email: info@acnm.org

A.C.N.M. Foundation

Web: <http://www.midwife.org/foundation>
Email: fdn@acnm.org

Communications

Web: www.midwife.org/newsroom
Email: pr@acnm.org

Consumer Information

Web: www.ourmomentoftruth.com

Continuing Education and Practice Resources

Web: <http://acnm.sclivelearningcenter.com>
www.midwife.org/professional-resources

Finance

Email: accounting@acnm.org

Midwifery Practice & Education Global Outreach

Web: www.midwife.org/global-outreach
Email: globaloutreach@acnm.org

Government Relations

Web: www.midwife.org/advocacy
Email: govaffairs@acnm.org

Meetings

Web: www.midwife.org/news
Email: events@acnm.org

Membership & Publications

Web: www.midwife.org/member-resources
Email: membership@acnm.org
Email (Quickening): quick@acnm.org

Midwifery Employment

Web: www.midwifejobs.com

Midwifery Practice, Education, and Global Outreach

Email: MPEGO@acnm.org

Midwife Practice Locator

Web: <http://www.midwife.org/rp/find.cfm>

Publications

Web: www.midwife.org/ACNM-newsletters

Annual Meeting Dates May 2022: Chicago, Illinois

Mission

The American College of Nurse-Midwives (ACNM) works to establish midwifery as the standard of care for women. We lead the profession through education, clinical practice, research, and advocacy.

THE JOURNAL OF MIDWIFERY & WOMEN'S HEALTH, (Print ISSN: 1526-9523; Online ISSN: 1542-2011), is published bimonthly on behalf of the American College of Nurse-Midwives by Wiley Subscription Services, Inc., a Wiley Company, 111 River St., Hoboken, NJ 07030-5774.

Periodical Postage Paid at Hoboken, NJ and additional offices.

Postmaster: Send all address changes to THE JOURNAL OF MIDWIFERY & WOMEN'S HEALTH, John Wiley & Sons Inc., C/O The Sheridan Press, PO Box 465, Hanover, PA 17331.

DISCLAIMER: The Publisher, American College of Nurse-Midwives, and Editors cannot be held responsible for errors or any consequences arising from the use of information contained in this journal; the views and opinions expressed do not necessarily reflect those of the Publisher, American College of Nurse-Midwives, and Editors, neither does the publication of advertisements constitute any endorsement by the Publisher, American College of Nurse-Midwives, and Editors of the products advertised.

Copyright © 2022 American College of Nurse-Midwives. All rights reserved. No part of this publication may be reproduced, stored or transmitted in any form or by any means without the prior permission in writing from the copyright holder. Authorization to photocopy items for internal and personal use is granted by the copyright holder for libraries and other users registered with their local Reproduction Rights Organisation (RRO), e.g. Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923, USA (www.copyright.com), provided the appropriate fee is paid directly to the RRO. This consent does not extend to other kinds of copying such as copying for general distribution, for advertising or promotional purposes, for republication, for creating new collective works or for resale. Permissions for such reuse can be obtained using the RightsLink "Request Permissions" link on Wiley Online Library. Special requests should be addressed to: permissions@wiley.com.

INFORMATION FOR SUBSCRIBERS: The *Journal of Midwifery & Women's Health* is published in six issues per year. Institutional subscription prices for 2022 are: Print & Online: US\$840 (US), US\$840 (Rest of World), €647 (Europe), £595 (UK). Prices are exclusive of tax. Asia-Pacific GST, Canadian GST/HST and European VAT will be applied at the appropriate rates. For more information on current tax rates, please go to <https://onlinelibrary.wiley.com/library-info/products/price-lists/payment>. The price includes online access to the current issue, and the complete archive back to January 1st 2018, where available. For other pricing options, including access information and terms and conditions, please visit <https://onlinelibrary.wiley.com/library-info/products/price-lists>. Terms of use can be found here: <https://onlinelibrary.wiley.com/terms-and-conditions>.

DELIVERY TERMS AND LEGAL TITLE: Where the subscription price includes print issues and delivery is to the recipient's address, delivery terms are Delivered Duty Unpaid (DDU); the recipient is responsible for paying any import duty or taxes. Title to all issues transfers Free of Board (FOB) our shipping point, freight prepaid. We will endeavour to fulfil claims for missing or damaged copies within six months of publication, within our reasonable discretion and subject to availability.

BACK ISSUES: Single issues from current and recent volumes are available at the current single issue price from cs-journals@wiley.com. Earlier issues may be obtained from Periodicals Service Company, 351 Fairview Avenue - Ste 300, Hudson, NY 12534, USA. Tel: +1 518 822-9300, Fax: +1 518 822-9305, Email: psc@periodicals.com.

PUBLISHER: The *Journal of Midwifery & Women's Health* is published by Wiley Periodicals Inc., 101 Station Landing, Suite 300, Medford, MA 02155.

Journal Customer Services: For ordering information, claims and any enquiry concerning your journal subscription please go to <https://hub.wiley.com/community/support/onlinelibrary> or contact your nearest office.

Americas: Email: cs-journals@wiley.com; Tel: +1 781 388 8598 or +1 800 835 6770 (toll free in the USA & Canada).

Europe, Middle East and Africa: Email: cs-journals@wiley.com; Tel: +44 (0) 1865 778315.

Asia Pacific: Email: cs-journals@wiley.com; Tel: +65 6511 8000.

Japan: For Japanese speaking support, Email: cs-japan@wiley.com.

Visit our Online Customer Get-Help available in 7 languages at <https://hub.wiley.com/community/support/onlinelibrary>.

PRODUCTION EDITOR: Anju Upadhyay (email: jmwh@wiley.com)

ADVERTISING: MJ Drown (email: mdrawn@wiley.com)

COMMERCIAL REPRINTS: Lydia Supple-Pollard (email: lsupple@wiley.com)

View this journal online at www.wileyonlinelibrary.com/journal/jmwh.

Wiley is a founding member of the UN-backed HINARI, AGORA, and OARE initiatives. They are now collectively known as Research4Life, making online scientific content available free or at nominal cost to researchers in developing countries. Please visit Wiley's Content Access Corporate Citizenship site: <http://www.wiley.com/WileyCDA/Section/id-390082.html>

Printed in the USA by The Sheridan Group

Aims and Scope: The *Journal of Midwifery & Women's Health (JMWH)* is the official journal of the American College of Nurse-Midwives. This peer-reviewed journal presents new research and current knowledge across a broad range of clinical and interdisciplinary topics including maternity care, gynecology, primary care for women and newborns, public health, health care policy, and global health. With a focus on evidence-based practice, *JMWH* is dedicated to improving the health care of women throughout their lifespan and promoting excellence in midwifery.

The *Journal of Midwifery & Women's Health* accepts articles for Open Access publication. Please visit <https://authorservices.wiley.com/author-resources/Journal-Authors/open-access/onlineopen.html> for further information about OnlineOpen.

For submission instructions, subscription and all other information visit www.wileyonlinelibrary.com/journal/jmwh.

Abstracting and Indexing Services: The Journal is indexed by Science Citation Index, CINAHL, MEDLINE, PsycINFO, & SCOPUS. For a complete listing of A&I services please visit the journal homepage at www.wileyonlinelibrary.com/journal/jmwh.

Wiley's Corporate Citizenship initiative seeks to address the environmental, social, economic, and ethical challenges faced in our business and which are important to our diverse stakeholder groups. Since launching the initiative, we have focused on sharing our content with those in need, enhancing community philanthropy, reducing our carbon impact, creating global guidelines and best practices for paper use, establishing a vendor code of ethics, and engaging our colleagues and other stakeholders in our efforts. Follow our progress at www.wiley.com/go/citizenship.



Editorial

- 7** A New Year and a New Senior Editorial Team for the *Journal of Midwifery & Women's Health*
Melissa D. Avery

Commentary

- 9** The Urgency of Universal Paid Maternity Leave and Family Support Policies: The Role of Midwives as Agents of Change
Tanika Eaves, Jennifer Schindler-Ruwisch

Research Articles and Reviews

- 13** Factors Associated With Normal Physiologic Birth for Women Who Labor In Water: A Secondary Analysis of A Prospective Observational Study

Community and midwifery-led birth settings may increase the likelihood of normal physiologic birth among healthy women who labor in water.
Jane Carpenter, Ethel Burns, Lesley Smith

- 21** Midwives Mentoring Midwives: A Review of the Evidence and Best Practice Recommendations

Mentoring within the profession of midwifery provides reciprocal benefits to the mentor-mentee dyad and can increase confidence and professional development among students and new graduates.
Heather Bradford, Heather Findletar Hines, Yuliya Labko, Amber Peasley, Maria Valentin-Welch, Ginger Breedlove

- 31** Perspectives of Doulas of Color on their Role in Alleviating Racial Disparities in Birth Outcomes: A Qualitative Study

Doulas of color are uniquely positioned to support women of color and thus contribute to efforts to reduce racial disparities in birth outcomes.
Cosette A. Kathawa, Kavita Shah Arora, Ruth Zielinski, Lisa Kane Low

- 39** Virtual Visits in Prenatal Care: An Integrative Review

Virtual visits in prenatal care have been well-received by patients and providers, showing promise as an emerging model for improving access to care.
Katrina K. Wu, Cristina Lopez, Michelle Nichols

- 53** Clinical Practice Guidelines That Address Physical Activity and Exercise During Pregnancy: A Systematic Review

A systematic review of clinical practice guidelines addressing physical activity during pregnancy found that consistent recommendations provide relevant and clear guidance for health care professionals to offer information on physical activities to pregnant women while discrepant recommendations need further research to clarify.

Xiao Yang, Hanbing Li, Qian Zhao, Rongrong Han, Zhixuan Xiang, Lingling Gao

- 69** Neonatal Hypoxic Ischemic Encephalopathy and Planned Home Birth

In this study, neonates with hypoxic ischemic encephalopathy (HIE) were more likely to have been a planned home birth compared to infants without HIE.
Christina Buchanan, Sheree Kuo, Lea Minton, Men-Jean Lee, So Yung Choi, Reni Soon

- 75** Provider Characteristics Associated with Trust When Caring for Women Experiencing Substance Use Disorders in the Perinatal Period

Providers who approvingly approach women experiencing substance use disorders in the perinatal period, affirm their treatment efforts, and provide competent care foster trusting relationships.
Kalyn M. Renbarger, Kristin E. Trainor, Jean Marie Place, Allyson Broadstreet

- 95** Integrative Review of Disparities in Mode of Birth and Related Complications among Mexican American Women

Adjusting for individual factors and birth facility reveals disparities in cesarean rates as well as pregnancy and birthing complications among Mexican American women.
Elizabeth Jones Spurlock, Jennifer Kue, Shannon Gillespie, Jodi Ford, R. Jeanne Ruiz, Rita H. Pickler

I07 The Addition of Traditional Birth Attendant Care to a Home-Based Skilled Nursing Program in Rural Guatemala: A Secondary Analysis from a Quality Improvement Database

Antenatal care delivered by skilled nurses and traditional birth attendants (TBAs) supports the improvement of pregnancy care quality measures. Maintaining a role for TBAs may be important for rural Guatemala.

Amy Nacht, Claudia Rivera, Saskia Bunge Montes, Andrea Jimenez Zambrano, Molly M. Lamb, Antonio Bolanos, Edwin Asturias, Stephen Berman, Gretchen Heinrichs, Margo S Harrison

I14 Postpartum Health Experiences of Women with Newborns in Intensive Care: The Desire to Be by the Infant Bedside as a Driver of Postpartum Health

Despite increased risk for postpartum complications, women with infants in intensive care minimize or delay needed care so they can remain by the infant's bedside.

Renée M. Ferrari, Erin K. McClain, Christine Tucker, Nkechi Charles, Sarah Verbiest, Virginia Lewis, Katherine Bryant, Alison M. Stuebe

Recent Publications

I26 Systematic Reviews to Inform Practice, January/February 2022

Mary K. Barger

I33 Research and Professional Literature to Inform Practice, January/February 2022

Rebecca R.S. Clark

Clinical Bulletin

I40 American College of Nurse-Midwives Clinical Bulletin Number 18: Induction of Labor

American College of Nurse-Midwives, Nicole Smith Carlson, Alexis Dunn Amore, Jessica Ann Ellis, Katie Page, Robyn Schaffer

Announcement

I50 Index of ACNM Documents and Publications, January 2022

Share with Women

I55 Ruptured Membranes: When the Bag of Waters Breaks



Are You Using fFN Testing Correctly?

[Take the Quiz](#)

RapidfFN[®]

A New Year and a New Senior Editorial Team for the *Journal of Midwifery & Women's Health*

Happy New Year fellow members of the American College of Nurse-Midwives (ACNM), midwives more broadly, and readers of the *Journal of Midwifery & Women's Health (JMWH)*. It is an immense privilege to greet you as the new Editor-in-Chief of *JMWH*. I want to introduce myself and share my initial goals for the Journal. In addition, I would like you to meet the 2 Deputy Editors who join me in making up the new *JMWH* senior editorial team. Together, we share responsibility for Journal content, focus, and strategic development.

My love of our Journal has a long history. As a student at the University of Kentucky in the fall of 1980, I still remember the thrill of joining this exciting profession: Wow, we have our own journal! I looked forward to reading the many articles assigned in my midwifery courses. It was then that I began to think about someday submitting a manuscript to the Journal. Six years later, I had my first article published in the *Journal of Nurse-Midwifery*. My respect for our Journal is deep and continues to grow. Today our Journal is the only midwifery journal in the United States. I know it is also respected by you, our members who are our readers, peer reviewers, and authors, because you consistently rate *JMWH* as one of the top benefits of being a member of ACNM.

What else do I bring to the position of Editor-in-Chief of the *Journal of Midwifery & Women's Health*? As this issue of *JMWH* is published, I celebrate 40 years as a certified nurse-midwife. During that time, I have been a reader, author, peer reviewer, Contributing Editor, Consulting Editor, and Associate Editor of *JMWH*. In those early years as an author and peer reviewer, I had the pleasure of working with Mary Ann Shah who was Editor-in-Chief from 1975 to 2000. She fought long and hard for *JMWH* to finally be included in Index Medicus, among many other accomplishments.¹ I was honored as a co-author of the *JMWH* Best Paper of the Year in 2003 with 2 excellent midwife colleagues and friends, Catherine Carr and Patricia Burkhardt. As a clinician at heart and one who also loves teaching, I enjoyed practicing full-scope midwifery for 25 years and serving as a full-time faculty member at the University of Minnesota (UMN) for 27 years (combining clinical practice and teaching for many years) and led the UMN midwifery program for 24 of those years. My research has always been framed by our midwifery philosophy, including exercise in pregnancy, midwifery support of vaginal birth after cesarean, and the development of confidence for physiologic birth. As a professor, I helped many masters, DNP, and PhD students describe their own scholarly accomplishments. As Editor and Co-Editor of 2 books, I helped authors shape their chapters, while guiding the books to publication. Along the way, I have been an active and passionate ACNM member including serving as ACNM President from 2008 to 2010.

My initial goals for *JMWH* are to continue the current forward trajectory, making sure *JMWH* is the preferred source of information supporting midwifery practice and the growth of the profession in the United States. The editorial team, peer reviewers, and authors must reflect the broad diversity of our members. We will review every decision and policy to ensure representation of the full membership of ACNM as we strive to be inclusive and antiracist. While US midwifery practice is our main focus, we can learn much from midwifery colleagues around the world and from colleagues in complementary disciplines. Our team will encourage more quality submissions from US and international authors, while continuing our strong commitment to support new midwife authors. In partnership with our publisher, we will seek opportunities to increase access to the Journal and expand its reach, while examining evolving metrics to assess the impact of *JMWH*.

Joining me on the senior editorial team are Ira Kantrowitz-Gordon, CNM, PhD, FACNM, and Linda Hunter, CNM, EdD, FACNM. Ira was hired as Deputy Editor one year ago for a one-year term so the new Editor-in-Chief could hire their own team. I am fortunate that Ira enjoys the work and agreed to join our new team. He has been a peer reviewer for *JMWH* since 2012 and has served as Consulting Editor for Qualitative Research Methods. Ira is an Associate Professor at the University of Washington School of Nursing. He teaches midwifery and nursing courses and has a program of research that focuses on the stigma of perinatal opioid use disorder and mindfulness as a strategy to improve perinatal symptom management. He practices midwifery part-time in Everett, Washington. Joining our team in October 2021 was Linda Hunter. Linda has served as a peer reviewer, author, and Contributing Editor for Clinical Rounds articles for *JMWH*. She practices midwifery at Women & Infants Hospital, Providence, Rhode Island, and is Associate Professor of Obstetrics and Gynecology, Clinical Educator, at Brown University Medical School. Linda is also the current President of the American Midwifery Certification Board.

As a new team, we have big shoes to fill. With deep gratitude, I thank the outgoing senior editors and acknowledge their long legacy. Patricia (Patty) Aikins Murphy has been an editor for 40 years. In fact, when I cleaned out my faculty office several months ago, I found an old, typed letter in an envelope from Patty letting me know 3 decades ago that a manuscript I submitted had been accepted for publication. Working with Patty as an author improved my writing over the years. In addition to working with authors, Patty curated the former Research Exchange column and was first to hold the title Deputy Editor.² Sincere thanks as well to Tekoa King, *JMWH* Deputy Editor since 2008 and *JMWH* Editor-in-Chief from 2001 to



2007. Tekoa's energy and enthusiasm for the Journal will be missed as *JMWH* continues to be "the face and the voice of the profession."^{3(p566)} I have worked with Tekoa in multiple ways as she too helped shape my writing skills and shared her passion for mentoring *JMWH* authors.

Frances (Francie) Likis has been Editor-in-Chief from 2008 through 2021. During her tenure, the number of manuscripts submitted to *JMWH* increased, and the impact factor, or average number of times published articles are cited, has also increased. She has promoted respectful and inclusive language,⁴ led the way to a new, more inclusive Journal cover design, and created online collections of *JMWH* articles including the Racial Equity Library⁵ and the Health Care for Transgender and Non-binary Individuals virtual issue.⁶ Francie and I attended the recent ACNM Board of Directors meeting where President Cathy Collins-Fulea announced that the Board had voted unanimously to name Francie as Editor Emeritus, joining Mary Ann Shah with that recognition. Congratulations, Francie! And heartfelt thanks for opportunities to become more involved in *JMWH*, for your friendship, and for your grace as you pass the leadership of our Journal to me and to our new team.⁷

Francie has provided guidance to me the past several months, sharing what I needed to learn to take over as Editor-in-Chief. In addition to formal tasks such as working with authors on manuscripts and putting an issue together, 3 broad themes have emerged. First, this job can be done from anywhere in the world. When members hear from me, I may be working hard on your behalf in Minneapolis or corresponding from far-flung locations, travel now possible (as it becomes safer) following retirement from my faculty position. Second, Francie remarked early on that the Journal is a "well-oiled machine" and that I simply needed to learn my part in keeping it going. What that really means, however, is that many editors, authors, peer reviewers, and readers have developed this Journal over time; their legacy allows a new team to step in with ease. The Journal's mission and independence are well supported by ACNM, and our publisher, Wiley, provides resources to help the Journal remain impactful in the ever-changing academic publishing world. Finally, the third theme relates to editorial decisions. As Editor-in-Chief there are many publication decisions to make, some more complex than others. Our Journal team is blessed with rich resources to arrive at thoughtful and well-reasoned decisions, including the senior editors, peer reviewers, editorial board members, and our Managing Editor. Many thanks to our excellent Managing Editor for over 11 years, Brittany Swett, who is orienting our talented incoming Managing Editor, Laura Bolte.

Above all, as the editorial team transitions, remember that this Journal is *your* Journal. Whether you are a reader, a peer reviewer, an author, an editorial board member, or some combination, this senior editorial team values your partnership and participation—you have a home here. Let us know how you would like to see the Journal evolve in the coming years. I welcome hearing from you in the forthcoming

2022 Reader Survey and encourage your contributions to this Journal.

Melissa D. Avery, CNM, PhD
Editor-in-Chief



Melissa D. Avery, CNM, PhD, Editor-in-Chief



Linda A. Hunter, CNM, EdD, Deputy Editor



Ira Kantrowitz-Gordon, CNM, PhD, Deputy Editor

REFERENCES

1. Kraus N. A tribute to Mary Ann Shah. *J Nurse Midwifery*. 2000;45(4):289.
2. Murphy PA. Reflections on 40 years as a journal editor. *J Midwifery Womens Health*. 2021;66(4):435-436.
3. King TL. A professional journal that represents, reflects, and renews the profession. *J Midwifery Womens Health*. 2021;66(5):565-566.
4. Likis FE. Inclusive language promotes equity: the power of words. *J Midwifery Womens Health*. 2021;66(1):7-9.
5. Racism, antiracism, and racial equity. *J Midwifery Womens Health*. 2021;(online library). Accessed December 27, 2021. <https://onlinelibrary.wiley.com/page/journal/15422011/homepage/antiracism.htm>
6. Health care for transgender and non-binary individuals. *J Midwifery Womens Health*. 2021;(virtual issue). Accessed December 27, 2021. [https://onlinelibrary.wiley.com/doi/toc/10.1111/\(ISSN\)1542-2011.transgender-nonbinary-healthcare](https://onlinelibrary.wiley.com/doi/toc/10.1111/(ISSN)1542-2011.transgender-nonbinary-healthcare)
7. Likis FE. Looking back, looking forward: using our power for good. *J Midwifery Womens Health*. 2021;66(6):717-718.



Are You Using fFN Testing Correctly?

[Take the Quiz](#)

RapidfFN[®]

Factors Associated With Normal Physiologic Birth for Women Who Labor In Water: A Secondary Analysis of A Prospective Observational Study

Jane Carpenter¹, RM, DPhil, MRes, MSc , Ethel Burns¹, RM, PhD, Lesley Smith², PhD

Introduction: Research to understand factors associated with *normal physiologic birth* (unassisted vaginal birth, spontaneous labor onset without epidural analgesia, spinal, or general anesthetic, without episiotomy) is required. Laboring and/or giving birth in water has been shown to be associated with a high proportion of physiologic birth but with little understanding of factors that may influence this outcome. This study explored factors associated with normal physiologic birth for women who labored in water.

Methods: We conducted a secondary analysis of a UK-based prospective observational study of 8064 women at low risk of childbirth complications who labored in water. Consecutive women were recruited from birth settings in England, Scotland, and Northern Ireland. Planned place of birth, maternal characteristics, intrapartum events, and maternal and neonatal outcomes were measured. Univariable and multivariable logistic regression modelling explored factors associated with normal physiologic birth.

Results: In total, 5758 (71.4%) of women who labored in water had a normal physiologic birth. Planned birth in the community (adjusted odds ratio [aOR], 2.58; 95% CI, 2.22-2.99) or at an alongside midwifery unit (aOR, 1.21; 95% CI, 1.04-1.41) was positively associated with normal physiologic birth compared with planned birth in an obstetric unit. Duration of second stage (aOR, 0.66; 95% CI, 0.62-0.70), duration in the pool [aOR, 0.93; 95% CI, 0.90-0.96], and birth weight of the neonate (aOR, 0.74; 95% CI, 0.65-0.85) were negatively associated with normal physiologic birth. Parity was not associated with normal physiologic birth in multivariate analyses.

Discussion: Our findings largely reflected wider research, both in and out of water. We found midwifery-led birth settings may increase the likelihood of normal physiologic birth among healthy women who labor in water, irrespective of parity. This association supports growing evidence demonstrating the importance of planned place of birth on reducing intervention rates and adds to research on labor and birth in water.

J Midwifery Womens Health 2022;67:13–20 © 2022 The Authors. *Journal of Midwifery & Women's Health* published by Wiley Periodicals LLC on behalf of American College of Nurse Midwives (ACNM).

Keywords: birth setting, birthing pool, intrapartum, midwifery-led care, normality, water immersion, waterbirth

INTRODUCTION

There is an increasing global commitment to respect the physiology of childbirth and adopt strategies to facilitate it,¹⁻³ including growing interest in ways to enhance physiologic birth, generally defined in research and health policy literature as a birth with no, or limited, clinical intervention.⁴ Promoting physiologic birth aims to reduce the routine use of technology and interventions to manage pregnancy and childbirth, which is a global cause for concern.^{1,5}

The use of water immersion during labor and birth has been widely purported to support physiologic birth.⁶⁻¹¹ Laboring in water has been shown to provide a woman-centered, low-tech experience,⁷⁻¹² optimize physiology and relaxation, reduce pain, and increase maternal satisfaction with the birth

experience.^{6,12-15} Furthermore, studies demonstrate high levels of spontaneous vaginal birth,^{10,12} and physiologic birth,^{6,12} for healthy pregnant women, particularly in midwifery-led settings. However, it remains the case that not all women who labor in water have a physiologic birth, although at the onset of labor these women will usually be considered at low risk of obstetric complications. This raises the question of why such women do not go on to have a physiologic birth. This is important to understand; if factors are identified that are modifiable, it may be possible to enhance outcomes.

Monitoring physiologic birth rates, however, has been complicated by differing definitions¹⁶⁻¹⁸ and irregular reporting of physiologic birth statistics.¹⁹ In 2008, the Maternity Care Working Party (a panel of experts reporting to the UK government on maternity) produced a definition of *normal birth* as an unassisted vaginal birth with spontaneous onset of labor; without epidural analgesia, spinal, or general anesthetic; and without episiotomy.²⁰ This definition sought to remain focused on the process of childbirth, unlike some other definitions that also include outcomes.^{16,18} Including outcomes that occur after birth is less useful when investigating factors which may influence physiologic birth, as such outcomes may not be related to the birth process.⁴ The Maternity Care Working Party *normal birth* definition has been adopted in the research literature both when reporting rates,^{4,12,19,21} and

¹Oxford School of Nursing and Midwifery, Oxford Brookes University, Oxford, United Kingdom

²Faculty of Health Sciences, Hull University, Hull, United Kingdom

Correspondence

Jane Carpenter

Email: jane.carpenter@brookes.ac.uk

ORCID

Jane Carpenter  <https://orcid.org/0000-0002-7846-2489>

Quick Points

- ◆ There is currently limited research investigating factors associated with physiologic birth, despite current international interest in reducing unnecessary intervention
- ◆ This study examined factors associated with physiologic birth for women with a healthy pregnancy who labor in water
- ◆ Choosing community and midwifery-led birth settings for women who labored in water was associated with higher likelihood of physiologic birth.
- ◆ Parity was not associated with physiologic birth. Instead, duration of second stage, a modifiable variable, was negatively associated with physiologic birth.

factors associated with it.^{4,19} This definition is also used in the UK's National Maternity and Perinatal Audit (NMPA), which audits and regularly reports on the National Health Service maternity services across England, Scotland and Wales.²² However, the use of the phrase *normal birth* is no longer considered appropriate by many. This has led to the NMPA referring to the outcome as *birth without intervention* and the use of the term physiologic or *physiologic birth* to be used in preference to normal birth in the research literature. Therefore, in this study, we use the phrase *normal physiologic birth* when we are referring to the Maternity Care Working Party definition of *normal birth*, and *physiologic birth* when we are referring to the general concept of labor and birth that occurs without intervention.

Research that has the explicit aim of identifying factors that influence normal physiologic birth remains limited to 2 cross-sectional studies.^{4,19} These studies, both from Australia, included a total of 6612 women and used self-reported questionnaires to investigate factors that influenced whether women had a normal physiologic birth. They found normal physiologic birth to be associated with giving birth outside regular business hours, intrapartum continuity of care, mobility in labor, nonsupine birth positions, and labor without continuous fetal monitoring or augmentation.^{4,19} In addition, the Birthplace in England study, a national prospective cohort study,²¹ found that the rate of normal physiologic birth for women who were at low risk of complications differed depending on the place in which they were giving birth, with normal physiologic birth more likely at freestanding midwifery units or home than obstetric units.

Considering features associated with physiologic birth more generally, factors that potentially increase the incidence of physiologic birth or spontaneous vaginal birth include continuous support during labor and birth²³ and access to midwifery-led continuity models of care.²⁴ The latter Cochrane Review also found an increase in rates of intervention for women not receiving midwifery-led continuity models of care.²⁴ Other research on rates of intervention has shown a potential increase in intervention for women who gave birth in Germany who had less midwife involvement in birth,²⁵ gave birth during business hours,²⁵ and received continuous electronic fetal monitoring during labor.²⁶

There is limited research explicitly investigating factors influencing physiologic birth during water immersion.⁶ However, Shaw-Battista et al, in their systematic review, found that water immersion reduced the likelihood of intervention, pro-

vided pain relief, reduced maternal anxiety, and reduced fetal malpresentation while supporting greater mobility in labor.⁶ All of these factors facilitate physiologic birth. However, further research to investigate factors influencing physiologic birth is certainly indicated and yet currently lacking.⁶ The aim of this study, therefore, was to identify potential factors associated with normal physiologic birth, as defined by the Maternity Care Working Party,²⁰ for healthy pregnant women at low risk of obstetric childbirth complications who labored in water.

METHODS

Study Design

This was a secondary analysis of data collected during a prospective observational study.¹² The purpose of the parent study was to describe and compare the characteristics, interventions, and maternal and neonatal outcomes by planned place of birth for pregnant women who used a birthing pool. Research ethics approval to conduct the original study was sought and obtained from the host university.¹² Full methods for the original study can be found in the publication.¹² Methods relevant to this secondary analysis are reported here.

Study Setting and Participants

Data were prospectively collected for 8924 women who entered a birthing pool at some point during labor and birth. Twenty-six National Health Service Hospital Trusts provided data collected between 2000 and 2008. Birthing pool dimensions were ascertained to ensure that they were sufficiently large to enable a woman to adopt a range of different positions.

Three care settings contributed data to the study: (1) obstetric units, where care is obstetrician-led, supported by midwives and with anesthetic support available; (2) alongside midwifery units, where care is midwife-led, without obstetric or anesthetic care, but the unit is situated in the same hospital or site as an obstetric unit; and (3) community, which comprised both freestanding midwifery units, without adjacent access to obstetric or anesthetic care, and midwife-attended homebirths. These last 2 settings were combined into one variable as the care model is similar, and a sensitivity analysis performed in the original study showed no differences in perinatal outcomes between freestanding midwifery units alone and when merged with home.

Any woman who entered the birthing pool during labor in one of the participating centers was included in the original study. To be eligible for birthing pool use in the United Kingdom, it is usually recommended that women have a low-risk obstetric profile. This profile is defined as an uncomplicated pregnancy, singleton fetus in a cephalic presentation, labor at 37 weeks' or more gestation, and no preexisting disease that may affect a woman's risk of adverse outcome during labor.¹² This requirement has not changed since the period of data collection for this study. Thirty-nine women were excluded from the current study (20 previous cesarean birth, 19 who had a breech presentation) because they did not meet these criteria.

Data Collection

Using a data proforma, data were collected for consecutive women who entered the birthing pool for any duration of time, reducing the risk of recording bias. It was recorded whether each woman used the birthing pool for labor only (labor in water) or used the birthing pool during labor and for birth (waterbirth). The date, specific birthing center, and planned place of birth (obstetric unit, alongside midwifery unit, or community) were recorded for each woman. In the original study, data were collected on maternal characteristics, time spent in the pool, intrapartum events, and a wide range of maternal (eg, mode of birth, place of birth, perineal trauma, mode of placental birth, estimated blood loss, infection, readmission to hospital) and neonatal (eg, Apgar scores at 5 and 10 minutes, admission to neonatal intensive care unit, infection) outcomes up to 7 days postpartum.

A link person at each study center liaised with the study coordinator and compiled data. An initial pilot phase ensured any issues or inconsistencies with data recording were addressed early on in the study period. The link person entered the deidentified data onto a Microsoft Excel spreadsheet. The Excel file was checked for accuracy by the study coordinator.

Data Analysis

Data were imported into IBM SPSS version 26.0 statistical software (Armonk, NY) for analysis. Only complete data for the included variables were used. Summary descriptive statistics were calculated using appropriate measures of central tendency (mean, median) and dispersion (SD, range) for continuous data and number and percentage for categorical data.

A variable was selected for inclusion in the model if it was clinically plausible, according to best available evidence, for it to influence the likelihood of normal physiologic birth. Variables included in the analysis were as follows: Year of data collection was included to account for the possibility of a change in water immersion practice over the 8 years of data collection, affecting the normal physiologic birth rate. Categorical predictor variables were parity (nulliparous vs multiparous), planned place of birth (obstetric unit, alongside midwifery unit, community), augmentation with intravenous oxytocin infusion (yes or no), analgesia (no analgesia, opioid analgesia, or nonopioid analgesia), maternal age categorized as younger than 25 years, 25 to 34 years, and 35 years of age or older. Continuous variables included were total duration of time in the pool (completed hours), duration of the second stage of labor

(completed hours), and birth weight of the neonate (grams). Waterbirth (yes or no) was included as a variable as a potential confounding factor. By having a waterbirth, most requirements for normal physiologic birth are automatically met, but waterbirth is also associated with other predictor variables (eg, birth in a midwifery-led setting compared to an obstetric unit).

First, univariable logistic regression analyses were run with *normal physiologic birth* as the response variable; then, all potential predictor variables were added to a multivariable model using the ENTER method. For each variable, the normative category was chosen as the reference category. For maternal age, the middle category of 25 to 34 years old was chosen as the reference, as this is considered the optimal age range for childbearing.^{27,28} A *P* value less than .05 was considered to be statistically significant. The likelihood of explanatory variables being associated with normal physiologic birth is presented using odds ratios (ORs) and 95% CIs. All logistic regression model assumptions,²⁹ were met.

RESULTS

Detailed descriptive characteristics were published in the original study.¹² Summary descriptive statistics for the sample included in the current study are shown in Table 1. Summary descriptive statistics for the 39 women who were removed from analyses because they did not meet eligibility criteria can be found in the Supporting Information: Table S1. There are few published data on water immersion for such women to date, therefore inclusion of this information was considered important.

After removing women who did not meet eligibility criteria (*n* = 39) and had incomplete data (*n* = 821), the final sample size was 8064, compared with 8924 in the original study. Overall, of the 8064 women included, 5758 (71.4%) had a normal physiologic birth, and 2306 did not. Reasons for not having a normal physiologic birth included having an epidural analgesia (*n* = 1696), episiotomy (*n* = 734), operative vaginal birth (*n* = 560), a cesarean birth (*n* = 119), or induction of labor (*n* = 181). Sixty-two percent of the 4360 nulliparous women and 82.1% of the 3704 multiparous women had a normal physiologic birth (Table 2).

Univariable Analyses

Results of the univariable analyses are presented in Table 2. Eleven variables were tested for a potential association with normal physiologic birth. Multiparity, planned place of birth in an alongside midwifery unit or community setting, birth in water, and age over 35 years were associated with an increased likelihood of physiologic birth. There was a trend for increased likelihood of physiologic birth over time from 2000 to 2008. Augmentation with oxytocin, use of opioid or nonopioid analgesia, and age under 25 years were associated with a reduced likelihood of physiologic birth. Longer duration of time in the pool, duration of second stage, and heavier birth weight of the neonate reduced the likelihood of physiologic birth.

After adjustment for all other predictors via multivariable analysis, parity and maternal age over 35 years no longer

Table 1. Descriptive Characteristics Stratified by Normal Physiologic Birth			
Characteristics	Analyzed, N	Normal Physiologic Birth^a	
		Yes	No
Maternal age, n (%), y			
25-34	4803	3449 (59.9)	1354 (58.8)
<25	1791	1194 (20.7)	597 (25.9)
≥35	1470	1115 (19.4)	355 (15.4)
Gestational age, mean (SD), wk			
	8064	39.7 (1.1)	39.9 (1.1)
Parity, n (%)			
Nulliparous	4360	2716 (47.2)	1644 (69.2)
Multiparous	3704	3042 (52.8)	662 (30.9)
Planned place of birth, n (%)			
OU	3542	2304 (39.9)	1238 (53.7)
Community	2531	2083 (36.1)	448 (19.4)
AMU	1991	1371 (23.7)	620 (26.9)
Spontaneous vaginal birth, n (%)			
No	702	0 (0.0)	702 (30.5)
Yes	7362	5758 (100.0)	1604 (69.5)
Birth in water, n (%)			
No	3198	1505 (26.2)	1693 (73.4)
Yes	4866	4253 (73.8)	613 (26.6)
Augmentation with (oxytocin), n (%)			
No	7857	5734 (99.8)	2123 (92.1)
Yes	207	24 (0.4)	183 (7.9)
Analgesia, n (%)			
None	1225	1020 (25.4)	205 (5.1)
Nonopioid ^b	6779	4711 (74.0)	2068 (94.1)
Opioid	60	27 (0.7)	33 (0.8)
Duration in pool, median (IQR), h			
	8064	1.65 (1.8)	2 (2.3)
Duration second stage, mean (SD), h			
	8064	0.39 (0.62)	1.03 (1.8)
Newborn birth weight, mean (SD), g			
	8064	3528.9 (437.2)	3560.3 (440.1)

Abbreviations: AMU, alongside midwifery unit; OU, obstetric unit; Community, freestanding midwifery unit and home birth; IQR, interquartile range.

^aDefined as an unassisted vaginal birth of spontaneous labor onset without epidural analgesia, spinal or general anesthetic, and without episiotomy.

^bIncluded Transcutaneous Electrical Nerve Stimulation (TENS) machine and inhalational analgesia.

showed significant association with physiologic birth. Given the recognized importance of parity as a determinant of maternal outcome in other studies,^{21,30–32} this result was investigated further. Exploratory analyses found that adding duration of second stage into the model caused parity to lose its significance. These 2 variables were therefore tested for an interaction by entering the interaction term into the model in SPSS, but none was found (Table 2).

There was a positive association between year of study and normal physiologic birth, with increased likelihood of normal physiologic birth over time (Table 2). Planning to give birth in community or at an alongside midwifery unit increased the odds of normal physiologic birth, as did having a waterbirth (Table 2). Oxytocin augmentation, use of opioid or nonopioid analgesia, and maternal age under 25 years were associated with a reduction in the odds of normal physiologic birth. Increasing duration of time spent in the pool and duration of the second stage reduced the likelihood of normal phys-

iological birth, as did increasing birth weight of the neonate (Table 2).

DISCUSSION

This study examined potential factors associated with normal physiologic birth (as per the Maternity Care Working Party definition): unassisted vaginal birth with spontaneous onset of labor; without epidural analgesia, spinal, or general anesthetic; and without episiotomy,²⁰ for women at low risk of childbirth complications who used a birthing pool during labor. As might be expected for this cohort of women, a high proportion ($n = 5758$, 71.4%) of women who labored in water had a normal physiologic birth. This is higher than the original target of 60% set by the Maternity Care Working Party.²⁰ It is also higher than the level reported in the Birthplace study,²¹ which included a similar low-risk population but without a focus on water immersion and found 61.5% of

Table 2. Factors Associated with Normal Physiologic Birth for Women at Low Risk of Childbirth Complication Who Labored in Water

Factors	Univariable		Multivariable	
	OR (95% CI)	P Value	aOR (95% CI)	P Value
Year^a	1.07 (1.04-1.11)	<.001	1.05 (1.00-1.09)	.03
Maternal age, y				
25-34	1.00		1.00	
<25	0.79 (0.70-0.88)	<.001	0.87 (0.76-0.99)	.05
35+	1.23 (1.08-1.41)	.002	1.07 (0.91-1.26)	.42
Parity				
Nulliparous	1.00		1.00	
Multiparous	2.78 (2.51-3.09)	<.001	1.10 (0.96-1.26)	.19
Planned place of birth				
OU	1.00		1.00	
Community	2.50 (2.21-2.83)	<.001	2.58 (2.22-2.99)	<.001
AMU	1.19 (1.06-1.33)	.004	1.21 (1.04-1.41)	.02
Birth in water				
No	1.00		1.00	
Yes	7.81 (7.00-8.71)	<.001	4.89 (4.31-5.53)	<.001
Augmentation with oxytocin				
No	1.00		1.00	
Yes	0.05 (0.03-0.08)	<.001	0.21 (0.14-0.34)	<.001
Analgesia				
None	1.00		1.00	
Nonopioid ^b	0.46 (0.39-0.54)	<.001	0.78 (0.65-0.94)	.008
Opioid	0.16 (0.10-0.28)	<.001	0.52 (0.29-0.95)	.03
Duration in pool, h^a	0.87 (0.87-0.89)	<.001	0.93 (0.90-0.96)	<.001
Duration second stage, h^a	0.45 (0.43-0.47)	<.001	0.66 (0.62-0.70)	<.001
Newborn birth weight, g^a	0.85 (0.76-0.95)	.004	0.74 (0.65-0.85)	<.001
Interaction term: parity by length second stage	0.94 (0.80-1.11)	.46	1.14 (0.96-1.35)	.13

Abbreviations: AMU, alongside midwifery unit; OU, obstetric unit; Community, freestanding midwifery unit and home birth.

^aContinuous variables.

^bIncluded Transcutaneous Electrical Nerve Stimulation (TENS) machine and inhalational analgesia.

64,105 women had a normal physiologic birth. This may support the idea that water immersion is supportive of promoting normal physiologic birth, as found in the systematic review by Shaw-Battista.⁶ Comparison with the few other studies that report incidence of normal physiologic birth is made difficult by the inclusion of women with mixed levels of obstetric risk, leading to much lower levels of normal physiologic birth of 29.6% and 28.7%.^{4,19}

Planned place of birth was associated with normal physiologic birth in this study. In the multivariable analysis, women who planned birth in an alongside midwifery unit or community setting were more likely to have a normal physiologic birth than those who planned birth in an obstetric unit. The likelihood was twice as high (adjusted OR [aOR], 2.58; 95% CI, 2.22-2.99) in community settings (freestanding midwifery unit or at home) compared with alongside midwifery units (aOR, 1.04; 95% CI, 1.04-1.41). This adds to a growing body of knowledge demonstrating the importance of birth place, and particularly the community, in supporting normal physiology and vaginal birth.^{21,33,34}

Parity was not a significant predictor of normal physiologic birth in the multivariable model, despite univariable analysis showing multiparous women having strongly increased odds of normal physiologic birth. This was unexpected, as parity is often shown as an influential predictor of outcome for women.^{21,33,34} Studies evaluating the effect of parity on perinatal outcomes often include populations of women in the hospital (obstetric unit) setting and/or women with mixed risk factors,^{30,31} but this is not always the case.^{21,32} Our study only included healthy women who labored in several different birth settings available in the United Kingdom. We found that the association between parity and normal physiologic birth was lost when duration of second stage was entered into the model, suggesting that this finding may be affected by the fact that multiparous women are more likely to have a shorter second stage. The reliability of measures of duration of labor have been questioned, however, because of the reliability of assessing the onset of the second stage.³⁵ Nonetheless, this finding is still interesting, as unlike parity, second stage duration is a modifiable variable, which appears

to be more important in terms of achieving normal physiologic birth. It may be that a longer second stage was associated with more intervention, leading to this effect, suggesting careful consideration before intervention is required.² Or, it may be that midwifery practices to encourage a shorter second stage could directly influence normal physiologic birth rates. One such practice might be encouraging the use of upright positions during labor, including the second stage. These have been cited as methods to shorten the second stage of labor^{36,37} and have been found to be associated with normal physiologic birth in previous studies.^{4,19} However, a Cochrane Review of trials undertaken in a hospital setting found no significant effect of maternal position on second stage duration and calls for a higher quality of study on the subject,³⁸ suggesting further research on the topic is needed. One might consider that augmentation of labor would also encourage a shorter duration of second stage, and thereby positively influence normal physiologic birth rates. However, in this study, augmentation using intravenous oxytocin infusion was actually associated with a reduction in the likelihood of normal physiologic birth. In addition, augmentation also brings associated risks,³⁹ and Gaudernack et al concluded that augmentation with oxytocin should be used with caution.³⁹

It was important to explore any potential effect of time in our analyses, and indeed, we found a positive relationship between an increased incidence of normal physiologic birth over time (albeit weak). As this was only a period of 8 years, this may or may not reflect a long-term trend, but it is encouraging, and ongoing investigation is warranted. Such monitoring of long-term outcomes is important as a measure of quality improvement.⁶ Indeed, this has led to the inclusion of normal physiologic birth as an outcome in the NMPA.²²

Women who had a waterbirth were almost 5 times more likely to have a normal physiologic birth than women who exited the pool to birth on land. However, by virtue of having a waterbirth, most of the criteria for normal physiologic birth are met. Some women may have intended to have a waterbirth but then chose to exit the pool for reasons related to fetal and/or maternal well-being or a change of mind, biasing the results in favor of waterbirth and making further interpretation of this finding impossible. Recording “planned waterbirth,” as suggested by Bovbjerg et al,⁴⁰ would have gone some way to address this concern. Waterbirth was included in the model, however, as a potential confounder.

Despite the recognized need to promote physiologic birth and reduce the incidence of unnecessary obstetric interventions, there is little published research investigating factors that may influence normal physiologic birth.^{4,19,41} This may be partly due to the multiple definitions of physiologic birth making routine reporting difficult, and indeed, there is a greater body of research reporting on physiologic birth more generally, or individual components of it.

When comparing our results with wider research exploring factors influencing physiologic birth or its components, there is substantial overlap, even where those studies do not focus on water immersion. Such findings include a negative association between physiologic birth and augmentation of labor,^{4,19} duration of second stage,⁴² and neonatal birth weight^{43,44} and a positive association with planning to give birth in a community setting or an alongside midwifery

unit.^{21,33,34,45} However, unlike other research,^{21,30–32} we found no association between parity and normal physiologic birth in the multivariable model; instead, duration of second stage appeared to be a more important association. We also found a negative association with duration of time spent in the pool. It is difficult to fully understand the reason for this, but it may be due to longer labors being more likely to lead to intervention⁴² or that such women entered the pool earlier, as there is limited and dated evidence that this may increase intervention.⁴⁷

There is little comparable research available on factors influencing physiologic birth during water immersion.⁶ Shaw-Battista et al found that water immersion reduced the likelihood of intervention, provided pain relief, reduced maternal anxiety, and reduced fetal malpresentation while supporting greater movement in labor.⁶ Although not directly comparable, our findings certainly appear supportive of the findings reported in this study. Internationally, however, well-constructed prospective studies reporting intervention rates, physiologic birth rates, and birthing pool use, and factors influencing these, are certainly indicated.

The large sample size, prospective observational methodology, and inclusion of different settings across multiple sites in the current study means that this study makes a significant contribution to the evidence base on the use of water immersion during labor and/or birth. Furthermore, there are few studies investigating factors that may influence the likelihood of normal physiologic birth,^{4,19} and we are not aware of any other studies investigating it across the range of birth settings for women who labored in water. There is also a lack of research on this topic related to physiologic birth more generally.⁶ This study therefore adds to our understanding of factors influencing physiologic birth for women who labor in water.

Although there are strengths to the research design used, there are also limitations to any observational research design, particularly with respect to bias and confounding.⁴⁶ For example, although this was a prospective study, with careful consideration given to variables included, it is possible that variables were not included that would have influenced the results obtained, for example, continuity of care model, or accoucheur experience were not accounted for and could have had an impact on outcomes. In addition, although great effort was made to reduce errors during data collection and entry, the possibility of some recorder or transcriber error cannot be ruled out. For these reasons, the inability to infer causality from observational research is acknowledged. In addition, no comparator group (of women at low risk of complication who did not labor in water), is available for these data, which would have enabled direct comparison between the 2 groups, and as discussed above, obtaining data on planned waterbirth would have been beneficial. The data used in this secondary analysis are now more than 10 years old. Although birthing pool eligibility criteria have not changed over this period, and any women using the pool who did not fit these criteria were removed from the current analysis, this limitation should still be acknowledged.

The women included in this study were those considered to be at low risk of childbirth complication, and results will not be applicable to women with known obstetric or clinical complications. Some information that may have been

valuable in the study was not collected, for example, on ethnicity and body mass index (BMI) status. Therefore, we do not know how the results vary by ethnicity or BMI.

CONCLUSION

There is currently limited research exploring factors associated with physiologic birth for women with a straightforward pregnancy who labor in water. There is increasing evidence that for such women, both in and out of water, planning to birth in a community setting or an alongside midwifery unit, rather than an obstetric unit, may increase the likelihood of normal physiologic birth. Our study found that duration of second stage and duration of time in the pool were both negatively associated with likelihood of normal physiologic birth. However, further research is warranted to examine these relationships further. Careful monitoring of long-term trends of normal physiologic birth rates over time, including those in birthing pools, nationally and internationally, should be undertaken. This is particularly important given the current drive to reduce unnecessary intervention in childbirth and may enable better understanding of the efficacy of any changes to practice implemented with the aim of reducing intervention and increasing physiologic birth.

CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1. Selected Characteristics of Women Who Used a Birthing Pool During Labor but Were Excluded from Analysis Because of Not Meeting Usual Birthing Pool Access Criteria

REFERENCES

- Renfrew MJ, McFadden A, Bastos MH, et al. Midwifery and quality care: findings from a new evidence-informed framework for maternal and newborn care. *Lancet*. 2014;384(9948):1129-1145. [https://doi.org/10.1016/S0140-6736\(14\)60789-3](https://doi.org/10.1016/S0140-6736(14)60789-3)
- Lothian JA. Healthy birth practice #4: avoid interventions unless they are medically necessary. *J Perinat Educ*. 2014;23(4):198-206.
- Amis D. Healthy birth practice #1: let labor begin on its own. *J Perinat Educ*. 2019;28(2):68-80.
- Prosser SJ, Barnett AG, Miller YD. Factors promoting or inhibiting normal birth. *BMC Pregnancy Childbirth*. 2018;18(1):241. <https://doi.org/10.1186/s12884-018-1871-5>
- Renfrew MJ, Homer CSE, Downe S, et al. *Midwifery: An Executive Summary for The Lancet's Series*. Lancet; June 2014.
- Shaw-Battista J. Systematic review of hydrotherapy research: does a warm bath in labor promote normal physiologic childbirth? *J Perinat Neonatal Nurs*. 2017;31(4):303-316. <https://doi.org/10.1097/JPN.0000000000000260>.
- Nutter E, Meyer S, Shaw-Battista J, Marowitz A. Waterbirth: an integrative analysis of peer-reviewed literature. *J Midwifery Womens Health*. 2014;59(3):286-319. <https://doi.org/10.1111/jmwh.12194>.
- Camargo JCS, Varela V, Ferreira FM, et al. The Waterbirth Project: São Bernardo Hospital experience. *Women Birth*. 2018;31(5):e325-e333.
- Menakaya U, Albayati S, Vella E, Fenwick J, Angstetra D. A retrospective comparison of water birth and conventional vaginal birth among women deemed to be low risk in a secondary level hospital in Australia. *Women Birth*. 2013;26(2):114-118. <https://doi.org/10.1016/j.wombi.2012.10.002>
- Maude RM, Kim M. Getting into the water: a prospective observational study of water immersion for labour and birth at a New Zealand District Health Board. *BMC Pregnancy Childbirth*. 2020;20(1):312. <https://doi.org/10.1186/s12884-020-03007-6>
- Liu Y, Liu Y, Huang X et al. A comparison of maternal and neonatal outcomes between water immersion during labour and conventional labour and delivery. *BMC Pregnancy Childbirth*. 2014;14:160. <https://doi.org/10.1186/1471-2393-14-160>
- Burns EE, Boulton MG, Cluett E, Cornelius VR, Smith LA. Characteristics, interventions, and outcomes of women who used a birthing pool: a prospective observational study. *Birth*. 2012;39(3):192-202. <https://doi.org/10.1111/j.1523-536X.2012.00548.x>
- Cluett ER, Burns E, Cuthbert A. Immersion in water during labour and birth. *Cochrane Database Syst Rev*. 2018;5(5):CD000111. <https://doi.org/10.1002/14651858.CD000111.pub4>.
- Otigbah C, Dhanjal MK, Harsworth G, Chard T. A retrospective comparison of water births and conventional vaginal deliveries. *Eur J Obstet Gynecol Reprod Biol*. 2000;91(1):15-20. [https://doi.org/10.1016/s0301-2115\(99\)00238-9](https://doi.org/10.1016/s0301-2115(99)00238-9)
- Feeley C, Cooper M, Burns E. A systematic meta-thematic synthesis to examine the views and experiences of women following water immersion during labour and waterbirth. *J Adv Nurs*. 2021;77(7):2942-2956. <https://doi.org/10.1111/jan.14720>
- American College of Nurse-Midwives; Midwives Alliance of North America; National Association of Certified Professional Midwives. Supporting healthy and normal physiologic childbirth: a consensus statement by the American College of Nurse-Midwives, Midwives Alliance of North America, and the National Association of Certified Professional Midwives. *J Midwifery Womens Health*. 2012;57(5):529-532. 11.
- Queensland Clinical Guidelines. *Normal Birth*. Queensland Government; 2017. Accessed November 29, 2021. https://www.health.qld.gov.au/_data/assets/pdf_file/0014/142007/g-normalbirth.pdf
- Society of Obstetricians and Gynaecologists of Canada et al. Joint policy statement on normal childbirth. *J Obstet Gynaecol Can*. 2008;30(12):1163-1165.
- Miller YD, Prosser SJ, Thompson R. Back to normal: a retrospective, cross-sectional study of the multi-factorial determinants of normal birth in Queensland, Australia. *Midwifery*. 2015;31(8):818-827. <https://doi.org/10.1016/j.midw.2015.04.005>
- Maternity Care Working Party. *Making Normal Birth a Reality: Consensus Statement from the Maternity Care Working Party*. National Childbirth Trust; Royal College of Midwives; Royal College of Obstetricians and Gynaecologists; 2007. Accessed November 29, 2021. http://bhphelopartonormal.pbh.gov.br/estudos_cientificos/arquivos/normal_birth_consensus.pdf
- Birthplace in England Collaborative Group; Brocklehurst P, Hardy P, Hollowell J, et al. Perinatal and maternal outcomes by planned place of birth for healthy women with low risk pregnancies: the Birthplace in England National Prospective Cohort study. *BMJ*. 2011;343:d7400. <https://doi.org/10.1136/bmj.d7400>
- NMPA Project Team. National Maternity and Perinatal Audit: Clinical Report 2019: Based on Births in NHS Maternity Services between 1 April 2016 and 31 March 2017. Royal College of Obstetricians and Gynaecologists; 2019. Accessed September 11, 2021. <https://maternityaudit.org.uk/files/Uploaded/NMPA%20Clinical%20Report%202019.pdf>
- Bohren MA, Hofmeyr GJ, Sakala C, Fukuzawa RK, Cuthbert A. Continuous support for women during childbirth. *Cochrane Database Syst Rev*. 2017;7(7):CD003766. <https://doi.org/10.1002/14651858.CD003766.pub6>
- Sandall J, Saltani H, Gates S, Shennan A, Devane D. Midwife-led continuity models versus other models of care for childbearing women. *Cochrane Database Syst Rev*. 2015;15(9):CD004667. <https://doi.org/10.1002/14651858.CD004667.pub5>

25. Lerchl A. Where are the Sunday babies? III. Caesarean sections, decreased weekend births, and midwife involvement in Germany. *Naturwissenschaften*. 2008;95(2):165-170.
26. Alfirevic Z, Devane D, Gyte GML, Cuthbert A. Continuous cardiotocography (CTG) as a form of electronic fetal monitoring (EFM) for fetal assessment during labour. *Cochrane Database Syst Rev*. 2017;2(2):CD006066. <https://doi.org/10.1002/14651858.CD006066.pub3>
27. Bloomberg M, Birch Tyrberg R, Kjølhede P. Impact of maternal age on obstetric and neonatal outcome with emphasis on primiparous adolescents and older women: a Swedish Medical Birth Register Study. *BMJ Open*. 2014;4(11):e005840. <https://doi.org/10.1136/bmjopen-2014-005840>
28. Cleary-Goldman J, Malone FD, Vidaver J, et al. Impact of maternal age on obstetric outcome. *Obstet Gynecol*. 2005;105(5 Pt 1):983-990. <https://doi.org/10.1097/01.AOG.0000158118.75532.51>
29. Stoltzfus JC. Logistic regression: a brief primer. *Acad Emerg Med*. 2011;18(10):1099-1104.
30. Kalogiannidis I, Margioulas-Siarkou C, Petousis S et al. Parity affects pregnancy outcomes in women 35 and older. *Clin Exp Obstet Gynecol*. 2011;38(2):146-149.
31. Boudet-Berquier J, Salanave B, Desenclos JC, Castetborn K. Sociodemographic factors and pregnancy outcomes associated with prepregnancy obesity: effect modification of parity in the nationwide Epifane birth-cohort. *BMC Pregnancy Childbirth*. 2017;17(1):273. <https://doi.org/10.1186/s12884-017-1456-8>
32. Hollowell J, Pillas D, Rowe R, Linsell L, Knight M, Brocklehurst P. The impact of maternal obesity on intrapartum outcomes in otherwise low risk women: secondary analysis of the Birthplace national prospective cohort study. *BJOG*. 2014;121:343-355. <https://doi.org/10.1111/1471-0528.12437>
33. Janssen PA, Saxell L, Page LA, Klein MC, Liston RM, Lee SK. Outcomes of planned home birth with registered midwife versus planned hospital birth with midwife or physician. *CMAJ*. 2009;181(6-7):377-383. <https://doi.org/10.1503/cmaj.081869>
34. Scarf VL, Rossiter C, Vedam S, et al. Maternal and perinatal outcomes by planned place of birth among women with low-risk pregnancies in high-income countries: a systematic review and meta-analysis. *Midwifery* 2018;62:240-255. <https://doi.org/10.1016/j.midw.2018.03.024>
35. Walker KF, Kibuka M, Thornton JG, Jones NW. Maternal position in the second stage of labour for women with epidural anaesthesia. *Cochrane Database Syst Rev*. 2018;11(11):CD008070. <https://doi.org/10.1002/14651858.CD008070.pub4>
36. Kopas ML. A review of evidence-based practices for management of the second stage of labor. *J Midwifery Womens Health*. 2014;59(3):264-276. <https://doi.org/10.1111/jmwh.12199>
37. Moraloglu O, Kansu-Celik H, Tasci Y, et al. The influence of different maternal pushing positions on birth outcomes at the second stage of labor in nulliparous women. *J Matern Fetal Neonatal Med*. 2017;30(2):245-249. <https://doi.org/10.3109/14767058.2016.1169525>
38. Gupta JK, Sood A, Hofmeyr GJ, Vogel JP. Position in the second stage of labour for women without epidural anaesthesia. *Cochrane Database Syst Rev* 2017;5(5):CD002006. <https://doi.org/10.1002/14651858.CD002006.pub4>
39. Gaudernack LC, Frosli KF, Michelsen TM, et al. De-medicalization of birth by reducing the use of oxytocin for augmentation among first-time mothers – a prospective intervention study. *BMC Pregnancy Childbirth*. 2008;18(1):76. <https://doi.org/10.1186/s12884-018-1706-4>
40. Bovbjerg ML, Cheyney M, Everson C. Maternal and neonatal outcomes following waterbirth: the Midwives Alliance of North America Statistics Project, 2004 to 2009 cohort. *J Midwifery Womens Health*. 2016;61(1):11-20. <https://doi.org/10.1111/jmwh.12394>
41. Jepsen P, Johnsen SP, Gillman MW, Sørensen HT. Interpretation of observational studies. *Heart*. 2004;90:956-960.
42. Romano AM, Lothian JA. Promoting, protecting, and supporting normal birth: a look at the evidence. *J Obstet Gynecol Neonatal Nurs*. 2008;37(1):94-105.
43. Matta P, Turner J, Flatley C, Kumar S. Prolonged second stage of labour increases maternal morbidity but not neonatal morbidity. *Aust N Z J Obstet Gynaecol* 2019;59(4):555-560. <https://doi.org/10.1111/ajo.12935>
44. Siggelkow W, Boehm D, Skala C, Grosslercher M, Schmidt M, Koelbl H. The influence of macrosomia on the duration of labor, the mode of delivery and intrapartum complications. *Arch Gynecol Obstet*. 2008;278(6):547-553. <https://doi.org/10.1007/s00404-008-0630-7>
45. Stotland NA, Caughey AB, Breed EM, Escobar GJ. Risk factors and obstetric complications associated with macrosomia. *Int J Gynaecol Obstet*. 2004;87(3):220-226. [10.1016/j.ijgo.2004.08.010](https://doi.org/10.1016/j.ijgo.2004.08.010)
46. Davis D, Baddock S, Pairman S, et al. Planned place of birth in New Zealand: does it affect mode of birth and intervention rates among low-risk women? *Birth*. 2011;38(2):111-119. <https://doi.org/10.1111/j.1523-536X.2010.00458.x>
47. Eriksson M, Mattsson LA, Ladfors L. Early or late bath during the first stage of labour: a randomised study of 200 women. *Midwifery*. 1997;13(3):146-148. [https://doi.org/10.1016/s0266-6138\(97\)90005-x](https://doi.org/10.1016/s0266-6138(97)90005-x)



Ruptured Membranes: When the Bag of Waters Breaks

What is the amniotic sac?

The amniotic sac—also called the membranes or bag of waters—surrounds your baby in your uterus (part of the body where your baby grows) during pregnancy. The sac holds the amniotic fluid (water) that protects your baby and gives your baby room to move around. The amniotic sac also protects your baby from infections. The walls of the amniotic sac are made by 2 membranes called the chorion and amnion. The 2 membranes are stuck together into one sac. When your bag of waters breaks, it is called ruptured membranes.

When do the membranes rupture?

The membranes will usually rupture (break) on their own either just before you go into labor or sometime during your labor. In about 1 in every 10 women, the membranes rupture several hours before labor starts. Although rare, the bag of waters can break days or weeks before labor starts. When the bag of waters breaks before labor starts, this is called prelabor rupture of membranes (PROM). Your health care provider may break your bag of waters for you while you are in labor.

How will I know when my membranes rupture?

You will not feel any pain when your membranes rupture. You may feel a large gush of fluid coming from your vagina that makes your underwear and clothes wet. Or you may have just a small trickle of water that makes your underwear feel damp. Sometimes women hear a small pop when their bag of waters breaks. The amniotic fluid is warm like your body temperature, and it does not have any smell. It is usually clear like water. After your membranes rupture, you will keep leaking amniotic fluid. If you change your underwear, they will get wet again. Usually, you will only keep leaking a little bit of fluid. You will probably need to wear a pad or keep changing your underwear after your membranes rupture. If you are not sure if your bag of waters has broken, put a pad in your underwear and wait for a short time. If the pad gets wet, call your health care provider.

What should I do if my membranes rupture or I think they may have ruptured?

If you think your membranes have ruptured, call your health care provider and then follow their instructions. It will be important to tell your provider:

- What time the bag of waters broke
- What color the fluid is, such as clear, green, yellow, or brown
- If the water has a smell
- Your due date
- If you are having regular contractions
- If you have had a very quick labor in the past
- If your baby is not in the head-down position
- If you have been told the baby is very high in your pelvis
- If you had a cesarean birth in the past and plan to have another cesarean birth with this pregnancy
- If you tested positive for group B strep (GBS) during this pregnancy
- If you don't know if you have group B strep or not

Is there any danger to me or my baby when my membranes rupture?

After your bag of waters breaks, you and your baby have a chance of getting an infection if you do not give birth for a long time. Do not put anything in your vagina after your membranes rupture. Your health care providers should try to do as few vaginal exams as possible after your bag of waters breaks.



What will happen if I am within 3 weeks of my due date and my membranes rupture before I am in labor?

If your bag of waters breaks and you are within 3 weeks of your due date, you and your provider will talk about what to do. You may wait for a while to see if you go into labor on your own, or you may have your labor induced (started with medicine) soon. This decision will depend on how you and your baby are doing. You may be asked to come to your provider's office or the hospital to be checked. Your provider will collect a swab of fluid from inside of your vagina to test to see if your membranes are ruptured. Your provider will also see if it is safe for you to wait for labor to start on its own.

What will happen if it is more than 3 weeks until my due date and my membranes rupture?

If your bag of waters breaks more than 3 weeks before your due date, your health care provider may want you to stay in the hospital to stop labor so your baby is not born too early. You may also be given an antibiotic to help protect your baby against infection.

What should I do if my membranes rupture and I am not having my labor induced right away?

Labor contractions can start any time after your membranes rupture. Most women go into labor within 12 hours after the membranes rupture. About 1 in 10 women do not go into labor on their own after a day or so. Together, you and your provider will make a decision about how long you will wait if labor does not start.

While you are waiting for labor to start:

- Put on a clean pad
- Do not put anything in your vagina
- Drink plenty of liquids—a cup of water or juice each hour you are awake
- If you are tired, rest so you are ready for labor
- If you are not tired, take a walk or do something that you enjoy and will help you relax
- Take a shower or bath
- If there is any change in your baby's movements, call your health care provider right away
- Check your temperature with a thermometer every 4 hours—call your health care provider right away if your temperature goes above 99.6° F

For More Information

Mayo Clinic: Water Breaking

<http://www.mayoclinic.org/healthy-lifestyle/labor-and-delivery/in-depth/water-breaking/art-20044142?pg=1>

US National Library of Medicine: Premature Rupture of Membranes

<https://www.nlm.nih.gov/medlineplus/ency/patientinstructions/000512.htm>

Flesch-Kincaid Grade Level: 7.0

Approved August 2021. This handout replaces “Ruptured Membranes: When the Bag of Water Breaks” published in Volume 61, Number 4, July/August 2016.

This handout may be reproduced for noncommercial use by health care professionals to share with patients, but modifications to the handout are not permitted. The information and recommendations in this handout are not a substitute for health care. Consult your health care provider for information specific to you and your health.