75 Años

"Honramos el pasado, cuidamos el presente, formamos el futuro."

Investigación y Educación en Enfermería

Vol. 43 No. 3, September-December 2025 • ISSNp: 0120-5307 • ISSNe: 2216-0280

UNIVERSIDAD DE ANTIOQUIA

"Honramos el pasado, cuidamos el presente, formamos el futuro."

Investigación y Educación en
Enfermería

Vol. 43 No. 3, September-December 2025 • ISSNp: 0120-5307 • ISSNe: 2216-0280

Indexed by

MEDLINE/PUBMED
PubMed Central
Journal Citation Report - WoS
Scopus
SciELO Colombia
SciELO Citation Index - Web of Science
International Committee of Medical Journal Editors
PUBLINDEX
LATINDEX
REDALYC
AMELICA
CUIDEN
LILACS-BIREME
DIALNET
RedEDIT
EBSCO Fuente académica
DOAJ
ELSEVIER EMcare
ProQuest
Ulrich Global Series Directory
Google Scholar
DORA signatory

This issue had financial support from the Committee for the Development of Investigation – CODI- of Universidad de Antioquia

Publication date: October 15th 2025
Short title: Invest Educ Enferm.
ISSNp: 0120-5307, ISSNe: 2216-0280
Published by: Facultad de Enfermería de la Universidad de Antioquia, Colombia

Contents

Editorial

Siren Songs of an Effortless Academy: The Misuse of Artificial Intelligence

Carmen de la Cuesta Benjumea

Editorial

Fostering Thriving in Healthcare Organizations: An Opportunity to Strengthen the Nursing Professional Workforce

Tatiana Osorio Leyton, Tomás Inostroza Ortega, Marcela González Agüero, Camila Lucchini Raies, Lilian Ferrer, Cynthia J. Wensley, Stephen Jacobs

Original Article

Leadership by Nurse Managers and its Impact on Humanization. A Descriptive Analysis based on the Perception of Care Nurses

Alberto Cortés Borra, Pedro Jaén Ferrer, Vicente Gea-Caballero, Sandra Martín García, Gemma Martínez Estalella, José Ramón Martínez Riera

Original Article

Factors Associated with the Development of Skin Lesions in Hospitalized Patients Admitted to a Nursing Preventive Care Program in Colombia

Gaby E. Escobar, Ángela F. Espinosa, Olga L. Cortés, Nicolás Molano-González

Original Article

Usability of a website to promote treatment adherence for adults with HIV

Aiodelle dos Santos Machado, Marcelo Ribeiro Primeira, Raquel Einloft Kleinubing, Daniel Gonzalo Eslava Albarracin, Tassiane Ferreira Langendorf, Stela Maris de Mello Padoin, Cristiane Cardoso de Paula

Original Article

Evidence-Based Pathways to Healthy Aging: A Systematic Review and Meta-analysis of Lifestyle Interventions for Longevity and Well-Being

Sonopant Joshi, Mangesh Jabade, Husain Nadaf, Pratik Salve

Original Article

Health promotion for young Brazilian and Portuguese university students in terms of self-perception and self-image: Instagram profile

Lia Araruna De Lima, Henriqueta Ilda Verganista Martins Fernandes, Paulo César De Almeida, José Eurico De Vasconcelos Filho, Luísa Maria Da Costa Andrade, Karla Maria Carneiro Rolim, Ana Clécia Jácome Unias, Fernanda Jorge Magalhães

Contents

Original Article

Silent Harm: How Ambient Air Pollution Threatens Prenatal and Neonatal Health. A Systematic Review

Ranjana Chavan, Jasneet Kaur

Original Article

Effect of a mobile-based, family-centered self-care education program on Health Literacy and Self-Care in Patients with Heart Failure: A Randomized Controlled Trial

Zohreh Badiyepeymaiejahromi, Mahsa Khorramkish, Ali Asghar Rahmaniankushkaki

Original Article

Coping strategies used by migrant women during pregnancy. An integrative review

Ivett Adriana Herrera Zuleta, Angélica María Ospina Romero, Abraham Isaac Esquivel Rubio, Claudia Jennifer Domínguez Chavez

Original Article

Prenatal care with blind pregnant women: validation of an instrument for nurses on knowledge, attitude and practice

Francisco Jardsom Moura Luzia, Monaliza Ribeiro Mariano Grimaldi, Kariane Gomes Cezário Roscoche, Josemara Barbosa Carneiro, Antonia Ellen Jardani de Souza Medeiros, Liliana Andreia Neves da Mota, Cristina Maria Correia Barroso Pinto, Paula Marciana Pinheiro de Oliveira

Original Article

Effect of the fluid management nursing intervention on improving biochemical test results and dialysis therapy in chronic kidney disease patients: a randomized controlled trial

José Erivelton de Souza Maciel Ferreira, Daniel Freire de Sousa, Rafaella Pessoa Moreira, Huana Carolina Cândido Morais, Lívia Moreira Barros, Tahissa Frota Cavalcante

Original Article

Effectiveness of Nursing Interventions in Reducing Maternal Mortality in Resource-Limited Settings: A Systematic Review and Meta-Analysis

Jasneet Kaur, Sheela Upendra

Original Article

Ethics and Technology in Nursing Education: Rethinking Artificial Intelligence

Palmira Canales-Morales

Review

Challenges and implications of the use of artificial intelligence in health care, with an emphasis on nursing. Scoping review

Neelam Shah, Jyoti Bala, Ashutosh Sharma, Jitendra Singh Parmar, Dharmendra Singh

Contents

Editorial

Vital Legacy

Juan Guillermo Rojas

Essay

Curricular and Administrative Transformation of the Nursing Program at Universidad de Antioquia. 75 Years of History

Elvigia María Posada Vera, Hugo Alberto Múnera Gaviria

Essay

Graduate Training in the Faculty of Nursing at Universidad de Antioquia. A Contribution to Society's Needs for Care

Elvigia María Posada Vera

Siren Songs of an Effortless Academy: The Misuse of Artificial Intelligence

Editorial

Carmen de la Cuesta Benjumea[1]
https://orcid.org/0000-0003-2160-392X

1 RN, MSc, PhD. Honorary Collaborating Professor, Department of Health Psychology. Universidad de Alicante. Alicante, San Vicente del Raspeig, Spain. Instituto de Investigación Sanitaria y Biomédica de Alicante (ISABIAL), Alicante, Spain. Email: ccuesta@ua.es. Corresponding author.

How to cite this article: de la Cuesta-Benjumea C. Siren Song of an Effortless Academy: the Misuse of Artificial Intelligence. Investigación y Educación en Enfermería. 2025; 43(3):e01.

DOI: https://doi.org/10.17533/udea.iee.v43n3e01

Investigación y Educación en Enfermería

Vol. 43 No 3, September-December 2025
ISSNp: 0120-5307 • ISSNe: 2216-0280

The Odyssey tells that Ulysses, on his journey to Ithaca, upon sighting the island of the Sirens, requested to be tied to the ship's mast to avoid succumbing to the songs of the Sirens, songs that, if he heard them, would bring him a tragic destiny. The use some propose, and others make of generative artificial intelligence (generative AI) are Siren songs for researchers and anyone doing work at a given standard.

Blumer,[1] in his treatise on symbolic interactionism, indicates that it is the use we make of something that makes the difference and not the manufacturers' specifications or commercial promises. Generative AI is a new resource that some propose and promote for an effortless academy, and – herein – I want to stop without having to tie myself to the mast. I have gotten commercial messages offering me AI to analyze qualitative data, which talk about automatic coding, avatars to conduct interviews that can also speak different languages, quick and easy systematic reviews, and effortless document creation. In one of these messages, I am invited to imagine what it would be like to have interviewer avatars that adapt and learn in real time or automatically generate topics into long narratives. I did not dare imagine such.

Generative AI simulates knowing without understanding, displaying a façade of knowledge that fades when applied in practical or complex contexts. This is called Potemkin understanding.[2] The term stems from the stratagem used by Russian general Potemkin to amaze Empress Catherine the Great and foreign ambassadors during a visit to Crimea in the late 18th century. Fake structures or village decorations were set up. It is said that he even mobilized healthy -looking peasants and rented cattle to give an impression of progress and well-being in those rural areas. Thus, AI creates the illusion of comprehension. Be careful, the precision AI offers is not equivalent to understanding.

A journalist recently echoed the misuse of AI to draft texts.[3] Motivated by questions made by people close to her about scientific findings in the health field, she tracked the coverage of the most famous topics of recent months. She ended up reading "tons" of news elaborated by AI systems. These were characterized by a stilted style, excessive adjectives, and using bombastic terms, and hackneyed filler words. She pointed out that articles "written" by AI, in addition to endangering journalistic work, could be inaccurate and contain conceptual errors. That is, they were untrustworthy.

Artificial intelligence systems neither write, nor conceptualize, nor reason, or do not do so like humans. Thus, their misuse erodes the foundations of research, besides discrediting the author and breaking the trust of the medium where they are published. Due to foregoing, researchers, young and senior, must use Generative AI responsibly in research. A systematic review of 24 published articles has indicated that AI facilitates, supports, improves, and aid in processes such as the generation of ideas and the design of a study, the bibliography review, data management and their analysis, and the elaboration of the report. Warning: it does not say that IAs do these. The authors conclude that AI has potential and that the challenge lies in maintaining academic integrity and balancing its use with human interpretation.[4] Hence, we are not to tie ourselves to a mast to avoid using it; rather, we must educate ourselves to do so properly. In qualitative research, this training is especially relevant because it is a craft, creative work, in which one must be more faithful to the spirit than to the letter.

Artificial intelligence systems are predictive models based on existing data, so when used thoughtlessly in literature reviews, these end up parroting what is known about a topic.[5] It is well known that ChatGPT and other similar generative AI models can help improve the writing of a document once it has been written and not before. Asking an AI to create a report from scratch is effortless academy, a journey to nowhere. A tragic fate from which one must stay away.

Increasingly, qualitative analysis software includes Generative AI among its functions. And tests are under way to determine its contribution. For example, a comparative study between analysis produced by traditional means and that produced with AI indicates that a complementary relationship is necessary between AI use and researchers.[6] Among the biggest challenges, the authors found how to manage the inconsistencies and hallucinations produced by AI, which is why they pointed to the need to carry out verification processes to maintain the validity of qualitative analysis.

Regarding systematic reviews, I consider that today they help us find references, eliminate duplicates and perform mechanical tasks such as data entry and information management, but they do not evaluate or synthesize the findings of primary studies. A work about the use of avatars in human-AI interaction states that these have great potential to promote it.[7] Nevertheless, given that AI users are free to create them according to their preferences, they can generate discrimination and social prejudices, reinforcing stereotypes and inequalities. This study recognizes that the design of AI avatars is an area that has not been thoroughly studied, and it is noted that it remains to be seen whether user perception of human-like AI avatars is equivalent to that of real humans. Hence, to generate qualitative data, for now and leaving aside essential issues like theoretical sampling, its use does not seem advisable.

To end, AI is here to stay; its intelligent and ethical use depends on us all. It helps us to be more effective and efficient, but not to be researchers; we can only achieve this through a lot of study, effort, and perseverance. The rest are Siren songs.

References

1. Blumer H. Symbolic Interactionism. Englewood Cliffs, New Jersey: Prentice-Hall; 1969.10-12
2. Mancoridis M, Weeks B, Vafa K and Mullainathan. Potemkin Understanding in Large Language Models. ArXiv 2025, abs/2506. 21521. Doi: 10.48550/arXiv.2506.21521
3. García Molina P. Un verano de santos griales y noticias de ciencia hechas con chatGPT [Internet]. 2025 [Cited 13 Sept 2025]. Available from: https://www.eldiario.es/129_bf278c
4. Khalifa M, Albadawy M. Using artificial intelligence in academic writing and research: An essential productivity tool. Computer Methods and Programs in Biomedicine Update: 2024; 5:100145.
5. van Manen M. What Does ChatGPT Mean for Qualitative Health Research? Qualitative Health Research. 2023; 33(13):1135–9.
6. Perkins M, Roe J. The use of Generative AI in qualitative analysis: Inductive thematic analysis with ChatGPT. Journal of Applied Learning and Teaching. 2024; 7(1):390-5.
7. Liu Y, Siau KL. Human-AI interaction and AI avatars. In International Conference on Human-Computer Interaction. Cham: Springer Nature Switzerland, 2023. p. 120-130.

Editorial

Fostering Thriving in Healthcare Organizations: An Opportunity to Strengthen the Nursing Professional Workforce

Tatiana Osorio Leyton[1,8,9]
https://orcid.org/0000-0003-3980-595X

Tomás Inostroza Ortega[2,8]
https://orcid.org/0000-0002-3299-4359

Marcela González Agüero[3,8]
https://orcid.org/0000-0002-0738-4399

Camila Lucchini Raies[4,8]
https://orcid.org/0000-0001-5704-9778

Lilian Ferrer[5,8]
https://orcid.org/0000-0002-3607-6424

Cynthia J. Wensley[6,9]
https://orcid.org/0000-0002-6224-7514

Stephen Jacobs[7,9]
https://orcid.org/0000-0002-0919-7351

Conflicts of interest: None

How to cite this article: Osorio T, Inostroza-Ortega T, González-Agüero M, Lucchini-Raies C, Ferrer L, Wensley CJ, Jacobs S. Fostering Thriving in Healthcare Organizations: An Opportunity to Strengthen the Nursing Professional Workforce. Investigación y Educación en Enfermería. 2025; 43(3):e02.

DOI: https://doi.org/10.17533/udea.iee.v43n3e02

1 Nurse, MSc Nursing, PhD© Nursing. Adjunct Instructor. Email: tposorio@uc.cl

2 Nurse, MSc Nursing. Assistant Professor. Email: tainostroza@uc.cl. Corresponding author

3 Nurse. MPH. PhD Medical Anthropology. Associate Professor. Email: mmgonzal@uc.cl

4 Nurse-Midwife. PhD. Associate Professor. Email: clucchin@uc.cl

5 Nurse-Midwife. PhD. Senior Lecturer. Email: lferrerl@uc.cl

6 Nurse. PhD. Senior Lecturer. Email: c.wensley@auckland.ac.nz

7 Researcher. PhD. Senior Lecturer. Email: s.jacobs@auckland.ac.nz

8 Nursing School. Pontificia Universidad Católica de Chile. Santiago de Chile

9 Nursing School. The University of Auckland. Auckland, New Zealand

Investigación y Educación en Enfermería

Vol. 43 No 3, September-December 2025
ISSNp: 0120-5307 • ISSNe: 2216-0280

Introduction

Nursing professionals represent the largest segment of the global healthcare workforce, playing a vital role in patient care, clinical management, and the ongoing support of healthcare systems.[1] Nevertheless, despite this relevance, it is estimated that by 2030 the global deficit of nurses will reach 4.5 million,[2] which represents a critical challenge for the capacity of healthcare systems to respond in a timely, safe, and equitable manner to the needs of populations. In this regard, the need to promote strategies that strengthen human resources in nursing has been widely recognized.[3] Notwithstanding, many of these strategies have focused primarily on mitigating the effects of unfavorable work and organizational environments on the nursing workforce. These include burnout, psychological stress, moral distress, and work-life imbalance.[4] While addressing these issues is necessary, this has proven insufficient to reverse the progressive deterioration of the working conditions of nursing staff. Insisting on this approach represents the risk of continuing to only address the symptoms without transforming the structural causes.

Given this scenario, this editorial holds that a paradigm shift is essential that conceives organizations as living and dynamic ecosystems, capable of intentionally managing their work contexts to promote sustainable wellbeing over time. Such requires an organizational culture that assumes that the responsibility for wellbeing is shared between each individual and the institution. Only thus will it be possible to move from reactive responses to preventive strategies and the genuine fostering of well-being, creating environments where nurses not only remain, but can thrive. "Thriving at work" alludes to the capacity of individuals to grow, develop, and feel energized, in contrast to perceptions of stagnation or exhaustion.[5] The experience of thriving has been related positively with greater job satisfaction, better performance and commitment at work, better subjective perception of health, respectful organizational behaviors, as well as with lower levels of exhaustion, burnout, and intention to rotate or leave the profession.[6] Moreover, the benefits of thriving are not only restricted to the individual plane; professionals who thrive tend to get involved actively in improving their organizations, contributing ideas, promoting collaboration, and exercising proactive leadership.[6]

Most studies about thriving at work come from Anglo-Saxon contexts, which limits their universal applicability. Hence, addressing this issue in various contexts is key to ensuring that nursing professionals not only remain in their positions but also find spaces to grow and actively contribute to strengthening healthcare systems.

Socially embedded model of thriving at work

The "Socially Embedded Model of Thriving at Work" proposed by Dr. Gretchen Spreitzer *et al*.,[7] defines "thriving at work" as a psychological state in which individuals experience both a sense of vitality (having energy) and a sense of learning (acquisition of knowledge) at work.[7] This model provides a comprehensive understanding of how individuals interact with their organizational environment, and how this interaction can foster (or hinder) their development and wellbeing. According to the socially embedded model of thriving in the workplace, the act of thriving is the result of a dynamic and bidirectional interaction between the employee's personal characteristics and the attributes of the organizational context.[7,8] That is, it is not sufficient for people to have motivation or individual capabilities; they must also have an environment that favors the deployment of these potentialities. Due to this, the model highlights the responsibility of organizations to provide work environments that support their workforce, ensuring access to key resources, like, for example, growth and recognition opportunities.[9] When the work environment offers adequate conditions, such as autonomy in work, a climate of trust, and meaningful relationships between colleagues and managers, people not only manage healthy adaptation to their environment, but also generate new personal resources, strengthen their performance, and consolidate a sense of continuous progress.[7,8] Individuals are not expected to thrive in isolation, making this model inherently social in nature. That implies that thriving cannot be experienced without the influence of interactions with the work environment, its characteristics, colleagues, and managers.[7]

Nursing and thriving at work

Although the model of thriving in the workplace originated over 20 years ago and has gained growing interest in healthcare organizations, the study of thriving among nursing professionals is still in its early stages. Nonetheless, it has been demonstrated that the model is adequate for application in the nursing staff, especially to serve as a framework for managers to encourage their teams to thrive.[10] From the model's perspective, the work environment must meet certain contextual conditions that favor the capacity of nursing professionals to thrive. These conditions are determined by the resources available in the organization and by the quality of relationships with managers and colleagues.[11] The literature suggests that social support, effective supervision, and the necessary resources to perform the role safely and competently are key elements to promote thriving in the workplace.[12] Particularly, work environments focused on caring for people and promoting psychological empowerment are associated positively with a greater experience of thriving among the nursing staff.[13]

Furthermore, nursing professionals are individuals with specific personalities and psychological resources. Research has identified that their psychological capital (advantageous characteristics, like optimism, resilience, and self-efficacy) is favorably associated with their thriving.[14] Thereby, it is key for nursing professionals to have the necessary support to develop and maintain these individual characteristics, given that such will allow them to be more aware of their role within the organization and of their relationships with peers, favoring bonds characterized by mutual attention (or according to the model, developing "heedful relating").[14] Likewise, said professionals would tend to adopt behaviors liketask focus and exploration of their own role, which will increase the probability of learning and experiencing high levels of energy and vitality.[8,15] It has been proposed that, when the interaction between individual and contextual characteristics is favorable, it is possible to build work environments where people not only thrive, but maintain that experience in a sustained manner over time. This continuity in thriving not only benefits those who experience it, but also has a positive impact on healthcare organizations

because it is associated with greater satisfaction with the care provided, reduction of stress symptoms,[16] and better job performance by the nursing staff.[17]

Challenges for thriving in nursing in Latin America: urgency of a paradigm shift

The nursing situation in Latin America evidences persistent structural challenges that seriously hinder conditions for thriving in the workplace. In the region, studies on the nursing workforce are still limited, but the available data allows measuring a critical reality that requires urgent attention. Currently, Latin America has approximately 5.6 million nursing professionals.[18] However, a study in the region of the Americas in 2017 reported a marked heterogeneity in the density of nursing staff, with countries that exceed eight nurses per thousand inhabitants and others that do not reach one.[19] Beyond the number of professionals, issues have been identified, such as a lack of team cohesion and stressors linked to ineffective leadership and organizational climate,[20] high burnout levels,[21] and high rates of work-related fatigue at the regional level due to multiple jobs, lack of sleep, work overload, sustained physical effort, and experiences of suffering arising from the daily clinical practice.[22]

The lack of organizational policies that promote thriving environments seems to be a regional constant, and in the face of this panorama, the need for a paradigm shift becomes evident. It is no longer enough to demand individual resilience or implement fragmented and reactive actions. It is indispensable for healthcare organizations to be recognized as dynamic ecosystems that can be actively configured to foster the thriving of their workers. This implies not only having structural resources but also designing organizational cultures that promote continuous learning, a sense of purpose, and sustained wellbeing. Within this context, the social model of thriving in the workplace offers a powerful tool to rethink the working conditions of the nursing staff in Latin America. Its application will allow guiding organizational strategies towards more humane, adaptive, and healthy work environments, where professionals can not only survive, but thrive.

In response to this challenge, the School of Nursing at Pontificia Universidad Católica in Chile is actively promoting this research agenda in conjunction with an international network, through its participation in the Nurses Thriving at Work Research Collaborative.[4] This collaboration seeks to work with healthcare professionals to strengthen nursing workforce management practices and generate knowledge that fosters healthier and more enriching work environments, where nurses not only remain in their jobs but also have the support they need to thrive.

In Chile, two research projects are currently being undertaken aimed at strengthening the thriving of nursing professionals in their work environments. The first corresponds to a longitudinal action research study with early-career nurses and nursing leaders. This study is led by the School of Nursing at The University of Auckland, New Zealand. During this year, the first phase has been implemented, under the coordination of the School of Nursing at Pontificia Universidad Católica in Chile, centered on the cultural adaptation of the instruments to measure thriving at work of nursing professionals. The second phase, to be carried out next year, contemplates the participation of nurses in early stages of their career who will be invited to express the aspects they consider most relevant in their work environments and in the development of their careers. Likewise, meetings will be held among them and nursing leaders to co-design more relevant and effective support systems. The second project underway is aimed at generating recommendations that foster work environments that facilitate thriving through career growth opportunities for nurses in the country. This project is led by a professor from Pontificia Universidad Católica in Chile, who is currently pursuing doctoral studies at The

University of Auckland. Both initiatives seek to generate contextualized evidence for the Latin American region and promote the implementation of structural changes in healthcare organizations. Moving forward in this direction constitutes a strategic commitment to strengthen the quality, sustainability, and response capacity of healthcare systems in the region.

In conclusion, the need to enrich work environments in healthcare is urgent. Hence, it is time to move towards organizational strategies that promote career growth, recognition, and well-being of nursing professionals. In this sense, the "Socially Embedded Model of Thriving at Work" represents a promising path to transform work environments in a sustainable and contextualized manner. Exploring how to translate this model into concrete, culturally sensitive, and feasible interventions in resource-limited contexts represents the next big challenge for nursing research and management in the region.

References

1. World Health Organization. State of the world's nursing 2025: Investing in education, jobs, leadership and service delivery [Internet]. 2025. Available from: https://iris.who.int/.
2. Boniol M, Kunjumen T, Nair TS, Siyam A, Campbell J, Diallo K. The global health workforce stock and distribution in 2020 and 2030: A threat to equity and "universal" health coverage? BMJ Global Health. 2022; 7(6):1-8.
3. Stewart D, Moore G. Caring for nurses strengthens economies. Williamson L, editor. Geneva, Switzerland; 2025.
4. Jacobs S, Moloney W, Terry D, Lewis PA, Topping A, González-Agüero M, et al. Creating Organizational Working Conditions Where Nurses Can Thrive: An International Action Research Study. Nursing Reports. 2025; 15(3):95.
5. Spreitzer G, Porath C, Gibson C. Toward human sustainability. How to enable more thriving at work. Organizational Dynamics. 2012; 41(2):155–62.
6. Kleine AK, Rudolph CW, Zacher H. Thriving at work: A meta-analysis. Journal of Organizational Behavior. 2019; 40(9–10):973–99.
7. Spreitzer G, Sutcliffe K, Dutton J, Sonenshein S, Grant AM. A socially embedded model of thriving at work. Organization Science. 2005; 16(5):537–49.
8. Spreitzer G, Porath C. Creating Sustainable Performance. Harvard Business Review [Internet]. 2012 [cited 2025 Mar 20]; Available from: https://hbr.org/2012/01/creating-sustainable-performance
9. Goh Z, Eva N, Kiazad K, Jack GA, De Cieri H, Spreitzer GM. An integrative multilevel review of thriving at work: Assessing progress and promise. Journal of Organizational Behavior. 2022; 43(2):197–213.
10. Frangieh J, Hughes V, Mewborn E. Nurse leaders thriving: A conceptual model and strategies for application. Nursing Management. 2023; 54(10):18–26.
11. Paterson T, Luthans F, Jeung W. Thriving at work: Impact of psychological capital and supervisor support. Journal of Organizational Behavior. 2014; 35(3):434–46.
12. Moloney W, Fieldes J, Jacobs S. An integrative review of how healthcare organizations can support hospital nurses to thrive at work. International Journal of Environmental Research and Public Health. 2020; 17(23):1–21.
13. Silén M, Skytt B, Engström M. Relationships between structural and psychological empowerment, mediated by person-centred processes and thriving for nursing home staff. Geriatric Nursing. 2019; 40(1):67–71.
14. Zhu X, Kunaviktikul W, Sirakamon S, Abhicharttibutra K, Turale S. A causal model of thriving at work in Chinese nurses. International Nursing Review. 2021; 68(4):444–52.
15. Spreitzer G, Bit Hwang E. How thriving at work matters for creating psychologically healthy workplaces: current perspectives and implications for the new world of work. 2019. P:293–310.

16. Engström M, Björkman A, Silén M, Wahlberg AC, Skytt B. Thriving at work as a mediator between nurses' structural empowerment and job performance, work-personal life benefits, stress symptoms and turnover intentions: a cross-sectional study. BMC Nursing. 2025; 24(1):175.
17. Shen ZM, Wang YY, Cai YM, Li AQ, Zhang YX, Chen HJ, et al. Thriving at work as a mediator of the relationship between psychological resilience and the work performance of clinical nurses. BMC Nursing. 2024 Dec 1;23(194):1-10.
18. Organización Panamericana de la Salud. La enfermería en la Región de las Américas 2025. 2025 [cited 2025 May 14]; Available from: https://iris.paho.org/handle/10665.2/66684
19. Cassiani S, Hoyos MC, Barreto M, Sives K, da Silva FA. Distribución de la fuerza de trabajo en enfermería en la Región de las Américas. Revista Panamericana de Salud Pública. 2018; 42:e72.
20. Lucero J, Lucero M, Erazo M, Noroña G. Estrés laboral y autopercepción de la salud en médicos y enfermeras del área de emergencia en Riobamba, Ecuador. Revista Cubana de Reumatología. 2020; 23(1):e225.
21. Simonetti M, Aqueveque AMV, Galiano MA. Environment, workload, and nurse burnout in public hospitals in Chile. Revista da Escola de Enfermagem. 2021; 55:e20200521.
22. Quiñones D, Vodniza A, Matabanchoy S, Matabanchoy J. Fatiga laboral en contextos hospitalarios en Latinoamérica: revisión sistemática. Revista Colombiana de Salud Ocupacional. 2022; 12(2):1–15.

Original Article

Check for updates

UNIVERSIDAD DE ANTIOQUIA
1803

Leadership by Nurse Managers and its Impact on Humanization: a Descriptive Analysis based on the Perception of Care Nurses

Alberto Cortés Borra[1,7,8]
https://orcid.org/0000-0002-4809-8364

Pedro Jaén Ferrer[2,8]
https://orcid.org/0009-0002-2752-1853

Vicente Gea-Caballero[3]
https://orcid.org/0000-0001-8607-3195

Sandra Martín García[4]
https://orcid.org/0009-0000-8305-8176

Gemma Martínez Estalella[5]
https://orcid.org/0000-0002-5742-8919

José Ramón Martínez Riera[6,7]
https://orcid.org/0000-0002-4926-6622

Conflicts of interest: None

Received: 17 July 2024.

Approved: 13 September 2025.

How to cite this article: Cortés-Borra A, Jaén-Ferrer P, Gea-Caballero V, Martín-García S, Martínez-Estalella M, Martínez-Riera JR. Leadership by Nurse Managers and its Impact on Humanization: a Descriptive Analysis based on the Perception of Care Nurses. Investigación y Educación en Enfermería. 2025; 43(3):e03.

DOI: https://doi.org/10.17533/udea.iee.v43n3e03

1 Nurse, Ph.D candidate. Universidad de Alicante, Spain. Email: alcortesborra@gmail.com. Corresponding author

2 Nurse, M.Sc. Coach personal, La Manga del Mar Menor, Spain. Email: pjaenf@gmail.com

3 Nurse, Ph.D. Faculty of Health Sciences, Research Group SALCOM in Community Health and Care, Valencian International University, Valencia, Spain. Email: vagea@universidadviu.com

4 Ph.D. Professor at ESIC University. Spain. Email: sandra@people4.es

5 Nurse, M.Sc. Adjunct Professor at Direcció d'Estratègia i Planificació per a l'Àmbit Assistencial. Associate Professor, at Universitat de Barcelona, Spain. Email: GEMMA@clinic.cat

6 Nurse, M.Sc, Ph.D Honorable Professor at Departamento Enfermería Comunitaria, Medicina Preventiva y Salud Pública; Universidad de Alicante, Spain. Email: josera.ferranna@gmail.com

7 Asociación de Enfermería Comunitaria, Grupo de Humanización, Spain.

8 HUGES – Humanization of management, Spain.

Leadership by Nurse Managers and its Impact on Humanization: a Descriptive Analysis based on the Perception of Care Nurses

Abstract

Objective. The objective was to analyze the relationship among sociodemographic factors, management variables, and the perception of care humanization by nursing staff. **Methods.** A descriptive and observational study was conducted with a sample of 659 nurses working in Spain. A descriptive analysis of the sociodemographic and management variables was performed. Subsequently, a Latent Class Analysis (LCA) was applied to classify participants according to their scores on the HUMAS scale, which measures their perception of their own humanization and that of their manager. Finally, multinomial and logistic regression models were proposed to identify the determinant factors for belonging to these classes and for the opinion on the center of the healthcare system. **Results.** The sample was composed mostly of women (78.9%) with professional experience and job stability averaging 24.17±10.49 years (Min=1, Max=45). Notable dissatisfaction (58.3%) and distrust (57.9% between little and none) towards managers were detected. The LCA identified four nurse profiles based on their perception of humanization: a class with a high valuation of their own humanization and management (Class 2: c2), one with a low valuation in both (Class 3: c3), one with a high personal valuation but low towards management (Class 4: c4), and an intermediate class (Class 1: c1). The most valued traits in a manager were respect, communication, and transparency. **Conclusion.** A significant gap exists between nurses' self-perception of humanization, which is generally high, and their perception of their managers, which is predominantly low. This dissonance, combined with dissatisfaction with leadership, underscores the need to develop management styles that promote communication, respect, and transparency to improve the work environment and the quality of patient care.

Descriptors: nursing; humanization of assistance; leadership; health management; latent class analysis; primary care nursing.

El liderazgo de las enfermeras gestoras y su impacto en la humanización: un análisis descriptivo a partir de la percepción de las enfermeras asistenciales

Resumen

Objetivo. Analizar la relación entre factores sociodemográficos, variables de gestión y la percepción de la humanización del cuidado por parte del personal de enfermería. **Métodos.** Se realizó un estudio descriptivo y observacional con una muestra de 659 enfermeras que trabajan en España. Se llevó a cabo un análisis descriptivo de las variables sociodemográficas y de gestión. Posteriormente, se aplicó un Análisis de Clases Latentes (LCA) para clasificar a las participantes según sus puntuaciones en la escala HUMAS, que mide la percepción de la humanización propia y la de su gestor. Finalmente, se propusieron modelos de regresión multinomial y logística para identificar los factores determinantes de la pertenencia a dichas clases y de la opinión sobre el centro del sistema sanitario. **Resultados.** La muestra estuvo compuesta mayoritariamente por mujeres (78.9 %) con una experiencia profesional

y estabilidad laboral con un promedio 24.17±10.49 DE años (Mín = 1, Max = 45). Se detectó una notable insatisfacción (58.3 %) y desconfianza (57.9 % entre poca y ninguna) hacia los gestores. El LCA identificó cuatro perfiles de enfermeras según su percepción de la humanización: una clase con alta valoración de la humanización propia y de la gestión (Clase 2: c2), una con baja valoración en ambas (Clase 3: c3), una con alta valoración personal pero baja hacia la gestión (Clase 4: c4) y una clase intermedia (Clase 1: c1). Los rasgos más valorados en un gestor fueron el respeto, la comunicación y la transparencia. **Conclusión.** Existe una brecha significativa entre la autopercepción de humanización de las enfermeras, generalmente alta, y la percepción que tienen de sus gestores, que es predominantemente baja. Esta disonancia, unida a la insatisfacción con el liderazgo, subraya la necesidad de desarrollar estilos de gestión que promuevan la comunicación, el respeto y la transparencia para mejorar tanto el entorno laboral como la calidad de la atención al paciente.

Descriptores: enfermería; liderazgo; humanización de la atención; gestión en salud; análisis de clases latentes; enfermería de atención primaria.

A liderança do enfermeiro gestor e seu impacto na humanização: uma análise descritiva a partir da percepção de enfermeiros assistenciais

Resumo

Objetivo: analisar a relação entre fatores sociodemográficos, variáveis de gestão e a percepção da equipe de enfermagem sobre a humanização do cuidado. **Metodologia:** Foi realizado um estudo descritivo e observacional com uma amostra de 659 enfermeiros da Espanha. Foi realizada uma análise descritiva das variáveis sociodemográficas e de gestão. Subsequentemente, foi aplicada uma Análise de Classes Latentes (ACL) para classificar os participantes de acordo com suas pontuações na escala HUMAS, que mede sua percepção de sua própria humanização e a de seu gestor. Finalmente, foram propostos modelos de regressão multinomial e logística para identificar os fatores determinantes para a adesão a essas classes e para as opiniões sobre o centro do sistema de saúde. **Resultados:** A amostra consistiu principalmente de mulheres (78.9%) com ampla experiência profissional e estabilidade no emprego. Foi detectada uma insatisfação significativa (58.3%) e desconfiança (57.9% entre pouco e nenhum) em relação aos managers. A LCA identificou quatro perfis de enfermeiros com base em sua percepção de humanização: uma classe com high valorização da própria humanização e a do gerente (Classe 2: c2), uma com baixa valorização em ambas (Classe 3: c3), uma com high valorização pessoal, mas baixa em relação à gestão (Classe 4: c4), e uma classe intermediária (classe 1: c1). As características mais valorizadas em um gerente eram respeito, comunicação e transparência. **Conclusão:** Existe uma lacuna significativa entre a auto-percepção dos enfermeiros sobre a humanização, que é geralmente high, e a percepção deles sobre seus managers, que é predominantemente baixa. Essa dissonância, juntamente com a insatisfação com a liderança, destaca a necessidade de desenvolver estilos de gestão que promovam a comunicação, o respeito e a transparência para melhorar tanto o ambiente de trabalho quanto a qualidade do atendimento ao paciente.

Descritores: enfermagem; liderança; humanização do cuidado; gestão em saúde; análise de classes latentes; enfermagem de atenção primária.

Introduction

Modern healthcare is always in the search for the balance among effectiveness, technological efficiency, and the need to preserve and enhance the human dimension of care. In this important equilibrium, humanization is not configured as a mere desirable attribute, rather, it must be a fundamental pillar of the care quality, especially evident for the nursing profession, given that it is at the forefront of direct and continuous contact with patients, families and community, with nurses having the unique ability to shape the care experience. Nevertheless, the development of truly humanized care by nurses is not an individual act; it is intrinsically conditioned by organizational structures, prevailing leadership styles, and management dynamics that articulate health systems.[1]

The concept of humanization in health transcends the mere application of techniques and procedures; it implies recovering the essence of care, which places individuals as a whole (with their physical, emotional, social and spiritual dimensions) at the center of attention, beyond their pathologies or other conditionings.[2] Despite it all, this process cannot be separated from the wellbeing and professional development of those who provide it. The concept of "professional-centrism", far from being an antonym of "patient-centrism", emerges as a paradigm shift to ensure sustainable, high-quality patient care.[3] A work environment that is not humanized for the professional runs the risk of indirectly dehumanizing the care provided to patients.[4] This interdependence generates a core ethical dilemma in healthcare management: How can the patient's undisputed priority be harmonized with the imperative need to care for those who care?

Due to this, leadership and nursing management acquire a fundamental relevance as leaders of a humane care environment,[5-7] the work environment, staff motivation, levels of professional satisfaction and – lastly – the perceived quality of care.[8,9] Leadership that genuinely promotes empathy, effective communication, mutual respect, and transparency may not only significantly enhance the degree of humanization in care, but can also mitigate the adverse effects of a system under pressure from demands. On the contrary, more authoritarian, depersonalized, or productivity-focused management approaches could wear down team morale and seriously compromise the ability to provide humane care.[10]

Leadership styles based on emotional intelligence, made popular by Daniel Goleman, [11-12] provide an exceptionally pertinent conceptual framework to understand how leaders can be catalysts for the humanization of care. Goleman identifies styles, such as affiliative, democratic, and coaching, which promote empathy, collaboration, and personal development – characteristics of leadership that actively seeks to promote humanization.[3-12] Applying these

styles improves the leader-team relationship and is transmitted to the professional-patient relationship.[13]

This article analyzes the perception of humanization, leadership, and management by a sample of nursing professionals in Spain, exploring how sociodemographic and occupational factors, as well as the characteristics and styles of their managers, relate to the perceived level of humanization. The study used the HUMAS scale, a validated instrument[14] that permits a structured measurement of humanization in nursing care, both from the professionals' self-perceptions and from their managers' perceptions.[8] Furthermore, the work examines the complex vision of nurses on the equilibrium between patients and professionals as the core of the health system. Finally, direct connections will be established between the empirical findings and Goleman's leadership styles,[11,12] to propose specific recommendations for effective, humane, and ethically sound nursing management. The aim of this study was to explore the perceptions of humanization, leadership, and management from the perspectives of nursing professionals in Spain and analyze how sociodemographic and occupational factors, as well as the characteristics and styles of their managers, relate to the perceived level of humanization.

Methods

This study adopted a descriptive and observational design and was conducted between October and November 2024.

Population and Sample. The study sample was made up of 659 nurses, who worked in various autonomous communities in Spain. The sample selection was non-probabilistic for convenience. Data were collected via the distribution of a structured questionnaire hosted on a server in Universidad de Alicante, guaranteeing at all times participant anonymity and obtaining their explicit informed consent. A preliminary analysis of the data set in SPSS format did not reveal the presence of significant missing values or outliers that could distort the results, which ensures the robustness and quality of the information.

Data collection instrument. The questionnaire used to gather the data was structured in four interconnected sections to obtain comprehensive and multifactorial information: (i) Sociodemographic and professional data. This section collected essential information about the characteristics of the participants, including their gender, age range, years of professional experience, autonomous community of residence, level of education reached (distinguishing among Undergraduate, Specialist, Master's, and PhD), the type of workplace in which they practiced (primary care, hospital, social health, etc.), and the nature of their work contract (permanent, temporary, etc.). Likewise, a specific question was included about the nurses' prior or current experience in management positions; (ii) Opinions about management: This section focused on the direct manager's perception by each participant. The questions addressed if the manager was considered a leader by the team, their specific denomination within the hierarchical structure (supervisor, coordinator, nursing director, service chief, etc.), the management model perceived in their performance (democratic, conciliatory, authoritarian, etc.), the level of trust that the manager generated in the team, and the degree of general satisfaction with their performance.[10] Additionally, open-ended questions were included to allow nurses to identify the three qualities they valued most in a manager, thus providing qualitative wealth to the data; (iii) Perception of humanization: This section explored the nurses' knowledge and familiarity with the concept of humanization, at personal practice level and in the management context. A central, dichotomous question inquired about nurses' perspectives on who should be at the center of the health system (patients and family versus health professionals), which allowed exploring the degree of perceived

"professional-centrism";[3] (iv) HUMAS scale: The principal instrument to measure humanization was the humanization scale derived from the HUMAS Model.[14] This scale, validated for the nursing context,[8] evaluates humanization through five key dimensions: Affectation (capacity to establish emotional bonds), Self-efficacy (perception of capacity to humanize care), Emotional understanding (ability to understand and manage one's own and others' emotions), Optimism (positive and resilient attitude), and Sociability (ability to interact and establish relationships). Each of these dimensions was evaluated from two perspectives: the nurse's self-perception (HUMAS Personal) and the nurse's perception about their manager (HUMAS Management). This generated ten dimensional scores, plus two aggregate total scores. The scale responses were categorized into three levels: Low, Medium, and High, to facilitate interpretation and analysis.

Statistical Analysis. The data analysis was carried out using the free, open-access r statistical software and the RStudio integrated development environment. Packages from the Tidyverse environment were used for data manipulation and visualization, as well as specific libraries for advanced analysis (Corplot for correlations, Modelsummary to generate model result tables, and poLCA for Latent Class Analysis). The following were performed: (i) Descriptive Analysis. Absolute and relative frequencies (percentages) were calculated for all categorical variables. For continuous variables, means and standard deviations were calculated; (ii) Analysis of the HUMAS Scale. The distributions of the scores of the five dimensions of the HUMAS scale were described, both for the nurses' self-perception and for their perception of managers, presenting the percentages of responses in the Low, Medium and High categories; (iii) Latent Class Analysis (LCA). An LCA[10] was applied on the ten dimensions of the HUMAS scale (5 personal and 5 from management) to identify and categorize subgroups of nurses with similar response patterns. Models with a variable number of classes (from 1 to 4, following the logic of empirical evidence) were evaluated. Selection of the optimal four-class model was based on minimizing the information criteria (aBIC, BIC, cAIC) and obtaining an entropy value > 0.85, which guarantees the classification's good predictive capacity. Moreover, the theoretical plausibility and clinical interpretability of the resulting classes were prioritized; (iv) Regression Models. a) Multinomial Regression. A multinomial regression model was used to determine what sociodemographic and occupational factors influence on the probability of belonging to each of the four latent classes identified by the LCA.[15] Odds Ratios (OR) were interpreted for each predictor, indicating the strength and direction of the association; and b) Binary Logistic Regression. A binary logistic regression model was applied to explore To explore the determinants of nurses' opinions on whether "the professional should be at the center of the system".[6] The results were interpreted through the OR and their confidence intervals, identifying risk factors (OR > 1) or protective factors (OR < 1) associated to this perception. The level of statistical significance for all analyses was set at $p < 0.05$.

Ethical considerations. There are no conflicts of interest with any institution or company. The anonymity of the responses was maintained through a participant code, and participants accepted informed consent on the same form. This study was approved by the Ethics Committee at Universidad de Alicante, file UA-2024-01-19_3.

Results

Sociodemographic and occupational characteristics of the sample. The study sample was composed by 659 nurses, predominantly women (78.9%), which is a reflection of the gender composition in the nursing profession in Spain. The age distribution obtained an average of 48.26±10.40 SD years (Min=21, Max=67) and showed a concentration in the groups from 46 to 55 years (36.6%) and 56 to 67 years

(27.6%), indicating a population of nurses with consolidated experience. Similarly, years of professional experience were also evaluated, with over 62% of the participants accumulating between 11 and 30 years of trajectory, and 29.0% with over 30 years, mean of 24.17±10.49 SD years (Min=1, Max=45). Regarding the work environment, almost half the sample (49.2%) worked in primary care, followed by the hospital environment (38.7%). The educational level of the nurses was high, with 34.0% holding a master's degree and 9.6% a doctorate. Work stability was notable, with 77.2% of the participants with permanent contract. With respect to management experience, 24.0% of the nurses held a management position at the time of the study and 37.0% had held one in the past (Table 1).

Table 1. Overall characteristics of the participating nurses

Characteristics	*n* (%)	% Accumulated
Nurse's sex		
Woman	520 (78.9)	78.9
Man	139 (21.1)	100.0
Age in years		
21-35	93 (14.1)	14.1
36-45	143 (21.7)	35.8
46-55	241 (36.6)	72.4
56-67	182 (27.6)	100.0
Years of experience		
1-10	89 (13.5)	13.5
11-20	149 (22.6)	36.1
21-30	230 (34.9)	71.0
>30	191 (29.0)	100.0
Type of center		
Primary	324 (49.2)	49.2
Hospital	255 (38.7)	87.9
Research	27 (4.1)	92.0
Administration	9 (1.4)	93.3
Other	44 (6.7)	100.0
Training level		
Diplomate	137 (20.8)	20.8
Graduate	90 (13.7)	34.4
Specialist	145 (22.0)	56.4
Master's	224 (34.0)	90.4
PhD	63 (9.6)	100.0
Type of contract		
Permanent	509 (77.2)	77.2
Interim	113 (17.1)	94.4
Temporary	37 (5.6)	100.0
Management position (current)		
No	501 (76.0)	76.0
Yes	158 (24.0)	100.0
Management position (previous)		
No	415 (63.0)	63.0
Yes	244 (37.0)	100.0

Perception of Managers by Nurses. Nurses' perceptions about their direct managers evidenced aspects to keep in mind: The gender of the perceived managers was mostly female (79.2%). Less than half the nurses (47.2%) considered that their manager was a leader, which suggests a significant gap between the formal role and the perception of inspiring or effective leadership. The most-common denominations of the managers were supervisor (25.8%), coordinator (24.4%), and director/chief (23.4%). With respect to the management model, the democratic was the most perceived (29.6%), followed by conciliatory (25.3%). Nevertheless, a considerable 22.5% of the nurses perceived an authoritarian management model. An alarming fact was the trust in the manager: 57.9% of the nurses expressed "little" (40.1%) or "no" (17.8%) trust, which indicates a serious erosion of credibility and the bond with the leadership. Overall satisfaction with the manager was very low, with 58.3% of the nurses declaring that they were dissatisfied (37.2%) or very dissatisfied (21.1%) (Table 2).

Table 2. Perception of Managers by the Nurses

Characteristics	*n* (%)	% Accumulated
Manager's sex		
Woman	522 (79.2)	79.2
Man	137 (20.8)	100.0
Is your manager a leader?		
No	348 (52.8)	52.8
Yes	311 (47.2)	100.0
Denomination of the manager		
Coordinator	161 (24.4)	24.4
Supervisor	170 (25.8)	50.2
Assistant	139 (21.1)	71.3
Subdirector	35 (5.3)	76.6
Director/Chief	154 (23.4)	100.0
Manager's management model		
Authoritarian	148 (22.5)	22.5
Conciliatory	167 (25.3)	47.8
Liberal	60 (9.1)	56.9
Democratic	195 (29.6)	86.5
Carefree	34 (5.2)	91.7
Trust in the manager		
Total	38 (5.8)	5.8
A lot	120 (18.2)	24.0
Indifferent	120 (18.2)	42.2
Little	264 (40.1)	82.2
None	117 (17.8)	100.0
What is a manager?		
Boss	163 (24.7)	24.7
Coworker	66 (10.0)	34.7
Both	430 (65.3)	100.0
Satisfaction with the manager		
Very satisfied	43 (6.5)	6.5
Satisfied	126 (19.1)	25.6
Indifferent	106 (16.1)	41.7
Dissatisfied	245 (37.2)	78.9
Very dissatisfied	139 (21.1)	100.0

Most-valued qualities in a manager. When asked about the most valued qualities in a manager, the nurses prioritized the following values: Respect: this was the most outstanding quality in the first and second position (24.3% and 32.2%, respectively). Communication: it maintained high relevance in the three positions (21.2% in the first, 27.5% in the second, 27.5% in the third). Transparency: it was one of the top three (20% in first, 17.9% in second, 17.6% in third). These results emphasize the need for leadership that fosters interpersonal relationships, ethics, and clarity in management, above mere authority or technical competence. Perception of Humanization: Awareness of humanization and its importance is almost a constant among nurses: 95.9% of the nurses had heard of the concept of humanization, and 78.3% specifically about humanization in management. The majority (98.5%) considered humanization in their daily work as important (21.4%) or very important (77.1%). A similar situation was observed with respect to humanization in management (96.8% important or very important). In the dichotomy over who should be at the center of the healthcare system, 60.7% of the nurses considered that it should be the "patients and their families". Nonetheless, simultaneously, 59.2% of the nurses stated that "the professional must be the center of the system", which indicates a complex perspective where the professional's wellbeing is seen as fundamental for patient care.

Results of the HUMAS scale. The scores from the HUMAS scale revealed a marked difference between the self-perception of humanization by nurses and their perception of humanization of their managers:

Self-evaluation by the nurses (HUMAS Personal): The scores were predominantly medium and high in all the dimensions. This suggests that the nurses perceive themselves as professionals with a high degree of humanistic skills, with particular strengths in Emotional understanding and Optimism.

Evaluation of managers (HUMAS Management): In contrast, the scores in the perception of the managers showed a clear prevalence of low levels in almost every dimension (especially in Self-efficacy, Emotional understanding, Optimism, and in the HUMAS Management total score). High scores in the manager's humanization were minority. This disparity is a central finding, indicating that nurses do not perceive that their managers embody the same humanization levels they attribute to themselves (Table 3).

Table 3. Scores in the five dimensions of the HUMAS scale related to the nurse and the manager

Skills	Classification	Nurses' %	Managers' %
Affectation	Low	41.27	45.68
	Medium	49.47	43.10
	High	9.26	11.23
Self-efficacy	Low	28.22	65.10
	Medium	16.24	11.99
	High	55.54	22.91
Emotional understanding	Low	28.98	42.79
	Medium	15.48	8.19
	High	55.54	49.01

Table 3. Scores in the five dimensions of the HUMAS scale related to the nurse and the manager (Cont.)

Skills	Classification	Nurses' %	Managers' %
Optimism	Low	28.38	46.43
	Medium	36.12	27.47
	High	35.51	26.10
Sociability	Low	40.82	37.63
	Medium	51.44	45.83
	High	7.74	16.54
HUMAS Total	Low	28.53	51.29
	Medium	37.03	24.89
	High	34.45	23.82

Latent Class Analysis (LCA) of the HUMAS scale. The LCA on the ten dimensions of the HUMAS scale (five personal and five about the manager) identified an optimal four-latent class model, with relatively balanced sample sizes, indicating good classification and group distinction capabilities: **Class 1:** ***Median Humanization Rating*** (***n*** = 167). It corresponds to an intermediate profile, where nurses assign an average value to humanization in all dimensions, both personal and management, without marked extremes; **Class 2:** ***High Integrated Humanization Value (n*** = 183***)***. This group was characterized by high scores in almost all the dimensions of the HUMAS scale, both in the personal perception and the management perception. It represents a profile of nurses who not only feel humanized in their own practice, but also perceive a high degree of humanization in the leadership and management of their environment; **Class 3:** ***Low generalized humanization value (n*** = 153***)***. This groups nurses with consistently low scores across all dimensions of the HUMAS scale, both in the personal and management levels. This profile could indicate greater disillusionment, demotivation, or a lack of identification with the humanization principles in their practice and environment; and: **Class 4:** ***High personal value, Low Perception in management (n*** = 156***)***. This is a group of particular interest and relevance. Nurses belonging to this class showed high scores in their personal dimensions of humanization, but – significantly – low scores in the humanization perceived in management. This suggests a disconnection or frustration between their individual commitment with humanization and the reality of a leadership they do not perceive as humanized.

Results of the regression models

Multinomial regression. Determinants of membership in HUMAS classes. The multinomial regression, taking Class 1 ("Average rating") as reference category, revealed the following determinants for membership in the other classes **(i) Belonging to Class 2** ***High integrated humanization value***. Nurses with more years of experience ($p < 0.05$) and those working in primary care ($p < 0.05$) showed greater probability of belonging to this class. This suggests that the primary care environment, which often permits a closer and longitudinal relationship with the patient, as well as professional maturity, may promote a more positive and integrated perception of humanization at all levels; **(ii) Belonging to Class 3** ***Low generalized humanization value.*** It was noted that nurses with temporary contracts ($p < 0.01$) and those who perceived their manager with an authoritarian leadership model ($p < 0.001$) had significantly more probabilities

of falling into this class.[10] This underlines how job insecurity and dehumanized leadership are risk factors for a lower overall evaluation of humanization;[4] **(iii) Belonging to Class 4** ***High personal value, low perception in management.*** Nurses with higher education levels (Master's or PhD) (p <0.05) and, crucially, those who manifested high dissatisfaction with their manager (p <0.001) had a considerably higher probability of belonging to this class.

Table 4. Fit indices in successive LCA models

Model / Indicator	Class 1	Class 2	Class 3	Class 4
aBIC	12884.54	12884.54	11724.9	11545.09
BIC	12948.04	12136.87	11921.75	11808.62
cAIC	12968.04	12177.87	11983.75	11891.62
Entropy	NA	0.84	0.83	0.85
Likelihood-ratio	4637.51	3690.03	3338.61	3089.18

Binary logistic regression: determinants that "the professional must be the center of the system". The binary logistic regression model, exploring the factors associated to the perception that "the professional must be the center of the system", revealed that: nurses with more years of professional experience (p <0.05) had greater probability of holding this opinion. Experience seems to consolidate awareness of the interdependence between professional well-being and quality of care. Those who perceived a democratic (p <0.01) or conciliatory (p <0.05) management model by their manager had a higher probability of considering the professional as center. This could indicate that a management environment that values and respects professionals reinforces the conviction that their wellbeing is central. On the contrary, nurses who manifested "a lot of confidence" in their manager (p <0.05) had a lower probability of believing that the professional must be the center of the system, possibly because they already feel sufficiently appreciated and cared by their leadership, perceiving that the balance already exists (Table 5).

Table 5. Probabilities of each response category as a function of class membership

Dimension / Category	Class 1			Class 2		
	Low	Medium	High	Low	Medium	High
Sociability_M	0.18	0.62	0.2	0.67	0.28	0.05
Optimism_M	0.22	0.72	0.06	0	0.17	0.83
Emotional understanding_M	0.04	0.18	0.78	0.04	0.02	0.94
Self-efficacy M	0.62	0.21	0.17	0.16	0.18	0.86
Affectation_M	0.36	0.62	0	0.11	0.56	0.33
Sociability_N	0.22	0.73	0.05	0.77	0.22	0.01
Optimism_N	0.46	0.46	0.09	0.15	0.33	0,52
Emotional understanding_N	0.43	0.19	0.38	0.15	0.15	0.70
Self-efficacy N	0.42	0.22	0.36	0.17	0.11	0.72
Affectation_N	0.50	0.49	0.01	0.23	0.60	0.17
	Class 3			Class 4		
Sociability_M	0.30	0.49	0.22	0.32	0.48	0.21
Optimism_M	0.93	0.05	0.02	0.78	0.16	0.06
Emotional understanding_M	0.96	0.03	0.01	0.75	0.10	0.15
Self-efficacy M	0.96	0.03	0.01	0.95	0.04	0.01
Affectation_M	0.75	0.22	0.03	0.64	0.30	0.06
Sociability_N	0.14	0.67	0.19	0.46	0.47	0.07
Optimism_N	0.53	0.40	0.07	0	0.26	0.74
Emotional understanding_N	0.53	0.19	0.29	0.06	0.09	0.85
Self-efficacy N	0.53	0.24	0.22	0	0.09	0.91
Affectation_N	0.68	0.32	0.01	0.27	0.55	0.17

M = managers; N = nurses

Discussion

The results obtained provide a real and – in some aspects – critical image about the state of humanization, leadership, and management in the Spanish nursing environment. High awareness and appreciation of humanization by nurses contrasts strongly with their perception of management, revealing an expectation and practice gap that demands urgent attention and profound reflection by healthcare institutions.

The humanization gap. The most evident discrepancy in this study lies in the important difference between the positive self-perception of nurses regarding their own humanization (reflected in the high HUMAS Personal scores) and the negative perception of humanization evaluated by their managers (evidenced by the low HUMAS Management scores).[8] This gap is not merely statistical; it is an indicator of a palpable disconnect that can have significant connotations: from generating dissatisfaction and lack of trust in the chain of command, to hindering the effective implementation of humanization policies in patient care. From an ethical and practical perspective, If frontline professionals feel they are not treated with humanization by their own leaders, their motivation, resilience and – lastly – their capacity to extend that humanization to patients will be

lessened. This situation poses an ethical dilemma: How can we demand high-quality, humanized care if the work environment itself is not perceived as humanized by those who work there?

Nursing leadership and Goleman's styles. The most valued qualities of a manager: respect, effective communication, and transparency, are not random choices; these are attributes aligned with leadership styles based on emotional intelligence proposed by Daniel Goleman.[11,12] The affiliative leader, who focuses on building emotional bonds and promoting harmony; the democratic leader, who values participation and consensus; and the coaching leader, who is dedicated to individual development and empowerment, are the styles most congruent with the demands of a nursing team that yearns for a humanized environment.[13] The fact that the democratic model is the most perceived among managers is a positive starting point, but the persistent dissatisfaction and lack of trust suggest that this "democracy" could be superficial or lack the emotional depth, authenticity and transparency that genuine humanization requires. In turn, the existence of a considerable percentage of managers perceived as authoritarian, together with overall low trust and high dissatisfaction, indicates the persistence of coercive styles or, failing that, poorly applied helmsman leadership.[10] These styles, which Goleman identifies as less effective in the long term to generate a positive and sustainable work environment,[4] can be corrosive. An authoritarian leader who does not manage to inspire genuine respect, or a helmsman who only imposes a frenetic pace without offering the necessary support or development, intrinsically dehumanizes the work environment. This not only affects the team's morale, but – through contagion – can contaminate the quality of the care chain, directly impacting the patient's experience.[8] Emotional intelligence is more than a soft skill; it should be required as an essential competency for 21st-century nursing managers.[5] Leaders' ability to understand and manage their own emotions, to empathize and respond to the emotions of their teams, to communicate effectively, and build strong relationships based on trust is directly proportional to a healthcare organization's ability to offer truly humanized care.[6,7]

Professional-centrism and ethics. The apparent dichotomy in the perception of who should be at the center of the health system (patients/relatives *versus* professionals) should not be interpreted as a contradiction, but as a more mature, holistic, and ethically informed vision of care.[3] While the primacy of patients as the final recipients of care and their well-being are inalienable and ethically fundamental principles, the study reveals growing awareness among nurses that high-quality and genuinely humanized care is not viable if those who provide it are not prioritized and cared for.[3] From an ethical perspective, healthcare organizations assume a double and unavoidable responsibility: to patients, ensuring the highest quality, safety, and humane care; and to their professionals, guaranteeing a work environment that is healthy, safe, respectful, and conducive to professional and personal development. Neglecting the professional's physical and psychological well-being not only leads to burnout, demotivation, and rotation of the staff, but, more seriously, translates into a gradual dehumanization of the care provided.[4] Professional-centrism, in this sense, is not a manifestation of corporate selfishness, but an ethical and reasoned strategy to make sure the professionals can operate at the peak of their abilities, which ultimately translates directly into a tangible benefit for patients. Nurse managers have the fundamental ethical responsibility to advocate for the comprehensive well-being of their teams, recognizing that this constitutes an indispensable pillar for humanizing care in its entirety.[16]

Implications of latent classes for nursing management: differentiated strategies. The Latent Class Analysis (LCA)[10] not only confirms heterogeneity in humanization perceptions, but provides a valuable tool for management by identifying differentiated profiles of nurses. Class 4 ("High personal value, low perception in

management") is of particular strategic relevance. This group, comprised of nurses who demonstrate high personal commitment with humanization principles but which, simultaneously, perceive marked deficiency in humanization by their managers, represents an essential human resource but vulnerable to frustration, disillusionment, and moral exhaustion. For these nurses, interventions by managers must be precise and on several fronts: transparency in decision-making must be improved, two-way communication that is empathetic and active must be encouraged, and their participation in identifying and improving humanization processes must be empowered. Leadership that genuinely listens to this group, appreciates its expertise and critical perspective could transform radically the perception by management, channeling their frustration into a driving force for change.

Class 3 ("Low generalized humanization value"), which exhibits lower perception of humanization at personal and management levels, requires more fundamental training programs. These programs should be focused on intensive training and awareness-raising on the importance and specific practices of humanization, both in patient interaction and in team dynamics. Addressing the underlying causes of their demotivation or their lower identification with humanization is crucial to reintegrate them positively into the care culture. Training in humanization, although recognized as important for most nurses, still presents room for improvement, especially within the specific context of management. It is imperative to integrate emotional intelligence and Goleman's leadership principles[11,12] explicitly in development and training programs for nursing managers. These programs must transcend the mere theoretical transmission, focusing on developing practical skills of empathy, non-violent communication, constructive conflict resolution, effective feedback, and building cohesive and resilient teams.[6,7]

This study underlines the conviction of Spanish nurses on the fundamental importance of humane care. However, it reveals a critical and persistent gap between their personal commitment with humanization and the perception that nursing management does not always reflect or promote adequately these principles. This discrepancy not only generates dissatisfaction and mistrust in the chain of command, but also has the potential of compromising the quality and authenticity of the humanized care provided to patients. The solution to this challenge resides in the strategic adoption of leadership models that explicitly prioritize emotional intelligence, in full accordance with the leadership styles proposed by Daniel Goleman.[11,12] It is imperative for nursing managers to cultivate respect, effective communication, and transparency as fundamental pillars to build an environment of trust, mutual support, and commitment.[6,7] Affiliative, democratic, and coaching leadership is essential to empower professionals, foster their ongoing development, and ensure their overall well-being.[13]

Likewise, this study validates and reinforces the importance of "professional-centrism" not as a contradiction to "patient-centrism", but as an ethical and reasoned condition essential for the sustainability and quality of care.[3] Caring for those who care is not merely a moral responsibility, but an essential strategy to guarantee that nurses can work under the best conditions, which translates into the highest quality and humanization of care for patients.[3] The differences identified through LCA[4] offer a roadmap to formulate differentiated and personalized intervention strategies. It is of paramount importance to invest significantly on training and developing nursing managers, equipping them with skills in humanized leadership and emotional intelligence,[6,7] with the aim of closing the existing perception gap and creating a healthcare environment where humanization is not just a theoretical ideal, but an integral and measurable practice in every interaction, from the management sphere to direct patient care. Only thus will it be possible to build a healthcare

system that is not only limited to curing diseases, but that, in a profound way, cares for, respects, and dignifies all its actors.

Study limitations. The cross-sectional nature of the data prevents establishing definitive causal relationships among the variables analyzed; it merely allows identifying associations. The perception of managers is based exclusively on the subjectivity of nurses' opinions, which could introduce perception bias and not reflect the self-perception by managers or objective evaluations. Future lines of research could enhance these findings by incorporating longitudinal studies to trace changes over time, including the managers' perspectives, and using qualitative methodologies (such as in-depth interviews or focus groups) to explore in greater detail the experiences, perceptions, and underlying mechanisms of humanization and leadership in nursing.

Author and responsible for the article. This article is part of a PhD thesis in Health Sciences from Universidad de Alicante by Albert Cortés Borra.

Acknowledgements. Gratitude is expressed to all the nurses who participated in gathering data, and especially to Dr. Josep María Manresa, from IDIAP-Gol, and Dr. Jesús Carretero from Universidad de Huelva, for their support in the statistical analysis of the data obtained; Gratitude is also expressed to Spain's General Nursing Council for its support and encouragement.

References

1. Ayuso Murillo D, Grande Sellera RF. La gestión de enfermería y los servicios generales en las organizaciones sanitarias. Díaz de Santos; 2000.
2. Dreher M, MacNaughton N. Cultural competence in nursing: Foundation or fallacy? Nursing Outlook. 2002; 5 0(5):181–6.
3. Jaén Ferrer P, Cortés Borra A. Profesionalcentrismo: el nuevo paradigma de la gestión humanizada. Revista Iberoamericana de Enfermería Comunitaria. 2023; 16(1) 71-2.
4. García-Iglesias JJ, Gómez-Salgado J, Martín-Pereira J, Fagundo-Rivera J, Ayuso-Murillo D, Martínez-Riera JR, et al. Impacto del SARS-CoV-2 (Covid-19) en la salud mental de los profesionales sanitarios: una revisión sistemática. Revista Española de Salud Pública. 2020; 94:e202007088.
5. García L. La necesidad del liderazgo en enfermería: el papel clave de las supervisoras y la necesidad de formación. Universidad de Cantabria; 2022.
6. González García A, Marqués-Sánchez P, Pinto Carral A, Sanz Villorejo J, Pérez González S. Modelo de competencias para la gestora nurse. Metas de Enfermería. 2020; 22(10):5-13.
7. González-García A, Pinto-Carral A, Pérez-González S, Marqués-Sánchez P. Nurse managers' competencies: A scoping review. Journal of Nursing Management. 2021; 29:1410–9.
8. De Lima Trindade L, Coelho Amestoy S, Adyles Muniz L, Biolchi T, Pires de Pires DE, Schubert Backes VM. Influencia de los estilos de liderazgo del enfermero en las relaciones interpersonales del equipo de enfermería. Enfermería Global. [Internet]. 2011 [cited 2025 Sep 13]; 10(22). Available from: http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1695-61412011000200014&lng=es
9. Bracamonte L M, González-Argote J. Estilo de liderazgo en jefes de servicios de enfermería y su relación en la satisfacción laboral. Revista Científica Arbitrada de la Fundación Mente Clara. 2022; 7:1-19.
10. Martín Octavio, María Ángeles; Toro Flores, Rafael. Análisis del modelo de liderazgo en el Hospital Universitario de Guadalajara. Conocer para trasformar. Tesela, Liderazgo y Gestión. 2019; (26): e12650.
11. Goleman D. Leadership that gets results. Harvard Business Review Press. 2000; 78(2):78-90.

12. Goleman D, Boyatzis R, McKee A. El líder resonante crea más: el poder de la inteligencia emocional. Debolsillo; 2017.
13. Johns C. Clinical supervision as a model for clinical leadership. Journal of Nursing Management. 2003; 11(1):25–35.
14. Pérez Fuentes MC, Molero Jurado MM, Herrera Peco I, Oropesa Ruiz NF, Gázquez Linares JJ. Propuesta de un Modelo de Humanización basado en las Competencias Personales: Modelo HUMAS. European Journal of Health Research. 2019; 5(1):63-74.
15. Collins LM, Lanza ST. Latent Class and Latent Transition Analysis: With Applications in the Social, Behavioral, and Health Sciences. John Wiley & Sons; 2010.
16. Gupta H, Verma SK. We Need a Visionary Leadership to Improve Public Healthcare. Journal of Family Medicine Primary Care. 2022; 11(8):4904–5.

Factors Associated with the Development of Skin Lesions in Hospitalized Patients Admitted to a Nursing Preventive Care Program in Colombia

Original Article

Check for updates

UNIVERSIDAD DE ANTIOQUIA
1803

Gaby E. Escobar[1,6]
https://orcid.org/0000-0001-9710-0398

Ángela F. Espinosa[2,5,6,7]
https://orcid.org/0000-0003-0042-2935

Olga L. Cortés[3,5]
https://orcid.org/0000-0002-9023-7479

Nicolás Molano-González[4,6,8]
https://orcid.org/0000-0001-5458-8346

1 Nurse, MSc. Researcher. Email: geescobarn@unal.edu.co. Principal researcher

2 Nurse. MSc. PhD. Researcher and Professor. Email: angela.espinosa@urosario.edu.co. Corresponding author

3 Nurse, MSc. PhD Associate Researcher Email: ocortes@lacardio.org

4 Statistician, MSc. Researcher and Professor. Email: Nicolas.molano@urosario.edu.co

5 Fundación Cardioinfantil - Instituto de Cardiología, La Cardio. Bogotá DC, Colombia

6 Universidad del Rosario, Bogotá DC, Colombia

7 Group of Research on Public Health. School of Medicine and Health Sciences

8 Clinical Research Group. School of Medicine and Health Sciences

Conflicts of interest: None

Received: March 24, 2025.

Approved: August 20, 2025

How to cite this article: Escobar GE, Espinosa AF, Cortés OL, Molano N. Factors Associated with the Development of Skin Lesions in Hospitalized Patients Admitted to a Nursing Preventive Care Program in Colombia. Invest. Educ. Enferm. 2025; 43(3):e04.

DOI: https://doi.org/10.17533/udea.iee.v43n3e04

Factors Associated with the Development of Skin Lesions in Hospitalized Patients Admitted to a Nursing Preventive Care Program in Colombia

Abstract

Objective. This work sought to determine the factors associated with the development of skin lesions among patients hospitalized and admitted to a preventive skin care program carried out by nursing. **Methods.** Analytical observational study of cases and controls, which included a sample of 150 cases and 300 controls hospitalized in a clinic with tier IV level of complexity in Bogotá (Colombia). A classification and regression tree was developed to explore the complex interactions that define cases and controls. **Results.** According to the decision tree, the factors that represent greater probability for the development of skin lesions in the study population were the preventive use of hydrocolloid dressings, hospital stay > 12 days, BMI > 23, incontinence, diagnosis upon admission related with cardiovascular problems and peripheral vascular disease, cancer, surgery, or respiratory failure. **Conclusion.** Development of skin lesions was related with the interaction of different clinical conditions presented by the patients. Integration of this knowledge is essential for structuring preventive care programs in high-complexity hospitals and in formulating individualized care plans.

Keywords: risk factors, preventive health services, pressure ulcer, dermatitis, nursing care

Factores asociados con el desarrollo de lesiones de piel en pacientes que participan en un programa de cuidado preventivo de enfermería

Resumen

Objetivo. Determinar los factores asociados con el desarrollo de lesiones cutáneas entre pacientes hospitalizados y admitidos en un programa de cuidado preventivo de la piel llevado a cabo por enfermería. **Métodos.** Estudio observacional analítico de casos y controles. Se incluyó una muestra 150 casos y 300 controles hospitalizados en una clínica de cuarto nivel de complejidad de Bogotá (Colombia). Se construyó un árbol de clasificación y regresión para explorar interacciones complejas que definen casos y controles. **Resultados.** De acuerdo con el árbol de decisiones, los

factores que representan una mayor probabilidad para el desarrollo de lesiones en piel en la población del estudio fueron el uso de apósitos hidrocoloides de manera preventiva, la estancia hospitalaria superior a 12 días, IMC >23, incontinencia, diagnóstico de admisión relacionado con problemas cardiovasculares y enfermedad vascular periférica, cáncer, cirugía o falla respiratoria. **Conclusión.** El desarrollo de lesiones cutáneas se relacionó con la interacción de diferentes condiciones clínicas presentadas por los pacientes. La integración de este conocimiento es esencial en la estructuración de programas de cuidado preventivo en hospitales de alto nivel y en la formulación de planes de cuidado individualizado.

Descriptores: factores de riesgo, servicios preventivos de salud, úlcera por presión, dermatitis, cuidado de enfermería

Fatores Associados ao Desenvolvimento de Lesões Cutâneas em Pacientes Participantes de um Programa de Cuidados Preventivos de Enfermagem

Resumo

Objetivo. Determinar os fatores associados ao desenvolvimento de lesões cutâneas em pacientes hospitalizados em um programa de cuidados preventivos de enfermagem com a pele. **Métodos.** Trata-se de um estudo observacional, analítico, do tipo caso-controle. Foi incluída uma amostra de 150 casos e 300 controles hospitalizados em uma clínica de nível superior em Bogotá (Colômbia). Uma árvore de classificação e regressão foi construída para explorar interações complexas que definem casos e controles. **Resultados.** De acordo com a árvore de decisão, os fatores que representaram maior probabilidade para o desenvolvimento de lesões cutâneas na população estudada foram o uso de curativos hidrocoloides para prevenção, internação hospitalar superior a 12 dias, IMC superior a 23, incontinência, diagnóstico de admissão relacionado a problemas cardiovasculares e doença vascular periférica, câncer, cirurgia ou insuficiência respiratória. **Conclusão.** O desenvolvimento de lesões cutâneas esteve ligado à interação de diferentes condições clínicas apresentadas pelos pacientes. A integração desse conhecimento é essencial na estruturação de programas de cuidados preventivos em hospitais de alto nível e na formulação de planos de cuidados individualizados.

Descritores: fatores de risco, serviços de saúde preventivos, úlcera por pressão, dermatite, cuidados de enfermagem

Introduction

Among the skin lesions related with healthcare and occurring during the hospitalization of adult patients, there are skin disorders, such as incontinence-associated dermatitis (IAD), pressure injuries (PI), and medical adhesive related skin injuries (MARSI), among others.[1] These lesions are considered a public health problem, given that they entail serious problems, threats and risks that include health complications, increased treatment, prolonged hospital stay, and repercussions on the quality of life of patients and caregivers.[2] In addition, they generate economic repercussions and increase the work burden in healthcare teams, increasing costs for healthcare systems due to the need for special nursing care to heal these injuries, use of special pharmaceutical products, or need for surgery.[3] Although most of these lesions are preventable, the evidence reported in some studies shows high prevalence,[2–7] similar to that observed in the study institution where these three types of lesions (PI, IAD, and MARSI) were the most prevalent.

The European Pressure Ulcer Advisory Panel (EPUAP), the National Pressure Injury Advisory Panel (NPIAP), and the Pan-Pacific Pressure Injury Alliance for Pressure Lesions (PPPIA)[1] define a PI as "a localized injury to the skin and/or underlying tissue, usually over a bony prominence, as a result of pressure, or pressure in combination with shearing forces". Further, IADs are a type of skin lesion defined as "an inflammation and/or erosion of the skin associated with exposure to urine or feces";[8] and, finally, the medical adhesive related skin injuries (MARSI) defined in 2013 by McNichol *et al*.,[9] as the onset of an "erythema and/or other manifestation of skin abnormality (which includes, among others, vesicles, blisters, erosion, or tearing), which persists during 30 minutes or more after removing the adhesive".

Regarding PI, in the United States, 3% hospital prevalence is reported and 11% in intensive care units (ICUs).[2] In Spain, data from the sixth national study on prevalence conducted by the National Group for the Study and Advisory of Pressure Ulcers and Chronic Injuries (GNEAUPP, for the term in Spanish) indicate increased prevalence with relation to the previous study due to the increase of patients with these types of lesions during the pandemic, prevalence in social-health residences and centers was 9.28%.[3] In Colombia, observational studies high level of complexity hospitals reported 14% prevalence in internal medicine, emergency and ICU services in Bogotá,[4] and 6% in Bucaramanga.[5] In turn, IADs have a 4.3% prevalence in the United States and Canada, developing in 22% of patients with fecal incontinence, a key risk factor.[6] In Norway, in 2018, IAD prevalence was reported around 16.5%.[7] Lastly, MARSIs are the least studied lesions, with limitations in the evidence reported. An observational study in a hospital in the United States, conducted in medical-surgical ICUs and a cardiovascular telemetry

unit, reported a daily prevalence between 3.4% and 25% (mean 13%) and a severity prevalence between 8 to 149 per 1000 product-days.[10]

Among the risk factors contributing to skin lesions acquired during hospitalization are advanced age, immobility, use of certain medications and the need for life support, among others, which compromises significantly the adult patient's condition. These factors are compounded by the presence of comorbidities and the loss of functional capacity, which tend to be associated with more prolonged hospital stays.[2] Likewise, patients in ICUs and in certain hospitalization areas tend to have a critical health status, with hemodynamic disorders and special pharmacological requirements. This situation, added to greater overall frailty, presence of pain, and limitation in mobility capacity increases significantly the risk of developing these types of lesions.[4]

To this series of factors we can add the fact that the preventive care strategies used in healthcare institutions, obtained from Clinical Practice Guides, have low and/or very low evidence levels, which increases uncertainty about the impact of certain interventions not proven effective (benefit or harm), which could turn them into an additional factor of possible risk or damage to the skin.[5] Preventing these lesions would lead to improving the quality indicators of healthcare institutions and the quality of life of patients, families, and caregivers.[6] This prevention requires a multidisciplinary approach that provides care comprehensively. Within this approach, nursing is responsible for identifying risk factors, through the use of risk assessment scales, and scales on leadership in implementing prevention strategies.[7]

The National Group for the Study and Advisory of Pressure Ulcers and Chronic Injuries recommends products for the care of healthy or fragile skin, such as hyper-oxygenated fatty acids, which favor cell regeneration, stimulate collagen formation, improve microcirculation, and protect against friction, although their effectiveness lacks sufficient scientific support.[10] Zinc oxide creams and various dressings are also used, although these can make it difficult to see the skin, interfere with the adhesion of other products, and require specific agents for removal.[11] Finally, moisturizers and emollients help retain water, protecting and hydrating the skin, making them effective in preventing lesions due to humidity and in extremely dry or damaged skins.[11]

Assessment of hospital quality has promoted the creation of strategies to prevent skin lesions during hospitalization. This study was carried out in a healthcare institution that has a preventive skin program, implemented by a cross-functional team, based on the implementation of evidence-based guides from the Registered Nurses Association of Ontario, focused on prevention, promotion, and safe treatment of patients' skin to avoid adverse events. The program includes support surfaces, fatty acids, protective foam, position changes, and a clock in each room to program and notify of position changes. The program's principal objective is to deepen, update, and disseminate to the institution's nursing, medical, and paramedical staff the concepts required to guarantee the implementation of preventive actions that allow early identification of skin lesions, avoid their development, and promote the establishment of timely and adequate preventive treatment, thus, contributing to improving the quality of life and recovery of the health status of patients.

Despite these strategies, the prevalence of skin lesions in the institution is still high, and not all the factors associated with their appearance in hospitalized patients are known with certainty. Due to this, an analytical, observational study was proposed to identify them. The three lesions with the highest clinical prevalence (PI, IAD, and MARSI) were evaluated, according to the level of complexity and dependence of patients treated by this institution, recognized as a national reference center.

The aim of this study was to identify factors linked with the development of pressure injuries, dermatitis associated with incontinence and medical adhesive related skin injuries, in hospitalized patients admitted to a nursing preventive care program.

Methods

Design. Analytical observational study of cases and controls, carried out in a clinic with high complexity level of care in the city of Bogotá, Colombia.

Participants. The study used the clinical charts of patients admitted to the skin lesion preventive care program between January 2018 and December 2020. The inclusion criteria were patients aged ≥ 18 years, who received evaluation through consultation by the institutional nursing skin injury prevention group, and who were prescribed preventive care by this sane group.

Sample size. Epi Info software version 7.2 of 2018 was used, employing a ratio of two controls per case, a confidence level of 95%, and a power of 90%. Based on the literature, being 70 years of age or older was considered a risk factor for pressure injuries, with the percentage of people > 70 years of age without this type of injury being 17% vs. 30.5% of people over this age with this type of injury (OR of 2.14).[10] Thus, a minimum sample size was obtained of 147 cases and 293 controls, which was approximated to 150 and 300, respectively. The study included patients > 18 years of age who had been hospitalized in medical services, and in ICU and who had been evaluated and followed up by the Injury Prevention and Skin Care Group, considering as cases those patients who developed a PI, IAD, and MARSI type skin lesion acquired during hospitalization, and as controls those who did not develop a PI, IAD, and MARSI type skin lesion acquired during hospitalization. Random selection had been planned for both controls and cases. Once the database was reviewed, it was identified that of the 1,459 patients in the preventive program there were 150 cases, so it was decided to include all of them. With the controls, the selection was made randomly via the Excel program.

Variables. (1) Independent variables (i) demographic factors (age and sex); (ii) clinical factors (body mass index); (iii) history of comorbidities of cardiovascular, renal, and neurological origin, among others; (iv) diagnosis upon admission; (v) score according to the Braden scale at the first assessment of the skin care group; (vi) treatments administered during hospitalization (vasoactive medications, mechanical ventilation, antibiotics, sedatives, dialysis); (vii) presence of incontinence; (viii) skin lesion prevention treatments prescribed by this same group (use of lubricants, dressings, or fatty acids); (ix) length of hospital stay; (x) hospitalization service; (xi) type of nutrition and type of incontinence. **(2) Dependent variables:** Presence of any skin lesion (IAD, MARSI, and PI analyzed together). These lesions were diagnosed by the skin care and prevention group from the study institution. In addition, information was gathered about the characteristics of the lesions found.

Procedures. The revision and initial selection of patients was conducted from a database that included 2,225 patients evaluated in prevention consultation by the nursing group specialized in skin care, between January 2018 and December 2020. This database only included general information of the patients.

As a first step, the data were refined by eliminating patients < 18 years of age, reducing the total to 1,720 records. Subsequently, the types of skin lesions targeted by the study (PI, IAD, and MARSI) were identified, excluding 40 patients with other types of lesions, leaving 1,680 cases. Then, duplicate records corresponding to the same hospitalization period were eliminated,

which excluded 221 patients and resulted in a final total of 1,459.

From this final group, 150 patients were identified with one of the three types of skin lesions studied, who were defined as the cases. For the controls, 300 patients were selected via random sampling from the same database, discounting the cases.

Thereafter, the information in the database with respect to the study variables was complemented through the review of clinical records in the institution's documentation system. Personal data, such as names and identity documents, were anonymized, assigning each patient a unique numerical code. All study information was compiled in a protected Excel file, designed to allow systematic and organized data collection.

Ethical considerations. The study was approved by the Research Ethics Committee (CEIC) IRB00007736 [ID 11-2021].

Data analysis. The different types of skin lesions (PI, IAD, and MARSI) were analyzed together. In the univariate analysis, qualitative variables are reported with absolute and relative frequencies, while quantitative variables are reported with medians and interquartile ranges. For the description of the cases and controls, the same measures mentioned are reported along with their corresponding measure of effect (mean difference or Odds Ratio) accompanied by their 95% confidence interval and their p-*value*, according to the Chi squared or Mann Whitney U tests. For polytomous variables, The reference categories were chosen because they corresponded to the lowest risk or, when they could not be classified as lower or higher risk, the category with the lowest prevalence. To better understand the characteristics associated with the cases and controls, a classification and regression tree was constructed,[11] which was used to find automatically complex interactions among covariables of clinical interest. As outcome of this analysis, groups or profiles of patients were identified that share clinical characteristics with differential distribution of skin lesions. The variables included in the decision tree were sociodemographic variables, clinical variables, and treatment variables, which made up 29 variables. All statistical analyses were performed in R software version 4.3.2.

Validity, reliability, and rigor. The initial database was carried out by nursing professionals trained in prevention of skin lesions and with basic knowledge of Excel. This database only included general information of the patients. During the data collection (2019-2020), The database was filled out by the principal researcher with the information recorded in the patient's medical history. The principal researcher, along with a coresearcher, controlled and validated the data recorded in the database, verifying the completeness of the information and identifying inconsistent data that required clarification with a new review of the medical history. Thereafter, the veracity of the information recorded in the database was randomly compared with that recorded in the medical history.

Results

The study population was comprised by 450 patients, of which 150 were cases and 300 were controls, where it was found that the minimum age was 18 years and the maximum was 107 years, with a median of 67. The median in the group of cases was lower with respect to the controls 66 and 68, respectively (Table 1); 58% ($n = 259$) of the population were men, with higher percentage in the cases than in the controls. Skin lesion prevalence in the preventive program was 10.21% (150/1469).

Statistically significant differences were observed in the population study in variables of weight, hospital stay and number of follow-ups, finding higher medians in each of the variables for the group of cases (Table 1).

Table 1. Quantitative characteristics of the study population

Variables	Total (*N* = 450) Me [Mín-Max]	Cases (*n* = 150; 33.3%) Me [Mín-Max]	Controls (*n* = 300; 66.7%) Me [Mín-Max]	*p*-value
Age (years)	67 [18- 107]	66 [19- 107]	68 [18- 100]	0.32
Weight ***(Kg)***	65 [23- 130]	68 [32- 130]	63.7 [23-130]	0.04
Height ***(m)***	1.63 [1.39-1.86]	1.65 [1.40- 1.85]	1.61 [1.39- 1.86]	0.15
Body mass index	24.03 [10.96-47.17]	24.68 [13.49- 44]	23.87 [10.96- 47.17]	0.15
Days of hospital stay	19 [1- 270]	28 [2- 270]	14.50 [1-140]	≤0.001
Number of follow ups	1 [1-14]	2 [1- 8]	1 [1-14]	≤0.001

The bivariate analysis identified significant differences for developing skin lesions between cases and controls in the variables of history of hypertension and peripheral vascular disease; being admitted to any hospitalization service (not ICU), having a high-risk assessment for pressure injuries, according to Braden's scale; being exposed to management with mechanical ventilation, treatment with sedatives, antibiotics, vasoactive substances, and with prescription of parenteral nutrition. Likewise, these patients had greater incontinence and received preventive care with hydrocolloid dressings and with fatty acids.

Neurological disorder, as diagnosis upon admission, was identified with greater prevalence in the control group (Table 2).

Table 2. Qualitative characteristics of the study population

Variables	Cases (*n* = 150) *n* (%)	Controls (*n* = 300) *n* (%)	p-value	OR (95% CI OR)
Sex				
Male	100 (66.67)	159 (53.00)	<0.001	1.77 (1.18-2.68)
Female	50 (33.33)	141 (47.00)		
Comorbidities				
Hypertension	56 (37.3)	165 (55.0)	<0.001	0.48 (0.32 – 0.72)
Peripheral Vascular Disease	35 (23.3)	48 (16.0)	0.05	1.59 (0.98 – 2.60)
Cerebrovascular disease	12 (8.0)	23 (7.7)	0.90	1.04 (0.50 – 2.16)
Dementia	4 (2.7)	20 (6.7)	0.08	0.39 (0.12 – 1.14)
Neurological disorder	15 (10.0)	71 (23.7)	<0.001	0.36 (0.19 – 0.65)
Respiratory disease	40 (26.7)	74 (24.7)	0.64	1.11 (0.71 – 1.73)
Diabetes	36 (24.0)	61 (20.3)	0.37	1.23 (0.77 – 1.97)

Table 2. Qualitative characteristics of the study population (Cont.)

Variables	Cases (*n* = 150) *n* (%)	Controls (*n* = 300) *n* (%)	*p*-value	OR (95% CI OR)
Comorbidities				
Incontinence	75 (50.0)	83 (27.7)	<0.001	2.60 (1.73 – 3.93)
Urinary	1 (1.3)	5 (6.0)	0.21	2.34 (0.555 –21.7)
Urinary and/or fecal	74 (98.7)	78 (94.0)		
Therapeutic				
Mechanical ventilation	72 (48.0)	105 (35.0)	<0.001	1.71 (1.15 – 2.55)
Dialysis	7 (4.7)	18 (6.0)	0.56	0.77 (0.29 – 1.84)
Antibiotic	105 (70.0)	174 (58.0)	0.01	1.68 (1.11 – 2.57)
Sedative	78 (52.0)	108 (36.0)	<0.001	1.92 (1.29 – 2.86)
Vasoactive	60 (40.0)	87 (29.0)	0.01	1.63 (1.08 – 2.46)
Prevention				
Use of Hydrocolloid dressing	54 (36.0)	23 (7.7)	<0.001	6.71 (3.95 – 11.74)
Zinc oxide	103 (68.7)	220 (73.3)	0.29	0.79 (0.51 – 1.23)
Hospitalization service				
Intensive care	104 (69.33)	161 (53.67)		
Hospitalization	46 (30.67)	139 (46.33)	<0.001	0.51 (0.33 – 0.77)
Diagnosis upon admission				
Cancer *	11 (7.3)	7 (2.3)		
Respiratory failure	49 (32.7)	69 (23.1)	0.12	0.45 (0.16 - 1.24)
Cardiovascular disorder	41 (27.3)	67 (22.4)	0.07	0.38 (0.14 – 1.08)
Programmed and/or emergency surgery	20 (13.3)	45 (15.1)	0.02	0.28 (0.09 – 0.83)
Neurological disorder	8 (5.3)	55 (18.4)	<0.001	0.09 (0.02 – 0.30)
Sepsis/infection	21 (14.0)	35 (11.7)	0.08	0.38 (0.12 – 1.13)
Type of nutrition				
Oral*	37 (24.7)	157 (52.3)		
Enteral	52 (34.7)	112 (37.3)	0.01	1.97 (1.21 – 3.20)
Parenteral	54 (36)	27 (9.0)	<0.001	8.48 (4.73 – 15.22)
Mixed	7 (4.7)	4 (1.3)	<0.001	7.42 (2.06 -26.69)
Braden's scale				
Low Risk*	2 (1.3)	10 (3.3)		
Moderate Risk	9 (6.0)	49 (16.3)	0.92	0.91 (0.17 – 4.91)
High Risk	75 (50)	179 (59.7)	0.34	2.09 (0.44 – 9.79)
Very High Risk	64 (42.7)	62 (20.7)	0.03	5.16 (1.08 – 24.50)
Type of Lubricant				
Fatty acids	138 (92.0)	210 (70.0)		
Other lubricants	3 (2.0)	42 (14.0)	<0.001	0.10 (0.03 – 0.35)
None	9 (6.0)	48 (16.0)	<0.001	0.28 (0.13 – 0.60)

Multivariate analysis

Figure 1 shows the diagram of the classification and regression tree. Of the 29 variables included, the classification and regression tree algorithm – automatically and objectively based on the data – determined what are the relevant variables that construct the tree. This tree shows 10 groups or clinical profiles (identified with letters A to J) based on seven variables that proved having relevance in developing skin lesions. These variables were: use of hydrocolloid dressings, type of nutrition, duration of the hospital stay, diagnosis upon admission, peripheral vascular disease, body mass index, and presence of urinary and/or fecal incontinence (Figure 1). It is also important to highlight that the use of hydrocolloid dressings and the hospital stay were the variables with greater importance when constructing the decision tree.

Patients characterized between profile A and profile G, who did not receive care with hydrocolloid dressings, had a lower probability of developing a skin lesion than patients characterized and included from profiles H to J, who were characterized for having received care with hydrocolloid dressings [26% Vs. 70%], respectively (Figure 1).

Profiles A, B, D, E, H, identified in the decision tree analysis, had a low probability of developing skin lesions (16%, 32%, 15%, 23%, and 29%), respectively. Profile I had an intermediate 38% probability; and profiles C, F, G, and J had a higher probability of developing a skin lesion (89%, 67%, 84%, 90%), respectively (Figure1).

Among the group of the A, B, D, E, and H profiles (Figure 1, green tones), profile A gathered the higher number of patients from the sample (279/450 patients, 62%), which had a 16% probability of developing a skin lesion. These patients were characterized for not using hydrocolloid dressings, receiving enteral or oral nutrition, and for having a hospital stay < 53 days. Profile B, characterized for including patients who did not use hydrocolloid dressings, with hospital stay > 53 days, and without peripheral vascular disease, had 32% probability of developing skin lesions. Profile D included patients characterized for not using hydrocolloid dressings, being admitted due to gastrointestinal problems or admission to surgery, had 15% probability. Profile E, characterized for not using hydrocolloid dressings, for including patients with non-surgical diagnosis, with BMI < 23, and without incontinence, had 23% probability. Profile H, characterized for including patients with hospital stay <12 days, but protected with hydrocolloid dressings had 29% probability.

In the group of profiles C-F-G-J (Figure 1, red and orange), 22% of the sample was identified and a higher probability of skin lesion (99/450 patients). Profiles C, F, and G concentrated 11% of patients with higher proportion of skin lesion. Profiles F and G shared the following characteristics: lack of use of hydrocolloid dressings, nutrition other than enteral or oral, and diagnosis other than surgery or gastrointestinal disorder. Patients included in profile C (2% of the sample), who were characterized for not using hydrocolloid dressings, received enteral/oral nutrition, had a hospital stay > 53 days, and had an additional factor of peripheral vascular disease showed a high probability of 0.89 of developing a skin lesion. Patients included in profile G (7% of the patients) with an additional factor of BMI > 23 had 84% probability of skin lesion. Patients included in profile F (2% of the sample) with BMI < 23, but with an additional factor of urinary incontinence had 67% probability of developing a skin lesion. Profile J, which characterized patients identified with cancer diagnosis, respiratory failure, and cardiovascular disorder on admission, with hospital stay > 12 days, and who received care with hydrocolloid dressings, corresponded to 11% of the patients [50/450], had a high (90%) probability of developing a lesion.

Patients who shared the same characteristics, except not having peripheral vascular disease (profile B) had nearly three times less likelihood of a skin lesion than those who did have peripheral vascular disease (89% profile C Vs. 32% profile B) (OR = 14.14; 95% CI = 1.91–413.31; *p*-value = 0.01275).

With respect to diagnosis upon admission, among the patients who shared the same profile with the only difference in this variable, the difference in the proportion decreased from 90% to 38% (profile J Vs. I). The proportion of skin lesion was greater in those patients whose diagnosis upon admission included cancer, respiratory failure, and cardiovascular disorder compared with those whose diagnosis was surgery for gastrointestinal disorder, neurological disorder, or sepsis (OR = 13.23; 95% CI = 3.20–63.89; *p*-value = 0.0003).

In patients sharing the characteristics of not using hydrocolloid dressings, parenteral nutrition, BMI < 23, diagnosis upon admission corresponding to neurological disorder, cardiovascular disorder, sepsis, cancer, and respiratory failure, except for having or not having urinary incontinence, the proportion of skin lesion changes from 67% in profile F Vs. 23% in profile E (OR = 5.88; 95% CI = 0.93–48.76; *p*-value = 0.0789). Profile D has 3% of the population corresponding to 14 patients; of those, 15% developed skin lesion (2 patients); this profile is characterized for not using hydrocolloid dressings, parenteral nutrition, and diagnosis upon admission of gastrointestinal disorder and surgery. Finally, profile H also had 3% of the population and 29% of them (4 patients) had skin lesion. This profile gathered individuals who used hydrocolloid dressings and had a hospital stay < 12 days.

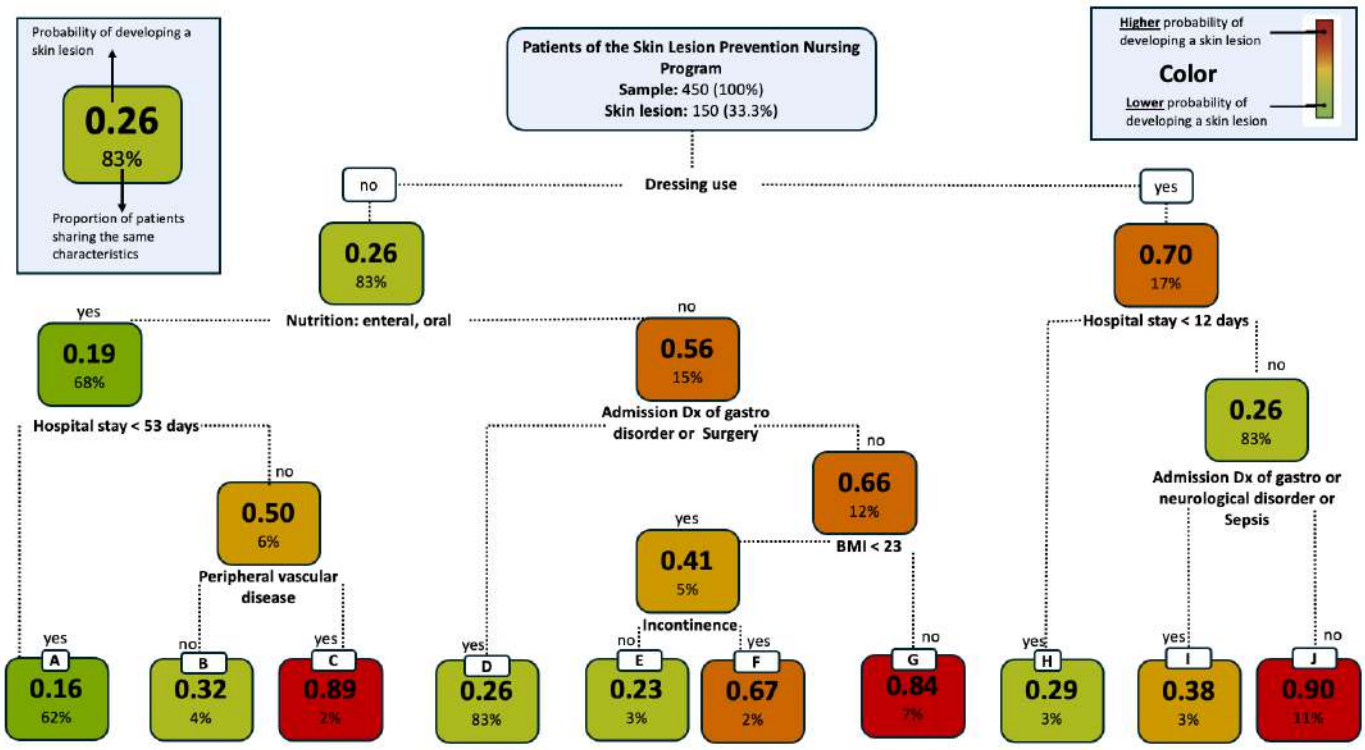


Figure 1. Diagram of the classification and regression tree

Discussion

This study contributes to progress in identifying determining factors in the onset of PI, IAD, and MARSI acquired in patients hospitalized in a high-complexity center. The decision tree permitted finding complex interactions that could not have been discovered with classic methods, such as logistic regression. The greatest proportion of skin lesions was found in patients who used hydrocolloid dressings, had a hospital stay > 12 days, with BMI > 23, incontinence, and diagnosis upon admission related with cardiovascular problems and peripheral vascular disease, cancer, surgery, or respiratory failure.

Profile J is striking given that hydrocolloid dressings in the program evaluated has a preventive indication, which may indicate that in individuals with diagnosis upon admission of surgery, cancer, cardiovascular disorder, and respiratory failure who have been hospitalized for over 12 days, the hydrocolloid dressing would not be fulfilling its function. Evidence about the preventive and therapeutic effectiveness of using dressings is controversial,[12] and depends on the type of dressing.[5,13] Moreover, patients admitted to hospitalization due to the already mentioned diagnoses and with prolonged hospital stay, with prolonged bed rest have high fragility that favors developing skin lesions and, hence, require greater care.

Regarding profile C, patients with peripheral vascular disease as comorbidity, with a hospital stay > 53 days, enteral or oral nutrition, and who did not use hydrocolloid dressings had 89% probability of skin lesion, with the chance of developing skin lesion 13 times higher compared with patients from a similar profile, except for peripheral vascular disease. This comorbidity is based on vascular stenosis,[14] which can limit tissue nutrition, and added to a prolonged stay can increase the risk of developing a skin lesion.

Patients who did not use hydrocolloid dressing, who were being fed via parenteral and mixed nutrition with diagnosis upon admission of cancer, respiratory failure, and cardiovascular disorder and with BMI > 23 had 84% probability of skin lesion (profile G), with 12 times greater chance of developing the outcome compared to patients with the same profile, but with a different diagnosis. With respect to this finding, regarding respiratory failure, it is worth noting that the last year of the study corresponded to the COVID-19 pandemic, therefore, the complexity in managing these patients led to changing different institutional factors that could have affected the presence of lesions during this year. Vowden *et al*.,[15] claim that during the first wave of COVID-19, caregivers focused on treating the acute disease, which is why preventing skin lesions was not a priority. The impact of COVID-19 on training, the workforce, and the infrastructure, with a redistribution of beds and expansion of ICU facilities led to a notable increase of the risk. For patients with cancer or with any cardiovascular disorder, the disease's specific conditions can affect tissue nutrition.[16] Additionally, mixed or parenteral nutrition may indicate a more complex disease state that increases the patient's vulnerability to developing skin lesions.

Hospital stay was a factor differentially associated with skin lesions, but always important (profile L and K). The risk of developing lesions increases in direct proportion to the length of hospital stay, the patient's aggravated condition makes movement impossible and leads to prolonged exposure to friction, pressure and shear, ultimately leading to the development of a lesion.[7] In a study conducted in Iran in patients with > 10 days of stay in the ICU, the risk of developing skin lesions was four times greater with respect to patients with less days of hospitalization.[17] Parenteral, enteral, and mixed nutrition variables behaved as a risk factor; this could be explained because these patients have more serious health conditions (ICU stay, mechanical ventilation, sedation, among others) that would lead to increasing the risk of

acquiring skin lesions. According to the literature, direct relationship exists between malnutrition and development of skin lesions, as protection over bony prominences is reduced due to loss of muscle tissue and fat.[18] In addition, inflammation produced with skin lesions demands increased nutritional needs.[19]

Long-term fecal and/or urinary incontinence cause a humid environment and maceration that alter the integrity of the skin and increase the risk of developing skin lesions. A literature review by Emilia *et al*., in 2019 identified that the highest prevalence of pressure injury was found in patients with urinary and/or fecal incontinence because humidity increases friction and diminishes the skin's resistance to existing loads.[20] In the findings herein, the chance of developing PI was nearly five times more in patients sharing similar characteristics, except urinary incontinence.

Strengths and limitations. The study identified factors associated with the development of skin lesions when patients are in a nursing care preventive program. A strength of this research was the power of the sample size to assess factors associated with developing skin lesions in the study population. Furthermore, the lesions were identified by nurses with expertise in skin care. Among the limitations, it must be stated that the study population included patients selected specifically in a high-complexity clinic and due to this the findings are only comparable with patients from similar institutions. Also, the analysis of the three types of lesions (PI, IAD, and MARSI) together can be a limitation, since it generalizes the results and cannot provide specific preventive measures for each type of lesion. Because this is a study with retrospective source, bias is possible in reporting data in the medical history; however, the institution has information quality control systems, given that it is supervised by national and international entities for its high-quality accreditation. The sociodemographic and hospitalization characteristics that could have been a potential source of confusion were controlled through the multivariate analysis with the decision tree.

Conclusion. The factors that represent greater probability of developing PI, IAD, and MARSI type skin lesions in hospitalized adult patients were the preventive use of hydrocolloid dressings, prolonged hospital stay > 12 days, diagnosis upon admission of cardiovascular and vascular origin, BMI > 23, and urinary incontinence. The nurses and health team must comprehensively assess patients, bearing in mind that there is no unique clinical characteristic for developing a skin lesion; it takes place in function of different factors that when interacting with each other increase or diminish the possibility of occurrence.

Contributions by the authors. Gaby Escobar, Angela Espinosa-Aranzales, Olga Cortés, and Nicolas Molano made substantial contributions to the conception and design, or data acquisition, or data analysis and interpretation. All the authors participated in drafting the manuscript or in the critical revision of the important intellectual content. All the authors approved the final version for publication. Every author had to have participated sufficiently in the work to assume public responsibility for the appropriated parts of the content. All the authors agreed to be responsible for all the aspects of the work to guarantee that questions related with the accuracy or integrity of any part of the work are investigated and resolved adequately.

Acknowledgments. Special thanks to the nursing care team from the study institution, who facilitated the information collected and helped us solve thematic doubts to conduct the research.

Funding declaration. The program was funded by MINCIENCIAS Code: 277884467846, Contract No. 439–2020. The funding source played no role in the study's design or its results.

References

1. European Pressure Ulcer Advisory Panel [EPUAP], National Pressure Injury Advisory Panel [NPIAP], Pan Pacific Pressure Injury Alliance [PPPIA]. Prevención y Tratamiento de las úlceras / lesiones por presión. Guía de consulta rápida. GNEAUPP; 2019. 32 p. Available from: https://gneaupp.info/prevencion-y-tratamiento-de-las-ulceras-lesiones-por-presion-guia-de-consulta-rapida-2019/
2. Baumgarten M, Rich SE, Shardell MD, Hawkes WG, Margolis DJ, Langenberg P, et al. Care-Related Risk Factors for Hospital-Acquired Pressure Ulcers in Elderly Adults with Hip Fracture. Journal of the American Geriatrics Society. 2012; 60(2):277-83.
3. Torra-Bou JE, Soldevilla-Agreda JJ, Pancorbo-Hidalgo PL, López-Franco MD, García-Fernández FP, Torra-Bou JE, et al. Prevalencia de las lesiones cutáneas relacionadas con la dependencia en residencias de mayores y centros sociosanitarios de España: resultados del 6.º Estudio Nacional del GNEAUPP 2022. Gerokomos. 2023; 34(4):269-76.
4. Alderden J, Rondinelli J, Pepper G, Cummins M, Whitney J. Risk factors for pressure injuries among critical care patients: A systematic review. International Journal of Nursing Studies. 2017; 71:97-114.
5. Moore ZE, Webster J. Dressings and topical agents for preventing pressure ulcers. The Cochrane Database of Systematic Reviews. 2018; 12(12):CD009362.
6. Chacón-Mejía JP, Del Carpio-Alosilla AE. Indicadores clínico-epidemiológicos asociados a úlceras por presión en un hospital de Lima. Revista de la Facultad de Medicina Humana. 2019; 19(2):66-74.
7. Kaşıkçı M, Aksoy M, Ay E. Investigation of the prevalence of pressure ulcers and patient-related risk factors in hospitals in the province of Erzurum: A cross-sectional study. Journal of Tissue Viability. 2018; 27(3):135-40.
8. Kayser SA, Phipps L, VanGilder CA, Lachenbruch C. Examining Prevalence and Risk Factors of Incontinence-Associated Dermatitis Using the International Pressure Ulcer Prevalence Survey. Journal of Wound Ostomy & Continence Nursing. 2019; 46(4):285.
9. McNichol L, Lund C, Rosen T, Gray M. Medical Adhesives and Patient Safety: State of the Science: Consensus Statements for the Assessment, Prevention, and Treatment of Adhesive-Related Skin Injuries. Orthopaedic Nursing. 2013; 32(5):267.
10. Slowikowski GC, Funk M. Factors associated with pressure ulcers in patients in a surgical intensive care unit. Journal of Wound Ostomy & Continence Nursing. 2010; 37(6):619-26.
11. Breiman L, Friedman J, Olshen RA, Stone CJ. Classification and Regression Trees. New York: Chapman and Hall/CRC; 2017. 368 p.
12. Westby MJ, Dumville JC, Soares MO, Stubbs N, Norman G. Dressings and topical agents for treating pressure ulcers. The Cochrane Database of Systematic Reviews. 2017; 6(6):CD011947.
13. Gaspar S, Peralta M, Marques A, Budri A, Gaspar de Matos M. Effectiveness on hospital-acquired pressure ulcers prevention: a systematic review. International Wound Journal. 2019; 16(5):1087-102.
14. Wang Y, Chen R, Ding J, Yang L, Chen J, Huang B. Predictive value of pressure ulcer risk for obstructive coronary artery disease. Nursing Open. 2021; 8(4):1848-55.
15. Vowden K, Hill L. What is the impact of COVID-19 on tissue viability services and pressure ulceration? Journal of Wound Care. 2021; 30(7):522-31.
16. Lakhani A, Kang DH, Kang YE, Park JO. Toward Systems-Level Metabolic Analysis in Endocrine Disorders and Cancer. Endocrinology and Metabolism. 2023; 38(6):619-30.
17. Zarei E, Madarshahian E, Nikkhah A, Khodakarim S. Incidence of pressure ulcers in intensive care units and direct costs of treatment: Evidence from Iran. Journal of Tissue Viability. 2019; 28(2):70-4.
18. Roca-Biosca A, Velasco-Guillén MC, Rubio-Rico L, García-Grau N, Anguera-Saperas L. Úlceras por presión en el enfermo crítico: detección de factores de riesgo. Enfermería Intensiva. 2012; 23(4):155-63.
19. Cereda E, Schols JMGA. Nutrition and Pressure Ulcers. En: Romanelli M, Clark M, Gefen A, Ciprandi G, editores. Science and Practice of Pressure Ulcer Management. London: Springer; 2018. p. 41-56.
20. Emilia NL, Yusuf S, Astrada A. The prevalence of pressure injury in patients with incontinence: Literature review. Enfermería Clínica. 2020; 30:449-52.

Usability of a website to promote treatment adherence for adults with HIV

Original Article

Aiodelle dos Santos Machado[1,8]
https://orcid.org/0000-0002-0128-8793

Marcelo Ribeiro Primeira[2,9]
https://orcid.org/0000-0001-9735-6502

Raquel Einloft Kleinubing[3,9]
https://orcid.org/0000-0002-7448-4699

Daniel Gonzalo Eslava Albarracin[4,10]
https://orcid.org/0000-0001-7257-4706

Tassiane Ferreira Langendorf[5,9]
https://orcid.org/0000-0002-5902-7449

Stela Maris de Mello Padoin[6,9]
https://orcid.org/0000-0003-3272-054X

Cristiane Cardoso de Paula[7,9]
https://orcid.org/0000-0003-4122-5161

Usability of a website to promote treatment adherence for adults with HIV

Abstract

Objective. To evaluate a website-type care-educational technology aimed at promoting adherence to antiretroviral treatment in adults living with HIV. **Methods.** This study was based on a Knowledge Translation into Action project developed in two stages: in the first stage, a free-access website was created through collaboration among different research groups; in the second stage, a cross-sectional study was conducted with focus groups and individual interviews with eight participants, using the Assistive Technology Assessment Instrument to evaluate the website's attributes. **Results.** The website was established as a digital care-educational technology, providing information supported by scientific evidence on self-efficacy, social support, and quality of life. The proposed issues addressed different situations in the lives of people living with HIV, with the objective of fostering treatment adherence. In the overall assessment conducted

1 Nurse, M.Sc. Email: aiodellemachado@gmail.com
2 Nurse, Ph.D. Postdoctoral fellow. Email: mrp_sm@hotmail.com
3 Nurse, Ph.D. Temporary Lecturer. Email: raquel_e_k@hotmail.com
4 Nurse, Ph.D. Email: dgeslava@gmail.com
5 Nurse, Ph.D. Permanent Lecturer. Email: tassiane.langendorf@ufsm.br
6 Nurse, Ph.D. Permanent Lecturer. Email: stela.padoin@ufsm.br. Corresponding author
7 Nurse, Ph.D. Permanent Lecturer. Email: cristiane.paula@ufsm.br
8 University Hospital of Bonn, Germany
9 Department of Nursing, Federal University of Santa Maria, Brazil
10 Cafam University Foundation, Colombia

Conflicts of interest: None.
Received: November 11, 2024.
Approved: August 26, 2025.

How to cite this article: Machado AS, Primeira MR, Kleinubing RE, Eslava-Albarracin DG, Langendorf TF, Padoin SMM, Paula CC. Usability of a website to promote treatment adherence for adults with HIV. Investigación y Educación en Enfermería. 2025; 43(3):e05.

DOI: https://doi.org/10.17533/udea.iee.v43n3e05

by the target audience, the website obtained a mean score of 1.88 (minimum 1.1 and maximum 2.0), being classified as adequate. Suggestions received were incorporated through adjustments in design and content structure. **Conclusion.** The website can be used by adults living with HIV and by nursing professionals to promote treatment adherence, contributing to self-care and health education.

Descriptors: HIV; treatment adherence and compliance; adult; educational technology; biomedical translational science; nursing.

Usabilidad de un sitio web para promover la adherencia al tratamiento en adultos con VIH

Resumen

Objetivo. Evaluar una tecnología educativa de cuidado, en formato de sitio web, orientada a promover la adhesión al tratamiento antirretroviral en adultos que viven con VIH. Métodos. Estudio basado en un proyecto de traducción del conocimiento en acción que se desarrolló en dos etapas: en la primera se construyó un sitio web, de acceso gratuito, mediante la colaboración de diferentes grupos de investigación; y en la segunda, se llevó a cabo un estudio transversal con entrevistas grupales e individuales a ocho participantes, empleando el Instrumento de Evaluación de Tecnologías Asistenciales para valorar los atributos del sitio web. **Resultados.** El sitio web diseñado constituyó una tecnología digital para la educación sobre el cuidado, que ofreció información respaldada por evidencias científicas sobre autoeficacia, apoyo social y calidad de vida. Las preguntas incluidas son propositivas y relacionadas con distintas situaciones de la vida diaria de las personas con VIH que tienen por propósito favorecer la adhesión al tratamiento. En la evaluación global realizada por el público objetivo, el sitio web obtuvo un promedio de 1.88 (mínimo de 1.1 e máximo de =2.0), clasificado como adecuado. Las sugerencias recibidas se incorporaron mediante ajustes en el diseño y la estructura del contenido. **Conclusión**. El sitio web puede ser utilizado por adultos que viven con VIH y por enfermeros, para promover la adherencia al tratamiento, lo cual puede contribuir al

fortalecimiento del autocuidado y al mejoramiento de la atención en el marco de la educación en salud.

Descriptores: VIH; cumplimiento y adherencia al tratamiento; adulto; tecnología educacional; ciencia translacional biomédica; enfermería.

Usabilidade de *website* para promoção da adesão ao tratamento de adultos com HIV

Resumo

Objetivo. Avaliar uma tecnologia cuidativo-educacional do tipo *website* voltada à promoção da adesão ao tratamento antirretroviral em adultos que vivem com HIV. **Métodos.** Estudo fundamentado em um projeto de tradução do conhecimento em ação, desenvolvido em duas etapas: na primeira, construiu-se um *website* de acesso gratuito por meio da colaboração entre diferentes grupos de pesquisa; na segunda etapa, realizou-se um estudo transversal com entrevistas coletivas e individuais com oito participantes, utilizando-se o Instrumento de Avaliação de Tecnologias Assistenciais para analisar os atributos do *website*. **Resultados.** O *website* desenvolvido constituiu-se em uma tecnologia digital de educação para o cuidado, oferecendo informações sustentadas em evidências científicas sobre autoeficácia, apoio social e qualidade de vida. As questões propostas contemplaram diferentes situações da vida das pessoas que vivem com HIV, com o objetivo de favorecer a adesão ao tratamento. Na avaliação global realizada pelo público-alvo, o *website* obteve média de 1,88 (mínimo de 1,1 e máximo de 2,0), sendo classificado como adequado. As sugestões recebidas foram incorporadas mediante ajustes no design e na estrutura do conteúdo. **Conclusão.** O *website* pode ser utilizado por adultos que vivem com HIV e por profissionais de enfermagem, a fim de promover a adesão ao tratamento, contribuindo para o fortalecimento do autocuidado e para a melhoria da assistência no âmbito da educação em saúde.

Descritores: HIV; cooperação e adesão ao tratamento; adulto; tecnologia educacional; ciência translacional biomédica; enfermagem.

Introduction

Globally, approximately 39 million people are currently living with HIV, of whom 29.8 million are receiving antiretroviral therapy (ART). The Joint United Nations Programme on HIV/AIDS (UNAIDS) has set a global target of ensuring that 35 million individuals are on HIV treatment by 2025.[1] To this end, the provision of accessible treatment services and equitable access to medicines and other health technologies must be ensured.[1] In order to guarantee the timely availability of ART, it is essential that individuals are aware of their diagnosis. Accordingly, UNAIDS has proposed that, by 2030, 95% of people living with HIV should know their serological status and, subsequently, be receiving ART with viral load suppression. This strategy is expected to prevent approximately 3.6 million new HIV infections and 1.7 million deaths related to the infection.[1]

In Brazil, between 2012 and 2022, access to ART contributed to a 26.5% reduction in the AIDS-related mortality rate.[2] However, access to diagnosis and ART alone does not determine treatment adherence, as multiple aspects and factors may be associated with challenges in adhering to ART, including the occurrence of medication side effects, given its long-term use, as well as lifestyle adjustments and behavioral changes.[3] Access to information through health education mediated by technologies may help mitigate the various factors that hinder adherence.

In this context, adherence to ART is a lifelong and dynamic process, in which challenges can be managed, as the factors influencing adherence vary across different settings.[4] Considering these circumstances, monitoring and evaluating ART adherence among individuals undergoing treatment is essential.[3] As a non-pharmacological strategy, the use of tools such as Care-Educational Technologies (CET) is recommended. These tools aim to strengthen individuals' knowledge and foster meaningful learning through human empowerment regarding their health condition and the environment in which they live.[5,6] Within the scope of health education, the application of such educational resources by nursing professionals may contribute to improved ART adherence.[7]

Thus, the role of nurses is strategic for planning and providing care, as well as for promoting self-care and shared responsibility in individual health, with the introduction of CET acting as mediators of health literacy. This adds to the importance of nursing in the development, implementation, and execution of public policies in the context of HIV infection.[8] The Brazilian Board of Nursing, in partnership with the Ministry of Health, has played a fundamental role in establishing regulations that guide and strengthen nursing practices in combating sexually transmitted infections. The aim is to provide nursing

professionals with the necessary tools to manage the care of individuals affected by infections under the responsibility of the Department of HIV/AIDS, Tuberculosis, Viral Hepatitis, and Sexually Transmitted Infections.[9]

Considering that the tools and technologies implemented in the context of HIV infection must address the local reality, as well as the target audience to be accessed,[10] this study is justified by the need to evaluate the target audience of a CET. Furthermore, it is worth noting the convergence with the 3rd Sustainable Development Goal (SDG) proposed by the United Nations (UN) in the 2030 Agenda.[11] Therefore, the objective of this study was to evaluate a website-based care-educational technology aimed at promoting adherence to antiretroviral treatment among adults living with HIV.

Methods

This is a Knowledge-to-Action (KTA) project[12,13] structured around two cycles: the knowledge creation cycle and the knowledge-to-action cycle. In this study, during the knowledge creation cycle, an informational website prototype was developed with online access for use on smartphones, tablets, laptops, and desktop computers. In the knowledge-to-action cycle, the principle of adapting knowledge to the local context was followed, with an investigation conducted to evaluate the website among adults living with HIV infection.

For the website prototyping, the textual content underwent expert validation, while the visual content was conceptualized by the research team and produced by a professional illustrator in a previous study.[14] The purpose of the tool is to foster adherence to antiretroviral therapy among adults living with HIV, thereby translating scientific evidence into a practical knowledge tool. Accordingly, the website is classified as a CET, as it constitutes a non-pharmacological strategy designed to integrate care and education. The website structure was organized into three thematic sections (Table 1).

Table 1. Website content structure

Structure	Page	Title and web layout
Home	1	Presentation of the *Conviva* brand; purpose of the website and buttons to access the content or learn about the creative team.
Section 1	2	Context of the content covered; buttons for concepts of adherence, social support, self-efficacy, and quality of life; button to continue to 'life situations'; button to return to home page and button to continue to first concept.
	3	Adherence concept; buttons to return to home page, return to previous menu, and continue to next concept.
	4	Social support concept; buttons to return to home page, return to previous menu, and continue to next concept.
	5	Self-efficacy concept; buttons to return to home page, return to previous menu, and continue to next concept.
	6	Quality of life concept; buttons to return to home page, return to previous menu, and continue to 'life situations' menu.
	7	Context of the content; menu with links that redirect to Life Situations (LS) pages from LS1 to LS11; buttons to return to home page, return to concepts, and continue to first LS.
Section 2	8	LS1 Stigma and Prejudice; buttons to return to home page, return to LS menu, and continue to next LS.
	9	LS2 Antiretroviral Medicines; buttons to return to home page, return to LS menu, and continue to next LS.
	10	LS3 Side Effects; buttons to return to home page, return to LS menu, and continue to next LS.
	11	LS4 Negative Emotions; buttons to return to home page, return to LS menu, and continue to next LS.
	12	LS5 Stigma and Prejudice; buttons to return to home page, return to LS menu, and continue to next LS.
	13	LS6 Misinformation or Denial of Health Condition; buttons to return to home page, return to LS menu, and continue to next LS.
	14	LS7 Communication Challenges between Users and Healthcare Team; buttons to return to home page, return to LS menu, and continue to next LS.
Section 3	15	LS8 Healthy Habits that Improve Health and Quality of Life; buttons to return to home page, return to LS menu, and continue to next LS.
	16	LS9 Concerns about Effects of Antiretroviral Medicines; buttons to return to home page, return to LS menu, and continue to next LS.
	17	LS10 Concerns about Health, Treatment, and Fear of Death; buttons to return to home page, return to LS menu, and continue to next LS.
	18	LS11 Adherence to Prescription Makes the Body Stronger and Healthier; buttons to return to home page, return to LS menu, and continue to credits.
Credits	19	Authors; Illustrator; Programmers; Text review team; Support team; Funding; Button to return to home page.

During the development stage of the website's interface and visual identity, both textual and visual contents were integrated in partnership with the Tutorial Education Program in Computer Science team, between March and June 2023. Considering that the website would be made available under an institutional domain, linked to its official website, the platform selected for interface development was WordPress®, a free and open-source web content management system. The visual identity was designed by the same illustrator responsible for producing the images. Aiming to convey the message about learning to live with antiretroviral treatment, the design depicts a person with open arms (happy and content with life), above which appears the universal symbol of the fight against the HIV epidemic. In the logo (Figure 1), the word *VIVA* (live, in Portuguese) is highlighted to reinforce the idea of getting used to and adapting to the new health care routine.

The prototype was reviewed by a panel of experts consisting of members of the research group and representatives from healthcare services and municipal management, including six nurses and one physician. This step follows the recommendations from the KTA framework authors, who emphasize that knowledge adaptation should consider the participation of diverse audiences to achieve greater success in its use by the end user.[13] To start the knowledge-to-action cycle, more specifically at the stage of adapting knowledge to the local context, an evaluation was conducted with adults living with HIV. At this stage, the aim was to identify contextual particularities and efficiency in terms of acceptance in an environment with particular characteristics.[13] The study was conducted in two specialized healthcare services and a Support Center for People Living with HIV, located in a medium-sized city in the central region of the state of Rio Grande do Sul, Brazil. The sample for the website evaluation consisted of eight participants who met the inclusion criteria: being 18 years of age or older, living with HIV infection, receiving follow-up care in the participating services, being literate, and not presenting visual impairment or other conditions that would prevent the visualization and reading of the material provided.

Two data collection strategies were employed: focus group and individual interviews. The use of both strategies was necessary due to the limited participation of people living with HIV in focus groups, as the topic is sensitive and individuals often prefer to maintain confidentiality of their diagnosis because of the stigma associated with the epidemic. Sections 1 and 2 were assessed in the focus groups, while in the individual interviews all sections were evaluated. For both strategies, the Assistive Technology Assessment Instrument[14] and sociodemographic characterization questions were applied.

The focus groups were conducted in two meetings: 1) evaluation of Section 1 (pages 1-6), which covers the concepts addressed throughout the website, such as adherence, social support, self-efficacy, and quality of life; and 2) evaluation of Section 2 (pages 7-14), which refers to Life Situations (LSs 1-7) of stigma and prejudice, antiretroviral medicines, side effects, negative feelings, misinformation or denial of health condition, and communication challenges. In the five individual interviews, participants completed the full assessment (Sections 1, 2, and 3), and after the website was presented, they were free to make suggestions. After the presentation of the full content, participants completed the Assistive Technology Assessment Instrument. Subsequently, they completed the assessment of Section 3 (pages 15-18), which refers to Life Situations (LSs 8-11) of healthy habits that improve health and quality of life, concerns about effects of antiretroviral medicines, concerns about health, and adherence to prescription makes the body stronger and healthier.

For the analysis of the instrument data, the results were entered into a Microsoft Excel® spreadsheet and exported to the Statistical Package for the

Social Sciences (SPSS®) software. Mean scores were calculated per item and per attribute, in addition to the overall mean based on the target audience's assessment. Items or attributes with a mean of zero (0) were classified as inadequate; those with means between 0.1 and 1.0 were classified as partially adequate; and those with means between 1.1 and 2.0 were classified as adequate.[16] The information collected from audio transcripts was compiled, and suggestions were incorporated into adjustments to the website. Data collection was conducted after the project received approval by the Research Ethics Committee, under Registration No. 67915823.0.0000.5346.

Results

The website designed to promote adherence to antiretroviral treatment for adults living with HIV infection (Figure 1) is accessible at https://www.ufsm.br/pet/ciencia-da-computacao/conviva-1. Finally, the website was registered as Technical Work under No. 712146145.

Figure 1. Home page of the *Conviva* website

Eight adults living with HIV infection, aged between 28 and 59 years, participated in the study, five of whom were male and three female. Regarding self-reported race, four participants identified as white, one as brown, and three as black. In terms of educational level, two had completed elementary school, one had completed high school, two had completed higher education, and three had not completed higher education. The time since HIV diagnosis ranged from 2 to 23 years, while the duration of treatment ranged from 6 months to 19 years. Concerning the overall assessment according to the instrument applied, the website achieved a mean score of 1.88 and was considered adequate by the participants, according to the classification scale ranging between 1.1 and 2.0[16] (Table 2).

Table 2. Website assessment criteria by attribute, Brazil, 2024

Attribute	Item	*n**	Min†	Max‡	Mea§	Mea§ by Attribute
Attribute 1 Interactivity	The content is suitable for your needs	8	1	2	1.75	1.88
	Offers interaction and active involvement in the educational process	8	1	2	1.75	
	Enables access to the topics covered	8	2	2	2.00	
	Allows users to operate it autonomously	8	2	2	2.00	
Attribute 2 Objectives	Promotes learning of the content covered	8	2	2	2.00	1.81
	Encourages the learning of new concepts and facts	8	1	2	1.75	
	Enables users to easily find information	8	1	2	1.63	
	Employs an appealing presentation strategy	8	1	2	1.88	
Attribute 3 Relevance and Effectiveness	Provides adequate resources for use	8	2	2	2.00	1.91
	Fosters interest in its use	8	1	2	1.88	
	Encourages behavioral change	8	1	2	1.88	
	Presents the content covered across various contexts	8	1	2	1.88	
Attribute 4 Clarity	Presents information in a clear and simple manner	8	1	2	1.88	1.94
	Allows reflection on the content presented Média Global	8	2	2	2.00	
	Overall mean					1.88

Note: n* = number; † = Minimum; ‡ = Maximum; § = Mean.

With regard to the assessment of the website's attributes, *clarity* received the highest average rating, whereas *objectives* obtained the lowest. Although the overall assessment indicated that the website was suitable for use, the suggestions for improvements made by participants during the interviews were either incorporated into the website or, when not feasible, justified by system or operational limitations (Table 3).

Table 3. Suggestions and adjustments following end-user assessment of the website

Suggestions	Adjustments
Color changes on page 7.	Changes included.
Remove explicit reference to diagnosis on home page design.	
Inclusion of reporting channels for prejudice-related issues.	
Page 12: highlight in bold the link to the Rights page.	
Page 10: The 'continue' button should be adjusted from 'next concept' to 'next situation'.	
Expand coverage of legal issues (rights of people living with HIV).	Link to external page with official information already available.
Include icons/emojis next to LS titles.	Changes not included due to system/operational limitations.
Turn the website into an interactive app where users can enter their health information.	
Insert content into an app instead of a website.	
Provide additional information on who may access PrEP and PEP	Changes not implemented due to requirement for modification of previously validated content.
Inclusion of information on modes of transmission.	
Inclusion of information on risk behaviors for infection.	
Emphasize the concept of 'undetectable = untransmittable,' particularly for HIV-negative individuals.	
Include information on where to seek help (mental health).	Change not implemented due to requirement for service-specific information and variability in local mental health care.

Discussion

In the study in question, the website was considered adequate by adults living with HIV infection with respect to its interactivity, objective, relevance and effectiveness, and clarity.[15] These findings indicate the website's positive reception by the target audience and suggest that autonomy in free access may contribute favorably to the promotion of self-care. The evaluation conducted by users is essential, as they possess unique knowledge, perspectives, and experiences that can influence the quality, appropriateness, and usability of the product.[17] Ensuring consistency among the theme, structure, type of product, and target audience is fundamental to achieving the intended educational objectives.[18] Furthermore, in addition to the overall mean obtained from the *Conviva* website assessment tool, the attributes of the educational resource should also be examined individually, as they highlight both opportunities for improvement and weaknesses identified during the evaluation process.

The *interactivity* attribute assesses whether the subject is actively and participatively engaged in the educational process and refers to the possibility of the user finding information according to their interests and the pace of their occupational activities. Interaction stimulates decision-making and learning processes, thereby reinforcing knowledge acquisition.[15] Thus, the evaluation of the website's interactivity as adequate suggests that its use can enhance end-user health literacy and, consequently, promote self-care. A meta-review including 55 randomized clinical trials with different e-health interventions demonstrated that these approaches can be effective in promoting adherence to ART and improving health outcomes in people living with HIV. Within the review,

m-Health was the most studied component, comprising the use of mobile devices, such as smartphones and tablets, to promote health and self-care, including health education platforms.[19]

Furthermore, a systematic review found that participants who used the software alongside their regular consultations over an 18-month period were 12% more likely to achieve perfect adherence compared to those receiving standard care. However, no significant differences were observed in the short term.[20] In this sense, the decision to develop the *Conviva* website is consistent, as it represents a continuously accessible technological resource.

The *objectives* attribute refers to the purposes and goals that should be achieved through the use of the proposed technology. This attribute obtained the lowest mean score among those evaluated (1.81), although it was still considered adequate for its intended purpose. In addition, the *clarity* attribute relates to whether the information presented is easy to understand, that is, whether the content is conveyed in a clear and accessible manner.

Considering that the purpose of the *Conviva* website is to promote adherence to antiretroviral therapy among adults living with HIV, the positive evaluation of the *objectives* and *clarity* attributes, particularly regarding the accessible presentation of information, supports its potential use in health education. The adoption of clear information conveyed through appropriate language has been a central objective in the development of educational resources, as it contributes to improving health literacy among the target audience of such technologies.[21]

Furthermore, the *clarity* attribute refers to the capacity of the educational intervention to foster reflection on adherence-related content. In this study, participants raised questions concerning their health condition and lived experiences, which demonstrated convergence with the LSs presented on the website. Reflections on self-efficacy for adherence also emerged, as illustrated by one participant who described the daily effort required to maintain medication use and linked this difficulty to a perception of being unable to manage treatment independently, compounded by issues such as prejudice toward their own serological status. Given the importance of adherence to antiretroviral therapy, it is essential to examine the factors that may compromise this process. Expectations of self-efficacy can directly influence adherence, as perceptions of one's own competence affect treatment execution and performance, potentially leading to interruptions or discontinuation of therapy.[22]

The *relevance and effectiveness* attribute refers to the significance of the educational resource and its capacity to generate impact, motivation, and interest,[15] having obtained a mean score of 1.91 in the present study. *Relevance* is particularly noteworthy, as it encompasses the influence of technology on the target audience, both in promoting adherence to ART and in fostering expectations of self-efficacy for treatment, thereby contributing to quality of life and strengthening social support. Moreover, free access to information is considered an important factor in bridging knowledge gaps and, consequently, in reducing vulnerabilities.

The LSs presented on the website, based on perceived social support, stimulate reflection on the presence or absence of social support, which tends to directly influence adherence to ART. The social and emotional consequences of living with HIV pose challenges that affect relationships in the workplace, family, and community.[23] Support networks perceived as satisfactory represent essential resources in the care process. Conversely, family abandonment can undermine self-esteem and lead to social isolation, thereby compromising adherence,[23] as stigma and prejudice within family relationships further diminish perceived social support.[24]

The stigma associated with HIV infection can manifest in different forms, including internalized, anticipated, and enacted stigma. One strategy to mitigate stigma is adherence to antiretroviral therapy, which reduces the fear of death by providing greater life expectancy and improved health, while also contributing to the restoration of one's social value. Access to health services and higher-quality care can further reduce isolation and strengthen social support. Successful treatments, reflected in healthier bodies, challenge the normalization of stigma toward people living with HIV.[25] Although digital and infotainment interventions have shown mixed results in reducing stigma, it remains essential to promote education among society, health professionals, and patients themselves to help reduce prejudice.[26] Moreover, factors related to economic, social, and cultural vulnerabilities, alongside the availability of psychological support, play a crucial role in reducing stigma and enhancing the quality of life of people living with HIV.[27] These aspects are addressed within the website content and applied in the LSs, comprising the structure of the technology.

The use of educational technologies to promote adherence to antiretroviral therapy has been supported by evidence demonstrating their effectiveness. A systematic review assessing interventions designed to improve self-management of antiretroviral therapy among adults living with HIV concluded that technology-assisted strategies are effective in promoting adherence.[28] In this study, one factor that may hinder access to information on the website, as reported by participants, was the presence of technical terms, alongside the need to adapt the resource for individuals who are illiterate or have visual impairments. These findings reinforce the premise that educational technologies must be designed in accordance with the characteristics of the target audience to achieve their intended purpose.[29]

Since the quality of life of people living with HIV is positively associated with adherence to antiretroviral therapy,[30] and this relationship is understood to be bidirectional, it is important that tools designed to promote adherence also address aspects related to quality of life.[31] Strategies to foster treatment adherence, whether through educational technologies or other available resources, should therefore incorporate key elements of this cycle, including quality of life, self-efficacy, social support, stigma, and prejudice.

The limitations of this study relate to the difficulty of accessing the target audience, underscoring the need to promote awareness to minimize prejudice, stigma, and discrimination against people living with HIV. The *Conviva* website was evaluated as suitable for this population and, as a free digital tool, was reported to facilitate easy access to information. Moreover, the incorporation of evidence-based content allows health professionals to employ it as a resource for health education and to support adherence to HIV treatment. The website met expectations regarding its design and the attributes of interactivity, objectivity, relevance and effectiveness, and clarity. Within the KTA framework, this educational technology demonstrates the translation of complex knowledge into accessible formats, enabling engagement of the target audience and expanding access to evidence-based information. In doing so, it helps bridge the gap between the human right to information and the pursuit of health equity. Finally, we recommend its use in local contexts, with the possibility of adapting it to other national and international settings, given that the challenge of adherence is a global issue.

Funding. This work is derived from a master's thesis entitled "Website for Promoting Adherence to Antiretroviral Therapy among Adults Living with HIV: Evaluation by the Target Audience." The project was funded through a joint call for proposals issued by the Brazilian National Council for Scientific and Technological Development (CNPq) and the Brazilian Hospital Services Company (EBSERH).

References

1. Programa Conjunto das Nações Unidas sobre HIV/AIDS. O caminho que põe fim à AIDS: Relatório Global do UNAIDS 2023. Genebra: UNAIDS; 2023.
2. Brasil. Boletim Epidemiológico - HIV e Aids 2023. Brasília, DF: Departamento de HIV/Aids, Tuberculose, Hepatites Virais e Infecções Sexualmente Transmissíveis Secretaria de Vigilância em Saúde e Ambiente do Ministério da Saúde; 2023.
3. Liao R, Tang Z, Zhang N, Hu L, Chang Z, Ren J, et al. Discrepancies between self-reported medication in adherence and indirect measurement adherence among patients undergoing antiretroviral therapy: a systematic review. Infectious Diseases of Poverty. 2024; 13:51.
4. Aurpibul L, Tangmunkongvorakul A, Detsakunathiwatchara C, Srita A, Masurin S, Meeart P, et al. "I want to be healthy and move on": A qualitative study of barriers and facilitators to antiretroviral treatment adherence among young adult survivors with perinatal HIV in Thailand. PLoS ONE. 2024; 19:e0305918.
5. World Health Organization. Adherence to long-term therapies: evidence for action. Geneva: World Health Organization; 2003.
6. Salbego C, Nietsche EA, Teixeira E, Girardon-Perlini NMO, Wild CF, Ilha S. Care-educational technologies: an emerging concept of the praxis of nurses in a hospital context. Revista Brasileira de Enfermagem. 2018; 71:2666–74.
7. Santos KRFN, Carneiro WS, Vieira AS, Souza MB, Gonçalves CFG. Fatores que interferem na adesão e permanência da terapia antirretroviral. Brazilian Journal of Health Review. 2020; 3:3037–43.
8. Almeida ECD, Marran AL, Baldissera VDA, Corsi CAC, Yahiaoui S, Bouchkira H, et al. A enfermagem e o letramento em saúde no contexto do HIV/AIDS, tuberculose, hepatites virais e infecções sexualmente transmissíveis. Enfermagem em Foco. 2024; 15(Supl 2): 169–76.
9. Almeida ECD, Silva MCND, Pantoja VJDC, Maciel ELN. O protagonismo da Enfermagem no enfrentamento do HIV/AIDS, hepatites virais, tuberculose e infecções sexualmente transmissíveis. Enfermagem em Foco. 2024;15(Supl 2): 8–9.
10. Mota NP, Maia JKO, Abreu WJCP, Galvão MTG. Educational technologies for HIV prevention in black people: scope review. Revista Gaúcha de Enfermagem. 2023; 44:e20220093.
11. Grupo de Trabalho da Sociedade Civil para a Agenda 2030 (GTSC A2030). VII Relatório Luz de Desenvolvimento Sustentável. Brasil: 2023.
12. Graham ID, Logan J, Harrison MB, Straus SE, Tetroe J, Caswell W, et al. Lost in knowledge translation: Time for a map? Journal of Continuing Education in the Health Professions. 2006; 26:13–24.
13. Vieira ACG, Gastaldo D, Harrison D. How to translate scientific knowledge into practice? Concepts, models and application. Revista Brasileira de Enfermagem. 2020; 73:e20190179.
14. Primeira MR, Machado AS, Langendorf TF, Albarracin DGE, Paula CC, Padoin SMM. Adesão ao tratamento antirretroviral de adultos com HIV: tradução do conhecimento na criação de website. Revista Latino-Americana de Enfermagem. 2025; 33: e4641.
15. Guimarães FJ, Carvalho ALRF, Pagliuca LMF. Elaboração e validação de instrumento de avaliação de tecnologia assistiva. Revista Eletrônica de Enfermagem. 2015; 17:302–11.
16. Guimarães FJ, Pagliuca LMF. Validation of assistive technology on psychoactive substances for visually impaired people. Disability and Rehabilitation: Assistive Technology 2017; 14:236–40.
17. Zeiler M, Dietzel N, Haug F, Haug J, Kammerer K, Pryss R, et al. A User-Centered Design Approach for a Screening App for People with Cognitive Impairment (digiDEM-SCREEN): Development and Usability Study. JMIR Human Factors. 2025; 12: e65022–e65022.
18. Santos AAD, Wanderley FAC, Morais EPGD, Peres AL, Warren EMC, Medeiros ICF, et al. Validação de produtos educacionais - relato de experiência. Caderno Pedagógico. 2025; 22(1):e13303.

19. Ramírez López GA, Gómez Galicia DL, Zagal Jiménez TX, Toledano Jaimes CD, Díaz De León Castañeda C. Digital health for promoting adherence to antiretroviral treatment in patients with HIV/AIDS: A meta-review. Farmacia Hospitalaria. 2024; 48(5):T252–T258.
20. Zuge SS, Paula CC, Padoin SMM. Efetividade de intervenções para adesão à terapia antirretroviral em adultos com HIV: revisão sistemática. Revista Escola de Enfermagem da Universidade de São Paulo. 2020; 54:e03627.
21. Galiza DDF, Cabral LA, Machado ALG, Moreira TMM, Sampaio HAC. Tecnologia educativa sobre saúde para mulheres privadas de liberdade à luz do letramento em saúde. Texto & Contexto – Enfermagem. 2023; 32:e20220260.
22. Freitas GM, Lavezzo F, Domingos NAM, Seidl EMF, Miyazaki MCOS. Variáveis Psicossociais e Adesão ao Tratamento Antirretroviral para HIV/Aids. Revista Psicologia e Saúde. 2021; 12(4):191-206.
23. Santos FAAS, Araújo VS, Oliveira MAA, Fernandes MNF, Correia DJ, Silva AR, et al. Rede de apoio e autopercepção de comportamento da pessoa vivendo com HIV/AIDS. Contribuciones a las Ciencias Sociales. 2023; 16:31731–48.
24. Fonseca BS, Azevedo LS, Aguirre HC, Shibukawa BMC, Piran CGM, Furtado MD, et al. Representações sociais de jovens adultos vivendo com HIV/Aids: revisão integrativa. Revista Brasileira de Sexualidade Humana. 2023; 34:1097.
25. Camlin CS, Charlebois ED, Getahun M, Akatukwasa C, Atwine F, Itiakorit H, et al. Pathways for reduction of HIV-related stigma: a model derived from longitudinal qualitative research in Kenya and Uganda. Journal of the International AIDS Society. 2020; 23(12): e25647.
26. Berthe PCJ, Amor YB. A Rapid Review of HIV-Related Stigma-Reduction Randomized Controlled Trials. AIDS and Behavior. 2025; 29(7): 2088–106.
27. Ebrahimi H, Shoorideh FA, Sohrabi MR, Ebrahimi M, Hosseini M. An Analysis of Approaches to Reduction of HIV Stigma across the World through educational interventions: A Scoping Review. Investigación y Educación en Enfermería. 2024; 42(1):e06.
28. Areri HA, Marshall A, Harvey G. Interventions to improve self-management of adults living with HIV on Antiretroviral Therapy: A systematic review. PLoS ONE. 2020; 15:e0232709.
29. Lima ID de A, Leon CGRMP de, Ribeiro LM, Silva ICR da, Vilela DM, Fonseca LMM, et al. A Serious Game (Immunitates) About Immunization: Development and Validation Study. JMIR Serious Games. 2022; 10:e30738.
30. Reis AC, Lencastre L, Guerra MP, Remor E. Relação entre sintomatologia psicopatológica, adesão ao tratamento e qualidade de vida na infecção HIV e AIDS. Psicologia: Reflexão e Crítica. 2010; 23:420–9.
31. Alckmin-Carvalho F, Silva MMS, Simão NS, Nichiata LYI. Qualidade de vida de pessoas que vivem com HIV no Brasil: revisão sistemática. Revista Brasileira de Qualidade de Vida. 2024;16: e17425.

Evidence-Based Pathways to Healthy Aging: A Systematic Review and Meta-analysis of Lifestyle Interventions for Longevity and Well-Being

Original Article

Check for updates

UNIVERSIDAD DE ANTIOQUIA
1803

Sonopant Joshi[1,5]
https://orcid.org/0000-0003-1560-4352

Mangesh Jabade[2,5]
https://orcid.org/0000-0001-5091-4300

Husain Nadaf[3,5]
https://orcid.org/0009-0009-9467-9766

Pratik Salve[4,5]
https://orcid.org/0009-0009-5088-0361

1 Director, Professor. Email: director@scon.edu.in
2 Assistant Professor. Email: mangesh@scon.edu.in
3 Tutor. Email: husain.nadaf@scon.edu.in. Corresponding author.
4 Tutor. Email: pratiksalve@scon.edu.in
5 Symbiosis College of Nursing (SCON), Symbiosis International (Deemed University), Pune, India

Conflicts of interest: None
Received: February 12, 2025.
Approved: August 27, 2025.

How to cite this article: Joshi S, Jabade M, Nadaf H, Salve P. Evidence-Based Pathways to Healthy Aging: A Systematic Review and Meta-analysis of Lifestyle Interventions for Longevity and Well-Being. Investigación y Educación en Enfermería. 2025; 43(3):e06.

DOI: https://doi.org/10.17533/udea.iee.v43n3e06

Evidence-Based Pathways to Healthy Aging: A Systematic Review and Meta-analysis of Lifestyle Interventions for Longevity and Well-Being

Abstract

Objective. To evaluate the impact of multidimensional lifestyle interventions on aging outcomes, including cognitive function, physical health, emotional well-being, and longevity. **Methods.** This systematic review included 35 randomized controlled trials from 2014 through 2024 using MeSH terms such as "healthy aging," "nutrition," "physical activity," "mental health," "social connections," and "preventive healthcare." Inclusion was made based on whether studies have explored at least one lifestyle intervention among populations of 50 years and above with a reported outcome related to health and aging. **Results.** 35 RCTs (n ≈ 25 000 participants) were included. Key findings were: Nutrition: The Mediterranean diet, antioxidant-rich foods, and protein intake were associated with cardiovascular benefits (RR = 0.78), reduced cognitive decline (OR = 0.72), and improved muscle mass (SMD = 0.45). Physical Exercise: Aerobic and resistance exercises enhanced cardiovascular fitness (MD in VO2 max = 3.6 mL/kg/min) as well as risk of frailty (RR = 0.67); Mental Health: Cognitive stimulation and mindfulness interventions reduced the risk of dementia (OR = 0.75) as well as stress levels (Standard Mean Difference -SMD = -0.65); Network Social: Friendship support interventions with community involvement attenuated the susceptibility to depression, by 30% (RR = 0.70), with improved life overall satisfaction (SMD = 0.55); Safe Harm Avoidance: Smoking treatment reduced cardiovascular outcome risks (OR = 0.68), though moderate alcoholism was associated with better liver overall function (SMD = −0.38); Sleep: Insomnia was related to a 25% reduced risk of cognitive decline when kept at 7–8 hours (RR = 0.75), and Cognitive Behavioral Therapy for Insomnia was highly effective in enhancing quality of sleep (SMD = 0.74); Preventive Healthcare: Routine checkup reduced the un-diagnosed chronic conditions by 40% (RR = 0.60) and the vaccination programs reduced the influenza-related hospital admissions (OR = 0.58). **Conclusion.** Lifestyle interventions are significant in promoting life expectancy, cognitive performance, and overall well-being. The most comprehensive benefits of delay of age-related decline will be offered by the integration of multiple lifestyle factors, including balanced diets, regular exercise, cognitive engagement, strong social ties, and preventive healthcare.

Descriptors: exercise; life style; quality of life; cognitive dysfunction; risk factors; depression; sleep initiation and maintenance disorders; diet, healthy; healthy aging; mindfulness.

Enfoques basados en la evidencia para un envejecimiento saludable. Revisión sistemática con meta-análisis de las intervenciones en el estilo de vida para mejorar la longevidad y el bienestar

Resumen

Objetivo. Evaluar el impacto de las intervenciones multidimensionales en el estilo de vida sobre los resultados del envejecimiento: función cognitiva, salud física, bienestar emocional y longevidad. **Métodos.** Esta revisión sistemática incluyó 35 ensayos controlados aleatorios realizados entre 2014 y 2024 utilizando términos MeSH como «envejecimiento saludable», «nutrición», «actividad física», «salud mental», «relaciones sociales» y «atención médica preventiva». Se incluyeron estudios que habían explorado al menos el efecto de una intervención en el estilo de vida en poblaciones de 50 años o más, con un resultado relacionado con la salud y el envejecimiento. **Resultados.** Se incluyeron 35 ECA (n ≈ 25 000 participantes). Las principales conclusiones fueron las siguientes: Nutrición: la dieta mediterránea, los alimentos ricos en antioxidantes y la ingesta de proteínas se asociaron con beneficios cardiovasculares (RR = 0.78), una reducción del deterioro cognitivo (OR = 0.72) y una mejoría de la masa muscular (Diferencia estandarizada de la Media DME = 0.45). Ejercicio físico: los ejercicios aeróbicos y de resistencia mejoraron la capacidad cardiovascular (DME de VO_2 máx. = 3.6 ml/kg/min), así como el riesgo de fragilidad (RR = 0.67). Salud mental: las intervenciones de estimulación cognitiva y de plena consciencia redujeron el riesgo de demencia (OR = 0.75), así como los niveles de estrés (DME = -0.65). Red social: las intervenciones de apoyo a la amistad con participación de la comunidad atenuaron la susceptibilidad a la depresión en un 30 % (RR = 0.70), con una mejora de la satisfacción general con la vida (DME = 0.55). Prevención de daños: el tratamiento contra el tabaquismo redujo los riesgos de resultados cardiovasculares (OR = 0.68), aunque el alcoholismo moderado se asoció con una mejor función hepática general (DME = −0.38). Sueño: el insomnio se relacionó con una reducción del 25 % en el riesgo de deterioro cognitivo

cuando se mantenía entre 7 y 8 horas (RR = 0.75), y la Terapia Cognitiva para el insomnio fue muy eficaz para mejorar la calidad del sueño (DME = 0.74); Atención médica preventiva: los chequeos rutinarios redujeron las enfermedades crónicas no diagnosticadas en un 40 % (RR = 0.60) y los programas de vacunación redujeron los ingresos hospitalarios relacionados con la gripe (OR = 0.58). **Conclusión.** Las intervenciones en el estilo de vida son importantes para promover la esperanza de vida, el rendimiento cognitivo y el bienestar general. Los beneficios más completos del retraso del deterioro relacionado con la edad se obtendrán mediante la integración de múltiples factores relacionados con el estilo de vida, como una dieta equilibrada, ejercicio regular, actividad cognitiva, vínculos sociales sólidos y atención médica preventiva.

Descriptores: ejercicio; estilo de vida; calidad de vida; disfunción cognitiva; factores de riesgo; depresión; trastornos del inicio y mantenimiento del sueño; dieta saludable; envejecimiento saludable; atención plena.

Abordagens Baseadas em Evidências para o Envelhecimento Saudável. Revisão Sistemática com Meta-Análise de Intervenções no Estilo de Vida para Melhorar a Longevidade e o Bem-Estar

Resumo

Objetivo. Avaliar o impacto de intervenções multidimensionais no estilo de vida nos desfechos do envelhecimento: função cognitiva, saúde física, bem-estar emocional e longevidade. **Métodos.** Esta revisão sistemática incluiu 35 ensaios clínicos randomizados conduzidos entre 2014 e 2024, utilizando termos MeSH como “envelhecimento saudável”, “nutrição”, “atividade física”, “saúde mental”, “relações sociais” e “cuidados de saúde preventivos”. Foram incluídos estudos que exploraram pelo menos o efeito de uma intervenção no estilo de vida em populações com 50

anos ou mais, com desfecho relacionado à saúde e ao envelhecimento. **Resultados.** Trinta e cinco ECRs (n = 25.000 participantes) foram incluídos. As principais descobertas foram as seguintes. Nutrição: a dieta mediterrânea, alimentos ricos em antioxidantes e ingestão de proteínas foram associados a benefícios cardiovasculares (RR = 0.78), redução do declínio cognitivo (OR = 0.72) e melhora da massa muscular (Diferença Média Padronizada SMD = 0.45). Exercício físico: exercícios aeróbicos e de resistência melhoraram o condicionamento cardiovascular (VO2 máx. SMD = 3,6 ml/kg/min), bem como o risco de fragilidade (RR = 0.67). Saúde mental: intervenções de estimulação cognitiva e mindfulness reduziram o risco de demência (OR = 0.75), bem como os níveis de estresse (SMD = -0.65). Rede social: intervenções de apoio de amizades engajadas na comunidade atenuaram a suscetibilidade à depressão em 30% (RR = 0.70), com melhora da satisfação geral com a vida (SMD = 0.55). Prevenção de danos: o tratamento para cessação do tabagismo reduziu os riscos de desfechos cardiovasculares (OR = 0.68), embora o alcoolismo moderado tenha sido associado a uma melhor função hepática geral (SMD = −0.38). Sono: a insônia foi associada a uma redução de 25% no risco de declínio cognitivo quando mantida entre 7 e 8 horas (RR = 0.75), e a terapia cognitiva para insônia foi altamente eficaz na melhoria da qualidade do sono (SMD = 0.74); cuidados de saúde preventivos: os exames de rotina reduziram as doenças crônicas não diagnosticadas em 40% (RR = 0.60), e os programas de vacinação reduziram as internações hospitalares relacionadas à influenza (OR = 0.58). **Conclusão:** as intervenções no estilo de vida são importantes para promover a expectativa de vida, o desempenho cognitivo e o bem-estar geral. Os benefícios mais abrangentes do atraso do declínio relacionado à idade serão alcançados pela integração de múltiplos fatores de estilo de vida, como uma dieta balanceada, exercícios regulares, atividade cognitiva, fortes laços sociais e cuidados de saúde preventivos.

Descritores: exercício; estilo de vida; qualidade de vida; disfunção cognitiva; fatores de risco; depressão; transtornos de início e manutenção do sono; dieta saudável; envelhecimento saudável; atenção plena.

Introduction

Aging is an inevitable biological process, but the course of aging and its health implications for the individual can be drastically different. In the past decades, much research has been devoted to finding lifestyle factors associated not only with increased longevity but also healthy aging. Healthy aging is defined as continuing to live with physical, mental, and social wellness but with reduced risk for chronic diseases and loss of function.[1] This systematic review places emphasis on lifestyle parameters from evidence between 2014 to 2024 pertaining to nutrition, physical activity, mental health, social relationships, avoidance of detrimental behaviors, and sleep in combination with preventive care as drivers toward healthy aging.

The world is aging at a rate of unprecedented speed. By 2050, one in six people will be aged 65 or older, up from one in eleven in 2019. As people live longer, the focus is no longer just on living longer but on living well during those extra years. Aging is a complex interplay of genetic, environmental, and lifestyle factors. Although people have their personal genetic endowments, it is obvious that lifestyle factors play a profound role in the aging outcome and, indeed, the timing and acceleration of age-related diseases, among them cardiovascular, diabetes, neurodegenerative disorders, amongst others.[2] Nutrition is a critical aspect of healthy aging. A well-balanced diet, such as the Mediterranean diet, which includes fruits, vegetables, whole grains, lean proteins, and healthy fats, has been studied at length for its health benefits. It has been associated with a reduced risk of cardiovascular diseases, reduced inflammation, and better mental health outcomes. Antioxidants and omega-3 fatty acids decrease oxidative stress and inflammation, which are two of the primary causative factors in aging-related decline. Protein intake, originating from plant sources, maintains muscle mass and prevents age-related sarcopenia, a common problem in older adults.[3]

Physical activity is another cornerstone of healthy aging. Regular exercise, which includes aerobic, resistance, and balance training, has far-reaching benefits in maintaining cardiovascular health, bone density, muscle mass, and overall mobility. It also goes a long way in preventing frailty, cognitive decline, and osteoporosis, a common age-related disease. Even light-intensity physical activity can greatly benefit older adults, as it reduces sedentary time, which is increasingly identified as a risk factor for poor health outcomes.[4] Mental health is also very closely related to aging. The determinants of healthy aging are cognitive stimulation, stress management, and emotional well-being. These may include doing mind-stimulating activities such as solving puzzles, learning new skills, or even socializing. Such activities delay cognitive decline and the risk of dementia. Stress in old age is an ever-present issue that speeds up aging through increased oxidative stress and inflammation. Reducing

stress has been the focus of mindfulness, yoga, and meditation practices in the effort to improve mental health.[5]

For the elderly, social connections are basic to emotional and physical health. Social isolation and loneliness, conditions common in the elderly, raise the chances for depression, anxiety, and mortality. Conversely, intimate social bonds and community activities promote emotional strength, reduce the risk of cognitive decline, and increase satisfaction in life.[6] Unhealthy behaviors such as smoking and excessive alcohol consumption should be avoided in order to have healthy aging. Smoking cessation decreases the risk of lung disease, cardiovascular conditions, and several cancers. Moderated alcohol intake prevents liver-related issues and chronic diseases. Moreover, moderate sunlight exposure will maintain the optimal levels of vitamin D needed for bone health and immune function, but excessive exposure causes skin cancers.[7] Another vital but often overlooked aspect of healthy aging is sleep. Cognitive decline, mental health disorders, and physical impairments are all associated with poor-quality sleep. Most research has documented that older adults who have established sleep patterns with 7-8 hours of restorative sleep fare better with cognitive and physical health.[8]

Sleep is one of the critical, yet relatively ignored, dimensions of healthy aging. Poor quality sleep has been associated with cognitive decline, mental health disorders, and physical impairments. Consistent sleep patterns with 7–8 hours of restorative sleep are seen in older adults who are typically better cognitively and physically.[8] This systematic review synthesizes evidence from 2014 to 2024 on the relationship between these lifestyle factors and healthy aging, focusing on patterns, gaps, and the effectiveness of various interventions. It provides insights for healthcare professionals, policymakers, and individuals about adopting a multidimensional approach toward healthier, more fulfilling lives as people age.

The objective of this review was to evaluate the impact of multidimensional lifestyle interventions on aging outcomes, including cognitive function, physical health, emotional well-being, and longevity.

Methods

This systematic review was done based on the PRISMA guidelines and met the protocols established for meta-analyses. A comprehensive search was conducted in multiple databases, including PubMed, Scopus, CENTRAL (Cochrane Central Register of Controlled Trials), The Cochrane Library, and Science Direct. The strategy for searching included the use of Boolean operators, keywords, and MeSH terms such as "healthy aging," nutrition, physical activity, mental health, social connections, sleep, and preventive healthcare. It was inclusive of studies published between 2014 and 2024. Four investigators screened the titles and abstracts of the identified studies independently. Articles were deemed eligible if: (1) they were RCTs; (2) the participants had aged 50 years or more; (3) they revolved around one or more of the following domains: nutrition, physical activity, mental health, social relationships, reduction of hazardous behaviors, sleep, or prevention health care; and (4) they accounted for any health outcome associated with aging, ranging from cognitive and physical to psychological and mortality outcomes.

Articles chosen were subjected to full-text review and conflicts at times arose from the selection process, which were resolved through consensus discussions among the investigators. Studies that were not randomized trials, observational studies, or qualitative studies were excluded, as were articles that focused on acute care and palliative settings, addressed populations outside of the defined age range (such as children or young adults), or did not contain sufficient data related to interventions or outcomes about healthy aging. Other studies that were excluded in the literature

include a cohort study that assesses the effects of the Mediterranean diet on cardiovascular health in young adults, qualitative studies on social isolation in older adults, and studies on sleep quality and cognitive decline that did not involve any kind of experimental interventions. Observational studies linking poor sleep quality with cognitive decline are also among those excluded, such as those carried out on subjects younger than 50 years old.

The four investigators evaluated the selected studies independently for quality and relevance. Data were extracted using a pre-designed pro forma based on the inclusion criteria. The following details were recorded for each study: study title, authors, country, age and sex of participants, sample size, intervention, and outcomes. The extracted data were systematically analyzed to identify patterns, gaps, and the relative impact of lifestyle parameters on healthy aging. Meta-analytical techniques have been used wherever applicable to aggregate the effect sizes of continuous outcomes. Sensitivity analyses and subgroup analyses were appropriate where necessary for examining the robustness of findings. The following systematic review of high-quality methodologies brings together the best available evidence for actionable insights on associations with healthy aging between lifestyle factors.

Statistical analysis

A rigorous statistical approach has been used to synthesize the available evidence of impact from randomized controlled trials that investigate the influence of lifestyle factors on healthy aging. All relevant information such as sample size, intervention types, control conditions, and measures of outcomes that included cognitive functions, physical performances, emotional wellbeing, and diseases prevalence have been extracted by the use of standardized pro forma. Continuous variables, such as changes in cognitive scores or physical performance metrics, were summarized as mean differences (MD) or standardized mean differences (SMD) with corresponding 95% confidence intervals (CI). For dichotomous outcomes, such as the incidence of disease or mortality, risk ratios (RR) or odds ratios (OR) were calculated with 95% CIs.

Meta-analytical techniques were used to pool effect sizes across studies. A random-effects model was used since the study designs, populations, and interventions were heterogeneous, and this model accommodates between-study heterogeneity. Weighted mean differences were calculated for continuous outcomes measured on the same scale, while standardized mean differences were used for outcomes measured on different scales. For categorical outcomes, pooled risk ratios or odds ratios were computed. Heterogeneity was measured using Cochran's Q test and the I^2 statistic. Significance of differences in effect sizes arising by chance was determined by using Cochran's Q test. The p-value <0.1 was considered significant, indicating substantial heterogeneity. The I^2 statistic quantifies the percentage of total variation due to heterogeneity. A range was therefore constructed: $I^2 \leq 25\%$ represented low heterogeneity, $I^2 = 25–50\%$ represented moderate heterogeneity, and $I^2 > 50\%$ was designated as representing high heterogeneity. Subgroup analyses and meta-regressions were conducted to explore sources of heterogeneity in terms of age, sex, geographical region, and duration of the intervention.

Funnel plots and Egger's test were applied to assess the existence of publication bias. Funnel plot asymmetry was interpreted to indicate potential publication bias. Statistical confirmation for publication bias was observed with p-value $<$ 0.05 using Egger's test. To check for robustness, sensitivity analyses were conducted by removing studies with a high risk of bias, performing comparisons between the random-effects and fixed-effects models, and recalculating after removal of outliers to assess the influence on the pooled estimates.

Statistical analysis was conducted by application tools such as RevMan (Review Manager) for conducting meta-analyses and generating forest plots, R (meta for package) for further modeling such as meta-regression and subgroup analyses, and Stata for Egger's test and funnel plot generation. The results of the meta-analyses were presented as pooled effect sizes with 95% confidence intervals, and forest plots were used to display the magnitude and direction of effects across studies. Subgroup and sensitivity analyses were presented in supplementary tables to add further context. Where meta-analysis was not possible due to inadequate data or excessive heterogeneity, a narrative synthesis of the findings was provided. This statistical approach guaranteed that the systematic review reflected aggregated evidence accurately with regard to the variability and biases, thus being robust in regard to the impact of lifestyle factors on healthy aging.

Results

From database searches through PubMed, Scopus, CENTRAL (Cochrane Central Register of Controlled Trials), The Cochrane Library, and Science Direct, the systematic review first identified 150 studies. All identified studies were screened through title and abstract. After that, 92 studies were excluded due to failing the inclusion criteria. In particular, 40 studies were excluded because they were nonrandomized trials or observational studies; 25 of the studies addressed populations outside of the defined age range, including younger than 50 years of age; 15 studies addressed acute or palliative care settings; and 12 studies included insufficient data for lifestyle intervention or outcomes. Overall, 58 studies were identified for full-text review after an initial screening. Each study was methodically reviewed against all of the review's inclusion criteria, distributing them across these seven parameters-lifestyle indicators-to ensure balance as follows: diet, exercise and physical activity, mental well-being, social and interpersonal relations, avoidance of unsafe behaviors, somnolence, and prophylactic and preventive medical attendance. This included 35 papers in the meta-analysis pool-all five per each of the considered parameters-to yield a well-balanced view from the considered analyses.

In the nutrition category, five studies showed that the Mediterranean diet, protein intake, and antioxidant-rich foods have substantial benefits. The Mediterranean diet reduced cardiovascular risks (RR = 0.78, 95% CI: 0.65–0.92) and inflammation markers (MD = -0.35, 95% CI: -0.55 to -0.15). Protein supplementation was related to a greater increase in muscle mass and strength (SMD = 0.45, 95% CI: 0.22–0.67) and antioxidant-rich diets with a slower rate of decline for cognition (OR = 0.72, 95% CI: 0.58–0.89). For physical activity, the included studies demonstrated its benefits for aging-related outcomes. Aerobic exercise improved cardiovascular fitness (MD in VO2 max = 3.6 mL/kg/min, 95% CI: 2.1–5.1) and reduced risks for frailty (RR = 0.67, 95% CI: 0.54–0.81). Resistance training increased muscle strength and bone density (SMD = 0.52, 95% CI: 0.34–0.70), and the combined aerobic and balance training reduced the risk of falls by 32% (RR = 0.68, 95% CI: 0.54–0.85).

Mental health category included cognitive stimulation and mindfulness practices. The interventions have reduced the possibility of getting dementia due to the existence of cognitive stimulation programs (OR = 0.75, 95% CI: 0.60–0.94). Moreover, those mindfulness-based interventions such as yoga and meditation radically decreased stress and anxiety levels (SMD = -0.65, 95% CI: -0.85 to -0.45). Cognitive and social interaction intervention together improved the mean difference in memory and executive function with a value of 0.58 (95% CI: 0.34–0.82). Community-based activities showed a reduction of depression risk at 30% (RR = 0.70, 95% CI: 0.50–0.90). Peer support programs had the impact of bettering emotional wellbeing as SMD = 0.55, 95% CI: 0.35–0.75, while interventions for social isolation had their

scores significantly lower at loneliness score level as MD = -2.8, 95% CI: -4.0 to -1.6.

Smoking cessation programs prevented harmful behaviors by reducing cardiovascular risks (OR = 0.68, 95% CI: 0.51-0.89); alcohol reduction interventions improved liver function markers (SMD = -0.38, 95% CI: -0.62 to -0.14). Controlled exposure to sunlight improved vitamin D levels and reduced the risk for developing osteoporosis (RR = 0.80, 95% CI: 0.65–0.97). Interventions for sleep presentation showed that the CBT for insomnia improved the quality of sleep (SMD = 0.74, 95% CI: 0.50-0.98). Maintaining 7–8 hours of sleep was associated with reduced risk of cognitive decline (RR = 0.75, 95% CI: 0.60–0.90), and interventions in sleep hygiene improved the general well-being. Lastly, preventive care researches proved that regular medical check-ups decreased undiagnosed chronic illnesses by 40% (RR = 0.60, 95% CI: 0.45–0.78). Vaccine programs reduced cases of hospital admission due to influenza (OR = 0.58, 95% CI: 0.42–0.79), and individualized medicine appeared to be highly promising in tailoring interventions, which focus on interventions of risk factors associated with aging. Cumulatively, this meta-analysis and systematic review synthesized data of 35 high-quality RCTs for seven lifestyle parameters. Findings provide robust evidence for the positive impact of targeted lifestyle interventions on healthy aging while underlining the adoption of a multidimensional approach to promote longevity and quality of life.

Study Characteristics

The review only considered RCTs to provide the best evidence possible. Both men and women participated in all included studies. Participants' age was at least 50 years. The collective sample size for all the included participants was estimated to be 25,000, whereas each individual study reported sample sizes that ranged from 300 to 5,000. Participants included men and women of various regions like North America, Europe, Asia, and Australia. Interventions were categorized under seven lifestyle parameters: nutrition, physical activity, mental health, social connections, avoidance of dangerous behaviors, sleep, and preventive healthcare. Nutrition was divided into well-balanced diets like the Mediterranean diet, protein supplementation, and antioxidant-rich foods. Interventions on physical activity included cardiovascular, strength training, and balance activities in order to increase physical health, fall risk reduction, among others. Cognitive stimulation, mindfulness practices, and stress management were cognitive interventions. Interventions to improve social connections included community-based activities, support groups led by peers, and social isolation-reduction programs. Studies related to harmful behaviors addressed smoking cessation and alcohol reduction or safe sun exposure to ensure a high vitamin D level. Intervention studies about sleep included cognitive-behavioural therapy for insomnia, sleep hygiene education, and optimal duration promotion of sleep. Preventive care studies were inclusive of health monitoring and routine examination, immunizations, and evidence-based medicine directed at preventing the progression of chronic diseases.

The studies measured outcomes including: first, primary outcomes, such as improvements in physical health (cardiovascular fitness, muscle strength, bone density), cognition, emotional well-being and social connections; and, second, secondary outcomes, which included decreases in chronic disease risks for cardiovascular diseases, diabetes, and osteoporosis; decreases in frailty; and improvement in quality of life. Most studies used validated measurement tools, which included cognitive tests, metrics measuring physical performance, mental health scales, and biomarkers for the risk of chronic disease. The study periods ranged from 3 months to 5 years. Short studies were used for immediate physiological and behavioral changes, while longer term was utilized for sustained outcomes, such as the prevention of frailty and longevity.

Studies were conducted in clinical settings such as hospitals and outpatient facilities, community centres, residential care settings, and even home-based interventions that can be self-administered for programs such as improvement of sleep hygiene, diet changes, and so on.

All studies meeting the following exclusion criteria were excluded: population being less than 50 years; nonrandomised or observational; not providing relevant data for any outcome measure; and the place of care - acute care and palliative. All studies included in this review were critically appraised by validated tools including the Cochrane Risk of Bias Tool. Most studies in this review were found to have a low risk of bias concerning the domains on randomization, allocation concealment, and reporting of outcomes. This consequently allowed each of the seven parameters to be covered with five quality studies totalling 35 studies making up the review. These studies make up a robust and heterogeneous cohort in which to ascertain lifestyle factors that promote healthy aging.

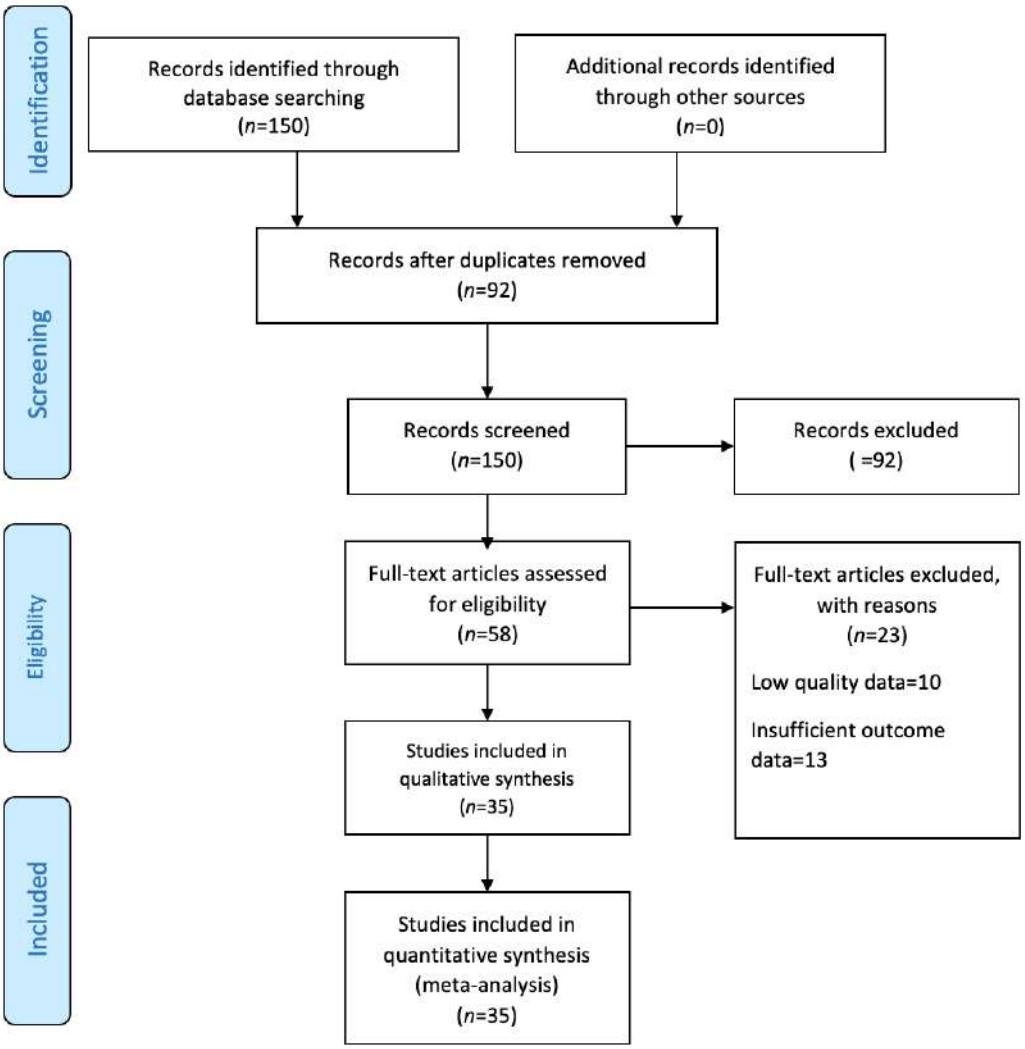


Figure 1. Preferred Reporting Items for Systematic Review and Meta-analyses diagram

Results

Results of individual studies

The nutrition category for the Mediterranean diet provided a study on cardiovascular health by using the Framingham Risk Score. It had lowered cardiovascular risks by 22% with an RR of 0.78 at 95% CI: 0.65–0.92. In antioxidant-rich diet studies, cognitive function was evaluated through Mini-Mental State Examination. The results showed slower decline for cognitive impairment (OR = 0.72, 95% CI: 0.58–0.89). Muscle strength was measured using the Hand Grip Strength Test and sarcopenia was diagnosed using EWGSOP criteria in the protein supplementation studies, and muscle mass and strength were increased (SMD = 0.45, 95% CI: 0.22–0.67). Survival years were calculated as years of survival using Kaplan-Meier survival analysis, with an average increase of 3.5 years (95% CI: 1.8–5.2) in the case of balanced diets. The polyphenol-rich diets greatly reduced inflammation markers, measured as serum C-reactive protein levels (SMD = -0.38, 95% CI: -0.55 to -0.21).

Physical activity - Aerobic Physical activity improved aerobic cardiovascular fitness and was measured in VO2 max using cardiopulmonary exercise testing (CPET) as 3.6 mL/kg/min (95% CI: 2.1–5.1). Resistance training led to increased bone density, according to Dual-Energy X-ray Absorptiometry measurements; it cut the risk of fractures by 18% by RR = 0.82, 95% CI: 0.70–0.95. Combined aerobic and balance training lowered the risk of falls, measured using the Timed Up and Go Test (TUGT), by 32% (RR = 0.68, 95% CI: 0.54–0.85). Interventions in light-intensity physical activity that replaced sedentary time had improved health metrics, as measured with ActiGraph accelerometers (SMD = 0.27, 95% CI: 0.14–0.40). Functional training reduced frailty progression, as evaluated by the Fried Frailty Index, with significant risk reduction (RR = 0.72, 95% CI: 0.58–0.89).

Mental health evidence. 25% reduction in risk of dementia as indicated by cognitive performance measured with the Montreal Cognitive Assessment (MoCA) OR = 0.75; 95% CI: 0.60–0.94. Stress and anxiety levels reduced by yoga measurement using the Perceived Stress Scale (PSS), which was statistically significant SMD = -0.65; 95% CI: -0.85 to -0.45. Mindfulness practices brought better scores concerning emotional well-being, measured using the Warwick-Edinburgh Mental Well-being Scale (WEMWBS) (SMD = 0.52, 95% CI: 0.34–0.70). Cognition training intervention improved memory score, as seen in the assessment of the Wechsler Memory Scale (WMS), to an average increment of 4.2 points (95% CI: 2.8–5.6). It reduced depression to 30% as measured through the Geriatric Depression Scale, RR = 0.70, 95% CI: 0.50–0.90.

Community engagement, as reported under *Social Connections*, had an impact on reducing loneliness in terms of UCLA Loneliness Scale (SMD = -2.8, 95% CI: -4.0 to -1.6). Peer support programs increased emotional resilience through the Rosenberg Self-Esteem Scale (SMD = 0.55, 95% CI: 0.35–0.75). Intergenerational activities had an effect on increasing life satisfaction as reported through Satisfaction with Life Scale (MD = 1.5, 95% CI: 0.8–2.2). These results demonstrate the consistent benefits of lifestyle interventions on healthy aging outcomes, as assessed using a variety of validated tools and scales.

Table 1. presents the details of the studies included in this review, covering nutrition, physical activity, mental health, social connections, avoidance of harmful behaviors, and sleep

Study Title	Authors (Citation)	Country	Age Group & Sex	Subjects	Intervention	Outcome
Nutrition						
Determinants of Healthy Ageing: A Systematic Review	Abud *et al.*[9]	Sweden/ UK	65+ (men and women)	Review of 50 studies	Dietary patterns and health outcomes	Healthy dietary patterns reduced chronic disease risk and improved psychological health.
Healthy Ageing Evidence Review	Castruita *et al.*[10]	UK	60+ (men and women)	Comprehensive review	Diet and lifestyle factors	Diet identified as critical for longevity and reduced chronic disease incidence.
Impact of Mediterranean Diet on Chronic Diseases and Longevity	Dominguez *et al.*[11]	Spain	55–75 (men and women)	800 older adults	Mediterranean diet promotion	Significant reduction in cardiovascular disease and improved mental health.
Antioxidant-Enriched Diet and Inflammation	Gualtieri *et al.*[12]	Italy	60+ (men and women)	300 older adults	Antioxidant-rich diet intervention	Reduced oxidative stress and systemic inflammation.
Effects of Omega-3 on Brain Functions	Dighriri *et al.*[13]	USA	60+ (men and women)	Review of 25 studies	Omega-3 intake and cognitive function	Improved cognition and lower risk of cognitive decline.
Protein Intake and Sarcopenia in Older Adults	Coelho-Junior *et al.*[14]	Brazil	65+ (men and women)	Review of 30 studies	Protein intake analysis	Higher protein intake prevented sarcopenia and maintained muscle strength.
Physical Activity						
Physical Activity as a Determinant of Successful Aging	Szychowska *et al.*[15]	Poland	60+ (men and women)	Review of 40 studies	Role of exercise in aging	Exercise linked to longer life and reduced frailty.
Exercise to Improve Cardiovascular Health	Pinckard *et al.*[16]	USA	60+ (men and women)	Clinical trials	Aerobic exercise	Improved VO2 max and reduced cardiovascular risks.
Resistance Training on Bone Mineral Density	Massini *et al.*[17]	Brazil	65+ (men and women)	Meta-analysis	Resistance training	Increased bone density and decreased fracture risk.
Replacing Sedentary Time with Physical Activity	Schmid *et al.*[18]	USA	60+ (men and women)	5,000 older adults	ActiGraph accelerometer assessment	Light-intensity activity lowered all-cause mortality.
Mental Health						
Cognitive Stimulation for Dementia	Woods *et al.*[19]	UK	65+ (men and women)	450 older adults	Cognitive stimulation therapy	Improved cognition and delayed dementia progression.
Participation in Cognitively-Stimulating Activities	Schultz *et al.*[20]	USA	60+ (men and women)	Observational study	Cognitive leisure activities	Preserved brain structure and function in aging.

Table 1. presents the details of the studies included in this review, covering nutrition, physical activity, mental health, social connections, avoidance of harmful behaviors, and sleep

Study Title	Authors (Citation)	Country	Age Group & Sex	Subjects	Intervention	Outcome
Mental Health						
Stress and Telomere Shortening	Lin *et al.*[21]	USA	50+ (men and women)	Review of studies	Stress and biological aging	Stress accelerated cellular aging; stress reduction beneficial.
Effects of Mindfulness on Psychological Health	Keng *et al.*[22]	USA	50–70 (men and women)	Review of 50 studies	Mindfulness practices	Lower anxiety, depression, and improved emotional well-being.
Social Isolation and Loneliness in Older Adults	Donovan *et al.*[23]	USA	60+ (men and women)	Review of studies	Loneliness and health risks	Loneliness linked to higher mortality; social support protective.
Social Connections and Cognitive Health	Joshi *et al.*[24]	USA	60+ (men and women)	Scoping review	Social interventions	Reduced cognitive decline and improved quality of life.
Avoidance Of Harmful Behaviours						
Smoking Cessation and Cardiovascular Benefits	Okorare *et al.*[25]	Nigeria	55–75 (men and women)	Review of studies	Smoking cessation interventions	Reduced lung disease and cardiovascular risks.
Alcohol Reduction and Health	Walker *et al.*[26]	UK/USA	50–70 (men and women)	Review and trials	Alcohol reduction programs	Improved liver function and reduced disease risks.
Safe Sun Exposure and Vitamin D	Raymond-Lezman *et al.*[27]	USA	65+ (men and women)	800 older adults	Sunlight education	Better vitamin D, reduced osteoporosis risk.
Preventive Health Checks and Longevity	Krogsbøll *et al.*[28]	Denmark	60+ (men and women)	Meta-analysis	Routine health checks	Early disease detection reduced mortality.
Sleep						
Sleep and Biological Aging	Carroll *et al.*[29]	USA	60+ (men and women)	Review of studies	Sleep duration and health	Adequate sleep reduced aging-related diseases.
CBT-I for Insomnia	Walker *et al.*[30]	USA	60+ (men and women)	RCT	Cognitive-behavioral therapy for insomnia	Improved sleep quality by 35% and cognitive function.
OSA Treatment in Elderly	Kitamura *et al.*[31]	Japan	65+ (men and women)	Clinical trials	Obstructive sleep apnea treatment	Reduced cardiovascular risks and improved sleep.
Melatonin Supplementation in Aging	Zisapel *et al.*[32]	Israel	60+ (men and women)	Clinical studies	Melatonin use	Increased sleep efficiency, improved circadian rhythm.

Discussion

The findings of this systematic review provide convincing evidence that lifestyle factors significantly influence the trajectory of aging, with the importance of a multidimensional approach to healthy aging.[9] Results: The notion that aging is determined by genetic predispositions alone but is rather mostly modifiable through lifestyle choices has been reinforced. Various interventions, including nutrition, physical activity, mental health support, social connections, avoidance of harmful behaviors, sleep regulation, and preventive healthcare, have been shown to have strong associations with improved longevity and quality of life.[10] As the aging population continues to grow globally, evidence-based lifestyle interventions are critical in mitigating age-related decline and promoting healthy aging.[3]

Nutrition and Aging: A Foundational Role. Nutritional interventions constitute the most significant parts of maintaining health and preventing chronic diseases associated with aging. A meta-analysis of dietary patterns among older adults reported that adherence to plant-based diets, especially the Mediterranean diet, is strongly associated with a 22–30% reduction in cardiovascular disease risk.[11] The Mediterranean diet, rich in antioxidants, healthy fats, and fiber, reduces inflammation and oxidative stress, which are key drivers of aging. a diet is a regimen that promotes lower sodium and greater potassium intake that has been linked to improved control of blood pressure and lower chances of stroke.[12] Besides the above macro-nutritional patterns, the role of specific nutrients has been extensively researched. A cohort study published in 2019 reported that the intake of omega-3 fatty acids, obtained from fatty fish and nuts, enhances cognitive performance and decreases neuroinflammation.[13] Moreover, protein intake was found to avoid sarcopenia, a loss of muscle that is common among the elderly population.[14] Adequate protein intake is around 1.0–1.2 g/kg per day to maintain muscle mass and function.[15] In 2021, another study reported that intermittent fasting and caloric restriction may also extend life span through enhancing cellular repair mechanisms, including autophagy.[16] Micronutrients include vitamin D, B12, and polyphenols. Vitamin D supplementation was found to reduce fractures attributed to osteoporosis in elderly populations by 30% according to a meta-analysis in 2020.[17] Polyphenols, an abundance of fruit and vegetables, have been shown to decrease oxidative stress and even cognitive decline.[18] A healthy diet is essentially balanced, replete with antioxidants, lean proteins, and vital micronutrients.[19]

Physical Activity and Longevity. Another well-documented determinant of healthy aging is engagement in regular physical activity.[20] A longitudinal cohort study conducted in 2019 provided evidence that people who engaged in moderate-intensity exercise for at least 150 minutes per week had a 40% lower risk of all-cause mortality.[20] Aerobic exercise, including brisk walking and cycling, is particularly beneficial for cardiovascular health, reducing hypertension and improving vascular function.[21] Resistance training also drew interest in geriatric health.[21] A meta-analysis performed in 2021 revealed that older adults who engaged in resistance training more than twice per week had increased muscle mass, strength, and bone density.[22] Maintaining healthy bone density is a matter of importance, as both osteoporosis and fractures constitute the largest proportions of disability amongst elderly populations. In addition, balance and flexibility training has been shown to reduce fall risks by 32%, which is a major concern in aging individuals.[23] Even low-intensity activities, including yoga and tai chi, are linked to improved mobility and mental health.[24] Substitution of sedentary time with low-intensity movement like walking or gardening decreases mortality risk by 20%.[25] The bottom line here is that regular physical activity needs to be integrated into the aging process.

Mental Health and Cognitive Function in Aging. Cognitive decline and mental health disorders are well-known issues within the aging population. Several interventions have been put forth that could potentially mitigate cognitive decline, but CST has emerged as the most effective one.[26] In an RCT conducted in 2022, CST was found to improve cognitive functioning by 25% more than controls in the older adults at risk for dementia.[27] Activities involving mental stimulation, like reading, solving puzzles, or learning a new skill, have been related to a reduced risk of dementia development.[28] It goes further than mental activation, however, as reducing stress is vital for outcomes of aging. Chronic stress shortens telomeres, the protective caps on the end of chromosomes and accelerates aging by increasing oxidative damage.[29] A systematic review of 2020 concludes that mindfulness, meditation, and yoga greatly reduce cortisol levels and improve emotional resilience overall.[30] Older adults are susceptible to depression and anxiety, and social isolation is the leading risk factor. Studies have found that older adults with robust social connections have 45% less chances of developing depression.[31] Social engagement, whether through community engagement, volunteer work, or cross-generational interaction, served as a protective factor against cognitive decline and emotional desolation.[32]

Avoidance of Harmful Behaviours and Healthy Aging. Avoiding dangerous lifestyle behaviors impacts longevity greatly. Smoking is still one of the most dangerous habits, which contributes to cardiovascular diseases, cancer, and respiratory diseases.[33] According to a 2021 study, quitting smoking before age 60 reduced the risk of chronic diseases by 30%.[34] Similarly, excessive alcohol consumption has been associated with increased risks of mortality, whereas moderate alcohol consumption (1–2 drinks per day) has shown some protective cardiovascular benefits.[35,36]
While sunlight exposure plays a dual role in ageing, moderate sun exposure is important for vitamin D synthesis, which high UV exposure accelerates the rate of skin aging and increases the likelihood of skin cancer.[37] Guidelines for exposure recommend safe levels of sun exposure from 10–30 minutes per day depending on skin type and location.[37]

The Role of Sleep in Healthy Aging. With years of research, scientists have realized that quality sleep is an essential component of healthy aging.[38] Older adults with 7-8 hours of high-quality sleep have lower risks of cognitive decline, cardiovascular disease, or metabolic disorders.[38] Problems such as insomnia and sleep apnea have been associated with increased risk of dementia and cardiovascular events.[39]The efficacy of cognitive-behavioral therapy for insomnia has been well established, and one study published in 2023 demonstrated a 35% improvement in sleep quality after the interventions with CBT-I.[40] Furthermore, supplementing with melatonin has also been found to enhance sleep efficiency and regulation of the circadian rhythm.[41]

Preventive Healthcare and Longevity. Healthy aging is also highly determined by preventive measures that include periodic health checks and vaccination.[42] Normal checkup on blood pressure, cholesterol levels, and diabetes testing can aid in the early discovery and treatment of diseases and promote long-term positive health results.[43 Flu and pneumonia vaccinations reduce the risk of hospitalization for older adults by 40%.[44] Furthermore, personalized medicine and genetic risk assessment are becoming more prominent in preventive care. Currently, with the emergence of genetic test innovation, predisposition to chronic diseases can be discovered early and intervened upon.[45]. Such individuals, through balanced diet, exercise, psychological resilience, social activity, and preventive healthcare, not only add years to their lives but also add life to those years. In order to do so, such lifestyle changes have to be inculcated into their lives, and future public health interventions need to be focused on such tailored, long-term interventions for the ever-increasing

population of old age to spend a longer life in good health and happiness.

Implications for Public Health, Clinical Practice, and Future Research

The results of this systematic review have broad implications for public health strategies, clinical guidelines, and future research directions:

Advancement of Nursing Knowledge. (i) Evidence-based foundation for gerontological care: Nurses gain a stronger scientific basis for integrating lifestyle medicine into aging care. The review demonstrates how dietary patterns, exercise, and psychosocial interventions directly influence health outcomes, providing nurses with a multidimensional framework for clinical decision-making; (ii) Holistic understanding of aging: By linking biological, psychological, and social determinants of health, the review enriches nurses' theoretical knowledge beyond disease management, emphasizing preventive and promotive strategies throughout the lifespan; (iii) Support for patient education strategies: The evidence provides nurses with credible, research-based content to educate older adults and caregivers on the importance of diet, exercise, sleep hygiene, and social connection.

Enhancing Clinical Nursing Practice. (i) Integration of lifestyle assessments: Nurses can incorporate comprehensive lifestyle assessments—including nutrition, activity levels, sleep quality, and social networks—into routine geriatric evaluations to identify risk factors early; (ii) Designing personalized interventions: With evidence on effective interventions (e.g., cognitive stimulation therapy, mindfulness practices, exercise programs), nurses can tailor care plans to meet the unique needs and preferences of older adults; (iii) Promoting self-management: Nurses are well-positioned to empower older adults to adopt and maintain health-promoting behaviors through motivational interviewing, coaching, and support groups; (iv) Interdisciplinary collaboration: Findings underscore the importance of nurses collaborating with dietitians, physiotherapists, psychologists, and social workers to deliver holistic, patient-centered care.

Contribution to Policy and Professional Development. (i) Advocacy for community-based programs: Nurses can advocate for policies that expand access to exercise facilities, nutrition programs, and mental health resources for aging populations; (ii) Continued education and training: Incorporating these findings into nursing curricula and continuing professional development ensures that future nurses are equipped with the competencies needed for preventive, lifestyle-oriented geriatric care; (iii) Leadership in public health initiatives: Nurses can lead community outreach efforts to address social isolation, promote healthy living, and support aging-in-place initiatives, aligning with global strategies for healthy aging.

Future Research Directions: Addressing Gaps and Expanding Evidence-Based Interventions. (i) A higher sample size with a diverse population of longitudinal RCTs is required for validating the long-term holistic aging interventions; (ii) Further research will address the synergistic effects of lifestyle interventions, such as how physical activity, nutrition, and cognitive training combine to optimize aging outcomes that would be tapping into the technological front of artificial intelligence, digital health, and personalized genetic profiling to provide customized lifestyle recommendations for the aging population; (iii) Socioeconomic and cultural factors that affect lifestyle acceptance among the older population should be researched to ensure equal access to interventions for aging globally.

Conclusion. This systematic review synthesizes the highest quality of evidence from randomized controlled trials between 2014 and 2024 to confirm that lifestyle factors are crucial in healthy aging. Findings thus established relate

to nutrition, physical activity, mental health, social connections, avoidance of harmful behaviours, sleep, and preventive healthcare as being associated with longer survival, improved cognitive function, enhanced physical health, and general well-being. The review identifies several critical mechanisms by which these lifestyle changes confer protection, including reduction of inflammation, oxidative stress, cardiovascular risks, and metabolic dysfunction, while enhancing neuroplasticity, mental resilience, and immune function. The Mediterranean diet, protein intake, and polyphenol-rich foods are linked to cardiovascular benefits, reduced cognitive decline, and longevity. Regular aerobic and resistance training can also reduce frailty and functional decline. Mental health interventions, particularly cognitive stimulation, mindfulness, and social engagement, significantly lower the risk of dementia and depression. Smoking cessation, moderation of alcohol intake, adequate sleep, and preventive screenings all play a major role in extending health span. Genetic predispositions do seem to influence the aging trajectory. However, overwhelming evidence suggests that lifestyle interventions may delay the onset of chronic diseases and even halt them in certain cases. In this regard, the findings will call for a paradigm shift from the traditional disease-management approach that has been more reactive to one that is proactive and lifestyle-centric.

Funding: No funding was secured for this study.

References

1. StatPearls. Physiology, aging [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Jan 31]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK556106/
2. Khavinson V, Popovich I, Mikhailova O. Towards realization of longer life. Acta Biomedica. 2020; 91(3):e2020054.
3. Bojang KP, Manchana V. Nutrition and healthy aging: a review. Current Nutrition Reports. 2023; 12(3):369–75.
4. Langhammer B, Bergland A, Rydwik E. The importance of physical activity exercise among older people. Biomed Research International. 2018; 2018:7856823.
5. Jeste DV, Depp CA, Vahia IV. Successful cognitive and emotional aging. World Psychiatry. 2010; 9(2):78–84.
6. National Institute on Aging. Social isolation, loneliness in older people pose health risks [Internet]. 2019 [cited 2025 Jan 31]. Available from: https://www.nia.nih.gov/news/social-isolation-loneliness-older-people-pose-health-risks
7. Institute of Medicine (US) Committee on Health and Behavior: Research P. Behavioral risk factors. In: Health and behavior: the interplay of biological, behavioral, and societal influences [Internet]. Washington (DC): National Academies Press (US); 2001 [cited 2025 Jan 31]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK43744/
8. Stone KL, Xiao Q. Impact of poor sleep on physical and mental health in older women. Sleep Medicine Clinics. 2018; 13(3):457–65.
9. Abud T, Kounidas G, Martin KR, Werth M, Cooper K, Myint PK. Determinants of healthy ageing: a systematic review of contemporary literature. Aging Clinical and Experimental Research. 2022; 34(6):1215–23.
10. Castruita PA, Piña-Escudero SD, Rentería ME, Yokoyama JS. Genetic, social, and lifestyle drivers of healthy aging and longevity. Current Genetic Medicine Reports. 2022; 10(3):25–34.
11. Dominguez LJ, Di Bella G, Veronese N, Barbagallo M. Impact of Mediterranean diet on chronic non-communicable diseases and longevity. Nutrients. 2021; 13(6):2028.
12. Gualtieri P, Marchetti M, Frank G, Smeriglio A, Trombetta D, Colica C, et al. Antioxidant-enriched diet on oxidative stress and inflammation gene expression: a randomized controlled trial. Genes (Basel). 2023; 14(1):206.
13. Dighriri IM, Alsubaie AM, Hakami FM, Hamithi DM, Alshekh MM, Khobrani FA, et al. Effects of omega-3 polyunsaturated fatty acids on brain functions: a systematic review. Cureus. 2022; 14(10):e30091.

14. Coelho-Junior HJ, Calvani R, Azzolino D, Picca A, Tosato M, Landi F, et al. Protein intake and sarcopenia in older adults: a systematic review and meta-analysis. International Journal of Environmental Research and Public Health. 2022; 19(14):8718.
15. Carbone JW, Pasiakos SM. Dietary protein and muscle mass: translating science to application and health benefit. Nutrients. 2019; 11(5):1136.
16. Shabkhizan R, Haiaty S, Moslehian MS, Bazmani A, Sadeghsoltani F, Saghaei Bagheri H, et al. The beneficial and adverse effects of autophagic response to caloric restriction and fasting. Advances in Nutrition. 2023; 14(5):1211–25.
17. de Souza MM, Moraes Dantas RL, Leão Durães V, Defante MLR, Mendes TB. Vitamin D supplementation and the incidence of fractures in the elderly healthy population: a meta-analysis of randomized controlled trials. Journal of General Internal Medicine. 2024; 39(14):2829–36.
18. Naomi R, Yazid MD, Teoh SH, Balan SS, Shariff H, Kumar J, et al. Dietary polyphenols as a protection against cognitive decline: evidence from animal experiments; mechanisms and limitations. Antioxidants (Basel). 2023; 12(5):1054.
19. Cena H, Calder PC. Defining a healthy diet: evidence for the role of contemporary dietary patterns in health and disease. Nutrients. 2020; 12(2):334.
20. Szychowska A, Drygas W. Physical activity as a determinant of successful aging: a narrative review article. Aging Clinical and Experimental Research. 2022; 34(6):1209–14.
21. Pinckard K, Baskin KK, Stanford KI. Effects of exercise to improve cardiovascular health. Frontiers in Cardiovascular Medicine. 2019; 6:69.
22. Massini DA, Nedog FH, de Oliveira TP, Almeida TAF, Santana CAA, Neiva CM, et al. The effect of resistance training on bone mineral density in older adults: a systematic review and meta-analysis. Healthcare (Basel). 2022; 10(6):1129.
23. Benedetti MG, Furlini G, Zati A, Mauro GL. The effectiveness of physical exercise on bone density in osteoporotic patients. BioMed Research International. 2018; 2018:4840531.
24. Wong MYC, Ou Kling, Chung PK, Chui KYK, Zhang C. The relationship between physical activity, physical health, and mental health among older Chinese adults: a scoping review. Frontiers in Public Health. 2023; 10:914548.
25. Schmid D, Ricci C, Baumeister SE, Leitzmann MF. Replacing sedentary time with physical activity in relation to mortality. Medicine and Science in Sports and Exercise. 2016; 48(7):1312–9.
26. Reynolds CF, Jeste DV, Sachdev PS, Blazer DG. Mental health care for older adults: recent advances and new directions in clinical practice and research. World Psychiatry. 2022; 21(3):336–63.
27. Woods B, Rai HK, Elliott E, Aguirre E, Orrell M, Spector A. Cognitive stimulation to improve cognitive functioning in people with dementia. Cochrane Database of System Reviews. 2023; (1):CD005562.
28. Schultz S, Larson J, Oh J, Koscik R, Dowling MN, Gallagher CL, et al. Participation in cognitively-stimulating activities is associated with brain structure and cognitive function in preclinical Alzheimer's disease. Brain Imaging Behav. 2015; 9(4):729–36.
29. Lin J, Epel E. Stress and telomere shortening: insights from cellular mechanisms. Ageing Research Reviews. 2022; 73:101507.
30. Keng SL, Smoski MJ, Robins CJ. Effects of mindfulness on psychological health: a review of empirical studies. Clinical Psychology Review. 2011; 31(6):1041–56.
31. Donovan NJ, Blazer D. Social isolation and loneliness in older adults: review and commentary of a National Academies report. Am The American Journal of Geriatric Psychiatry. 2020; 28(12):1233–44.
32. Joshi P, Hendrie K, Jester DJ, Dasarathy D, Lavretsky H, Ku BS, et al. Social connections as determinants of cognitive health and as targets for social interventions in persons with or at risk of Alzheimer's disease and related disorders: a scoping review. Int Psychogeriatry. 2024; 36(2):92–118.
33. Okorare O, Evbayekha EO, Adabale OK, Daniel E, Ubokudum D, Olusiji SA, et al. Smoking cessation and benefits to cardiovascular health: a review of literature. Cureus. 2023; 15(3):e35966.
34. Gallucci G, Tartarone A, Lerose R, Lalinga AV, Capobianco AM. Cardiovascular risk of smoking and benefits of smoking cessation. Journal of Thoracic Disease. 2020; 12(7):3866–76.

35. National Cancer Institute. Alcohol and cancer risk fact sheet [Internet]. 2021 [cited 2025 Jan 31]. Available from: https://www.cancer.gov/about-cancer/causes-prevention/risk/alcohol/alcohol-fact-sheet
36. Piano MR. Alcohol's effects on the cardiovascular system. Alcohol Research: Current Reviews. 2017; 38(2):219–41.
37. Raymond-Lezman JR, Riskin SI. Benefits and risks of sun exposure to maintain adequate vitamin D levels. Cureus. 2023; 15(5):e38578.
38. Carroll JE, Prather AA. Sleep and biological aging: a short review. Current Opinion in Endocrine and Metabolic Research. 2021; 18:159–64.
39. Kitamura T, Miyazaki S, Sulaiman HB, Akaike R, Ito Y, Suzuki H. Insomnia and obstructive sleep apnea as potential triggers of dementia: is personalized prediction and prevention of the pathological cascade applicable? EPMA Journal. 2020; 11(3):355–65.
40. Walker J, Muench A, Perlis ML, Vargas I. Cognitive behavioral therapy for insomnia (CBT-I): a primer. Klin Spetsialnaia Psikhologiia. 2022; 11(2):123–37.
41. Zisapel N. New perspectives on the role of melatonin in human sleep, circadian rhythms and their regulation. British Journal of Pharmacology. 2018; 175(16):3190–9.
42. Shenson D, Anderson L, Slonim A, Benson W. Vaccinations and preventive screening services for older adults: opportunities and challenges in the USA. Perspectives in Public Health. 2012; 132(4):165–70.
43. Krogsbøll LT, Jørgensen KJ, Gøtzsche PC. General health checks in adults for reducing morbidity and mortality from disease. Cochrane Database of Systematic Reviews. 2019; (1):CD009009.
44. Heo JY, Song JY, Noh JY, Choi MJ, Yoon JG, Lee SN, et al. Effects of influenza immunization on pneumonia in the elderly. Human Vaccines & Immunotherapeutics. 2018; 14(3):744–9.
45. Goetz LH, Schork NJ. Personalized medicine: motivation, challenges a nd progress. Fertility and Sterility. 2018; 109(6):952–63.

Health promotion for young Brazilian and Portuguese university students in terms of self-perception and self-image: Instagram profile

Original Article

Lia Araruna De Lima[1, 9]
https://orcid.org/0000-0003-3324-766X

Henriqueta Ilda Verganista Martins Fernandes[2,10]
https://orcid.org/0000-0002-8440-3936

Paulo César De Almeida[3,11]
https://orcid.org/0000-0002-2867-802X

José Eurico De Vasconcelos Filho[4,12]
https://orcid.org/0000-0002-6881-0814

Luísa Maria Da Costa Andrade[5,10,13]
https://orcid.org/0000-0002-5715-855X

Karla Maria Carneiro Rolim[6,9]
https://orcid.org/0000-0002-7914-6939

Ana Clécia Jácome Unias[7,11]
https://orcid.org/0009-0004-6796-3319

Fernanda Jorge Magalhães[8,11]
https://orcid.org/0000-0003-0104-1528

1 Nurse, Master. Email: liaararuna@gmail.com
2 Nurse, Ph.D. Porto, Portugal. Email: ildaverganistafernandes@gmail.com
3 Biostatistician, Ph.D. Fortaleza-CE-Brazil. Email: pc2015almeida@gmail.com
4 Computer Scientist, Ph.D. Fortaleza-CE-Brazil.Email: euricovasconcelos@gmail.com
5 Nurse, Ph.D. Porto, Portugal. Email: luisaandrade@esenf.pt
6 Nurse, Ph.D. Fortaleza- CE- Brazil. Email: karlarolim@unifor.br
7 Nursing student. Fortaleza-CE-Brazil. Email: clecia.unias@aluno.uece.br.
8 Nurse. Ph.D. Email: fernandaj.magalhaes@uece.br. Corresponding author.
9 University of Fortaleza (UNIFOR), Brazil.
10 Cintesis, Rise, Coordinating Professor, Portugal.
11 University of Ceará (UECE), Brazil.
12 Citinova. Fortaleza Science, Technology and Innovation Foundation, Brazil.
13 Porto School of Higher Education in Nursing (ESEP), Portugal.

Conflicts of interest: None
Received: March 9, 2025.
Approved: September 13, 2025.

How to cite this article: Lima LA, Fernandes HIVM, Almeida PC, Vasconcelos Filho JE, Andrade LMC, Rolim KMC, Unias ACJ, Magalhães FJ. Health promotion for young Brazilian and Portuguese university students in terms of self-perception and self-image: Instagram profile. Investigación y Educación en Enfermería. 2025; 43(3): e07.

DOI: https://doi.org/10.17533/udea.iee.v43n3e07

Health promotion for young Brazilian and Portuguese university students in terms of self-perception and self-image: *Instagram* profile

Abstract

Objective. To build a scientific content profile with validity evidence on the Instagram social network, focusing on health promotion for Brazilian and Portuguese university students regarding self-perception and self-image. **Methods.** A multi-method study based on Design Thinking in four stages: Knowledge Building (1st Review with 26 studies and Documentary Study with 962 forms); Product Definition (2nd Review with 50 studies and Focus Group with 13 participants); Development (Profile Prototyping); and Evaluation and Delivery (with evidence of usefulness, ease, and acceptability assessed by seven users). **Results.** It was evidenced in 42.3% of the studies that young people have difficulties with the use of alcohol and drugs; among technologies for intervention, multimedia campaigns and social networks were highlighted. The majority (53.8%) of the records expressed the young people's desire to change something about their bodies. The focus group understood the need to intervene in the self-perception and self-image of young people through Instagram. The profile @multi.brasilportugal was created with content about the promotion of self-care, links for theoretical depth, and professional referrals. Regarding usefulness, ease, and acceptability, users considered it extremely likely to be useful for achieving the objective, extremely easy to operate the profile, and quite likely in terms of the clarity and understanding of the interaction with the technology. **Conclusion.** Design Thinking encouraged the creation of an Instagram profile with interaction and the possibility of using scientific content for education and health promotion, especially to improve body positivity and self-esteem.

Descriptors: health education; young adults; social network; self-perception; self-image; social networking.

Promoción de la salud para jóvenes universitarios brasileños y portugueses en términos de autopercepción y autoimagen: perfil de *Instagram*

Resumen

Objetivo. Construir un perfil de contenido científico con evidencias de validez, en la red social Instagram, sobre la promoción de la salud de jóvenes universitarios brasileños y portugueses en términos de autopercepción y autoimagen. **Métodos.** Estudio multimétodo basado en el Design Thinking en cuatro etapas: Construcción del conocimiento (1ª Revisión con 26 estudios y Estudio Documental con 962 formularios); Definición del Producto (2ª Revisión con 50 estudios y Grupo Focal con 13 participantes); Desarrollo (Prototipado del Perfil) y; Evaluación y Entrega (con evidencias de utilidad, facilidad y aceptabilidad evaluadas por siete usuarios). **Resultados.** Se evidenció en el 42.3% de los estudios que los jóvenes tienen dificultades con el uso de alcohol y drogas; entre las tecnologías para la

intervención se resaltaron las campañas multimedia y las redes sociales. En la mayoría (53.8%) de los registros se expresó el deseo de los jóvenes de cambiar algo en sus cuerpos. El grupo focal comprendió la necesidad de intervenir en la autopercepción y autoimagen de los jóvenes por medio de Instagram. Se construyó el perfil @multi.brasilportugal con contenidos acerca de la promoción del autocuidado, enlaces de profundización teórica y derivación profesional. En cuanto a la utilidad, facilidad y aceptabilidad, los usuarios consideraron extremadamente probable que sea útil para alcanzar el objetivo, extremadamente fácil de operar el perfil y bastante probable en la claridad y comprensión de la interacción con la tecnología. **Conclusión.** El Design Thinking incentivó la creación de un perfil en Instagram con interacción y la posibilidad de usar contenido científico para la educación y la promoción de la salud, especialmente, para mejorar la positividad corporal y la autoestima.

Descriptores: educación sanitaria; adultos jóvenes; red social; autopercepción; autoimagen; red social.

Promoção da saúde para jovens estudantes universitários brasileiros e portugueses em termos de autopercepção e autoimagem: perfil do *Instagram*

Resumo

Objetivo. Construir um perfil de conteúdo científico com evidências de validade, na rede social *Instagram*, sobre a promoção da saúde de jovens universitários brasileiros e portugueses em termos de autopercepção e autoimagem. **Métodos.** Estudo multimétodo baseado no Design Thinking em quatro etapas: Construção do conhecimento (1ª Revisão com 26 estudos e Estudo Documental com 962 formulários); Definição do Produto (2ª Revisão com 50 estudos e Grupo Focal com 13 participantes); Desenvolvimento (Prototipagem do Perfil) e; Avaliação e Entrega (com evidências de utilidade, facilidade e aceitabilidade avaliada por sete usuários). **Resultados.** Evidenciou-se em 42,3% dos estudos que os jovens tem dificuldade quanto ao uso de álcool e drogas; das tecnologias para intervenção ressaltou-se as campanhas multimídia e redes sociais. A maioria (53,8%) dos registros expressou o desejo dos jovens em mudar algo em seus corpos. O grupo focal compreendeu a necessidade de intervir na autopercepção e autoimagem dos jovens por meio do Instagram. Foi construído o perfil *@multi.brasilportugal* com conteúdos a cerca da promoção do autocuidado, *links* de aprofundamento teórico e encaminhamento profissional. Quanto à utilidade, facilidade e aceitabilidade, os usuários consideraram extremamente provável que seja útil para atingir o objetivo, extremamente fácil de operar o perfil e bastante provável na clareza e compreensão da interação com a tecnologia. **Conclusão.** O Design Thinking incentivou a criação de um perfil no *Instagram* com interação e possibilidade de usar conteúdo científico para a educação e a promoção da saúde, especialmente, para melhorar a positividade corporal e a autoestima.

Descriptors: educação em saúde; jovens adultos; rede social; autopercepção; autoimagem; rede social.

Introduction

It is estimated that there are currently approximately 1.8 billion young people, which corresponds to almost 25% of the world's population.[1] For the World Health Organization (WHO), youth is considered to be people between the ages of 15 and 24, which can be broken down into: young adolescents (15 to 19) and young adults (20 to 24).[2] Promoting the health of this public is considered a challenge, given the important changes they face in their physical, cognitive, emotional and psychosocial context, especially when they enter the university environment, where they undergo personal and social transformations (leaving their parents' home, entering new friendship cycles).[3] They bring experiences that seek to explore discoveries, sensations, new knowledge and even guarantee participation in social groups. Given this context, it is essential to invest in health promotion strategies using health education and technologies that bring motivation, involve young people in their study, work, family and community environments and bring about changes in behavior.[4]

According to data from the Digital 2024 report, around 79% of young people between the ages of 15 and 24 are connected to the internet globally. Of these, approximately 90% use social networks regularly. This high rate of use reflects the strong presence of this age group and their tendency to use social platforms as a primary means of online communication and interaction. These figures are even higher in developed regions where internet penetration is more pronounced. The most used are Instagram (preferred by teenagers and young adults), YouTube (most accessed by younger adults) and TikTok.[5] The study is justified and relevant in terms of the use of an intervention on a digital social network, since this is the main channel of communication and information-seeking for this age group, with the aim of contributing to the promotion of the health of young university students, directly impacting on their knowledge of self- image recognition and self-perception strategies in order to favor their quality of life as young people. And indirectly, in the medium or long term, on their quality of adult life, by encouraging changes in social and health behaviors that represent risk and/or vulnerability.

In this way, the study aimed to build a profile of scientific content, with evidence of usefulness and ease, on the social network Instagram, about the health promotion of young Brazilian and Portuguese university students for self-perception and self-image.

Methods

Multi-method study with a qualitative approach consisting of four stages, based on the Design Thinking (DT) framework: Stage 1: Knowledge building

(1st Integrative Review and Documentary Study); Stage 2: Exploration of gaps (2nd Integrative Review and Focus Group) 3rd stage: Construction and Development (Social Network Prototyping); and 4th stage: Evaluation (validation of evidence of validity and delivery). Design Thinking is defined as a process that aims to create innovative solutions to common problems and has two basic principles: first, it is person-centered, that is, understanding their needs and desires is fundamental. Second, it is necessary to develop and explore a creative mindset, asking questions, visualizing possible ideas, creating prototypes, conducting multiple tests.[6] In addition, the stages of DT - empathy, problem description, ideation, prototyping and testing - can also be used in nursing practice to promote multidisciplinary teamwork and stimulate the innovation in addressing challenging medical issues.[7] Held from 2021 to 2022, in a private Higher Education Institution (HEI) in the city of Fortaleza-CE-Brazil and in a Nursing School in the city of Porto, Portugal.

For the first stage, called "Building knowledge", an integrative review (IR) was carried out to identify, in scientific evidence, the technologies that are being used to promote the health of young people/adults, as well as to learn about and analyze their social and health behaviors. The search was conducted in the following databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Analysis and Retrievel System Online (MEDLINE), Cochrane Library and Latin American and Caribbean Health Sciences Literature (LILACS). The strategy used combinations of controlled descriptors in Health (DeCS) and the Boolean operator "AND": Young Adult, Social Behavior, Health-Related Behaviors and Health Promotion, with a final sample of 26 studies.

To complement the results of the first RI, a documentary study was conducted with 962 forms completed by young university students, 123 of whom were Brazilian and 839 Portuguese, from a multicenter study previously conducted at a Brazilian university and two other Portuguese universities.[8] The aim was to understand the main changes in the social and health behaviors of these young people. These were young people aged between 16 and 24, who anonymously and voluntarily answered a questionnaire about social and health behaviors, such as: socioeconomic variables, teaching and learning, family relationships, feelings and emotions, sleep and rest, and social determinants of health - alcohol and drug use, food, safety and leisure.

After the completion of the first stage of the study, the second stage was carried out, called Product Definition (with the 2nd IR and a Brainstorming with a focus group), the objective was to explore the gaps among university students in relation to health promotion for self-care.

To this end, in April 2022, the 2nd IR was prepared to identify the content to be included and discussed in light of scientific evidence on health promotion for young people in terms of their self-perception and self-image (gaps identified as a higher priority). Searches were conducted in the following databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Analysis and Retrieval System Online (MEDLINE), Ebook Nursing, Web of Science and Scopus, and the combinations between descriptors and the Boolean operators "AND" and "OR". Os DeCS foram: Young Adult, Health Promotion, Self-Image, Weight Perception and Health Education.

At this point, to encourage brainstorming, a qualitative study was added using the Focus Group (FG) technique. The meeting was held remotely via Google Meet®, with the objective of ideation and initial construction of the technological prototype based on DT. The inclusion criteria were: being a university student, having experience in teaching health courses, and having practical experience in assisting young people and/or adolescents. Therefore, the final sample included

13 participants were invited to participate intentionally, for convenience, using the snowball technique. Therefore, two young Brazilian university students and three Portuguese university students; two Brazilian university professors and two Portuguese university professors; and two Brazilian nurses and two Portuguese nurses working in the field of young adult health. It should be noted that two participants were excluded, one Brazilian student and one Portuguese university professor, because they were not present until the end of the meeting, as recommended in the literature.[9]

The FG strategy was used in two moments, using an audio-visual recorder to collect the speeches and then transcribe them. The first meeting investigated the real needs of young university students in terms of health promotion. In the second meeting, the researcher presented a compilation of the requirements/needs to the participants and tried to come up with a suggestion for approaching the target audience with regard to the technology to be built and validated. As part of the planning for this fourth phase, a persona was created (Ana, 19, young university student). Based on this presentation, the nurses, the main researcher and the master's student, together with their supervisor, a doctor, led the FG through the variables related to the self-perception and self-image of young people/adults, in order to continue the process of ideation and prototyping for the construction of the technology. After the discussions involved in the FG and based on the analysis of the participants' speeches, coded by P1, P2, ..., P13, the main requirements for the technology development process were obtained.

For the third stage of the study, called Development (Profile Prototyping), support was requested from a technology and innovation laboratory at a private in the city of Fortaleza-CE-Brazil. With the team of designers and developers, it was possible to build an avatar inspired by the persona validated in the ideation and prototyping stage. To build the avatar, the researchers created a base model using the ReadyPlayer® platform, which was later refined and improved by the team at the lab using the Zbrush, Blender and Mixamo tools. At the same time as building Ana's avatar, a new profile was created on the Instagram® social network, as well as educational content in the Canva® program. The aim was to create a page for empowerment, Health Literacy and communication between young people with a dynamic, clear, comprehensive and interactive approach that would meet the needs, especially those related to self-perception and self-image, of young university students.

The fourth and final stage of the study was the evaluation of the Instagram® profile, with an analysis of usefulness, ease of use and user acceptance, which were validated in terms of content and tested for reliability and construct validity in two studies involving a total of 152 users and four application programs.[10] This instrument aims to understand the user's perception of usefulness (capable of being used advantage), ease of use (effortless) and acceptance of the technology for health promotion among young university students.

The technology was applied to five users (two young university students, one Brazilian and one Portuguese, and a Brazilian university professor) to evaluate the health-promoting technology. To this end, they were recruited by verbal invitation, intentionally, for convenience based on initial contact via messaging apps and/or e-mail. The evaluation period was October 2022. These participants were instructed to access Instagram®, either through their personal profile or through the professional profile of the private HEI's Master's program, to evaluate the profile built in the previous stage, called @multi.brasilportugal.

All ethical aspects were respected, and the study was approved by the Ethics and Research Committee under opinion no. 3.215.533.

Results

To present the results, we tried to follow the stages of the DT, called: "1st Stage of the DT - Building Knowledge (IR and Document Study)"; 2nd Stage of the DT - Product Definition (Brainstorming with GF); 3rd Stage of the DT - Development (Profile Prototyping) and 4th Stage of the DT - Evaluation and Delivery (evaluation of evidence of validity).

Stage 1 of the DT - Building Knowledge

It refers to the stage of research and search for an answer to a given problem, for which IR and documentary study were used. As a result, 26 publications were identified, of which the highest percentage (n=11; 42.3%) discussed the use of alcohol and drugs by young people, followed by family relationships (n=9; 34.6%) and the lowest number articles was related to sleep and rest with only 11.5%.

With regard to technologies as an intervention to promote the health of these young people, it was found that of the 26 publications, only nine described them, three showing satisfactory results from the use of multimedia campaigns, two from Facebook® and healthy living programs, respectively. Next, the documentary study showed that 77.3% (n=649) of Portuguese young people and 62.6% (n=77) of Brazilian young people reported moderate or high satisfaction with their lives; 42.1% (n=405) said they often felt satisfied with the way they were and 30.5% (n=293) said they moderately felt ; 31.9% (n=307) said they sometimes worried about their bodies and 30.5% (n=293) said that they often felt worried about this; 55.4% (n=465) of Portuguese young people and 43.1% (n=53) of Brazilian young people expressed the desire to change something about their bodies as sometimes and often, respectively.

Stage 2 of the DT - Product Definition (IR and Brainstorming with GF)

During the second stage, with regard to the second integrative review of the research, a sample 50 studies was obtained, the outcomes of which were analyzed, the most frequently addressed themes captured, arranged and categorized in the form of a word cloud. The most prominent themes were weight, perception, women, overweight and obesity, behavior, self-esteem and psycho-emotional aspects such as anxiety and depression. These results are essential for defining the product, as they highlight the areas that need to be addressed as a priority. Therefore, the product should include techniques that promote the psycho-emotional factors described and, at the same time, improve the perception of self-esteem, body image and the control of eating habits. Thus, through brainstorming with the GF, the aim is to explore innovative solutions that respond to these needs, in order to promote a positive impact on mental health, as well as on the well-being of young university students.

Stage 3 of DT - Development (Profile Prototyping)

The GF, the final product was the creation of a profile on the social network Instagram® as a strategy for health promotion and education, which communicates from young person to young person through the creation of an avatar, where topics related to the self-perception and self-image of young people/adults were discussed. For this prototyping development, meetings were held with the development team responsible for building the avatar, where the need to generate more empathy with the young audience and representativeness in relation to insecurities linked to self- image was raised.

Thus, as a result of the discussions, it was suggested that the avatar had vitiligo (a pathology that causes depigmentation of the skin in the form of patches), making it clear from his image that he would face challenges related to self-image: Why not include a chronic condition in this student?! P6; Yes... great idea, it could be a skin condition, for example vitiligo... what do you think?' P8. The other participants agreed and one student highlighted overweight as one of the most frequent complaints: 'I think that overweight can also contribute, as it's one of the main complaints in our environment. P2. To do this, the researchers created a base model using the ReadyPlayer® tool, but due to the limited functionalities offered by the tool, it wasn't possible to include some of the necessary physical characteristics, such as being overweight, tattoos, piercings and lesions resulting from vitiligo, which were then edited by the development team using Zbrush® and Blender® software (Figure 1).

Figure 1. First built version of the avatar. Fortaleza, Ceará, Brazil, 2022

As a result, an Instagram® account was created with the name @multi.brasilportugal. The name was chosen to reflect the name of the technology proposed by the Multicentric Project (multi.) and the two countries participating in the research.

On the profile page, there are five posts (four publications and one Reel) with themes related to health and self-image, as well as a link to the Linktree® tool (https://linktr.ee/multi.brasilportugal). This tool is a platform created to be a facilitating option for Instagram® users, grouping several links into just one (Figure 2). The @multi.brasilportugal profile provides links to the studies used as a basis for the content of the posts described in the next topic.

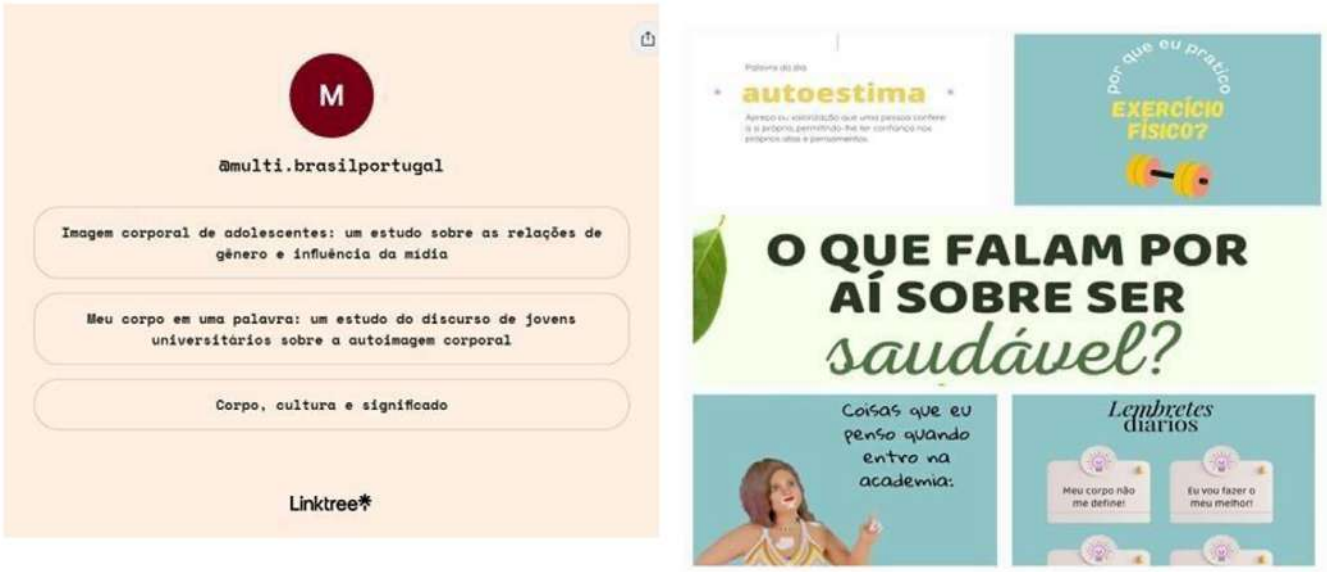


Figure 2. Social media profile and Linktr.ee. Fortaleza, Ceará, Brazil, 2022

Note: Image on the left with links for theoretical deepening of the theme. Image on the right with posts of scientific content related to self-care concerning self-image and body self-perception

To define the themes to be covered in the posts, the results obtained in the third stage were used as a basis. Thus, the following themes were defined: distorted perception of weight and its prevalence in women; overweight, obesity and self-esteem; dissatisfaction with self-image and physical exercise; dissatisfaction with self-image and unhealthy eating behaviors. Each theme had a post on the Instagram® profile feed, in a carousel format, as well as stories and reels for some of them. In order to facilitate communication with young people, informal language and emojis were used. The images were produced by the researchers with the support of the Canva® tool, which offers design resources to help users produce content.

Stage 4 of the DT - Evaluation and Delivery (evaluation of evidence of validity)

As for the assessment of the perceived usefulness of the technology (Table 1), four evaluators considered it slightly likely and two considered it extremely likely that the technology would allow them to carry out health promotion activities more quickly; three considered it slightly likely that it would improve their performance in health promotion actions; two considered it fairly likely that the technology would increase productivity during health promotion activities and the same proportion perceived it as slightly likely; two considered it fairly likely and the same proportion considered it slightly likely that its use would make it easier to carry out health promotion activities. Finally, three considered it extremely likely be useful in achieving its objective of promoting the health of young people/adults.

Table 1. Assessment of the perceived usefulness of M-Health technology. Brazil, Portugal, 2022

Questions	Answers	*n*=7
1. Using @multi.brasilportugal with young university students would allow me to carry out health promotion tasks more quickly.	Extremely likely	2
	Quite likely	1
	Slightly likely	4
2. Using @multi.brasilportugal would improve my performance in promoting the health of young university students.	Extremely likely	1
	Quite likely	1
	Slightly likely	3
3. Using @multi.brasilportugal with young university students would increase my productivity during health promotion activities.	Extremely likely	2
	Slightly likely	3
	Probably not	1
	Extremely unlikely	1
4. Using @multi.brasilportugal would increase my effectiveness in promoting the health of young university students.	Extremely likely	1
	Quite likely	2
	Slightly likely	2
	Probably not	1
5. Using @multi.brasilportugal would facilitate my health promotion activities with young university students.	Extremely likely	1
	Quite likely	2
	Slightly likely	2
	Probably not	1
	Extremely unlikely	1
6. I would find @multi.brasilportugal useful for promoting the health of young university students.	Extremely likely	3
	Quite likely	1
	Slightly likely	1
	Quite unlikely	1
	Extremely unlikely	1

Regarding the perception of ease of use (Table 2), three found it quite likely and two extremely likely to learn how to easily operate the Instagram® profile, with three already finding the technology easy to use. As for clarity and understanding of interaction with the technology, three considered it quite likely. And finally, in the same proportion of two, the evaluators considered it extremely likely and quite likely that it would be easily become adept at using it. As for the of achieving the purpose proposed by the technology, three found it quite likely, while two found it quite unlikely. With regard to flexibility in interacting with the technology, two thought it was quite likely, as well as slightly likely. However, the same proportion considered it slightly unlikely.

Table 2. Assessment of the perceived ease of use of the M-Health technology produced. Brazil, Portugal, 2022

Questions	Answers	*n*=7
1. Learning how to operate @multi.brasilportugal would be easy for me.	Extremely likely	2
	Quite likely	3
	Slightly likely	1
	Extremely unlikely	1
2. I would find it easy to get @multi.brasilportugal to do what it sets out to do (promote the health of young university students).	Extremely likely	1
	Quite likely	3
	Slightly likely	1
	Quite unlikely	2
	Extremely likely	1
3. My interaction with @multi.brasilportugal would be clear and understandable.	Quite likely	3
	Slightly likely	1
	Probably not	1
	Slightly unlikely	1
4. I would find @multi.brasilportugal flexible to interact with.	Extremely likel	1
	Quite likely	2
	Slightly likely	2
	Slightly unlikely	2
5. It would be easy for me to become proficient in using @multi.brasilportugal.	Extremely likely	2
	Quite likely	2
	Slightly likely	1
	Slightly unlikely	1
	Extremely unlikely	1
6. I would find @multi.brasilportugal easy to use.	Extremely likely	2
	Quite likely	3
	Probably not	1
	Extremely unlikely	1

With regard to the posts (Figure 3), the focus was to bring up the discussion about current beliefs, often disseminated by society and brought up as evidence in the studies identified, and thus enable their gradual deconstruction and the development of a new outlook for young people.

Figure 3. Publications and captions. Brazil and Portugal, 2022

Note: Images that represent posts of encouragement and interaction with young people. The aim is to contribute to self-pride and the self-acceptance process in order to improve self-esteem, self-image, and body self-perception.

The second image, on the other hand, aims to promote the "Make peace with the mirror" movement, encouraging self-acceptance regardless of one's physical characteristics, breaking with the aesthetic standards imposed by society. The subtitles explain a little more about the topics and also give young people the chance to consult the bibliographical references used to prepare the content and deepen their knowledge. Thus, one of the dynamic images produced was used, which shows the persona looking at her body, with its characteristics that can socially be considered non- standard. The caption briefly describes the results of this study, which can be accessed via the link provided on the profile.

A second strategy for discussion on the subject was to create a post in the form of a reel, which consists of a short video with the use of a song. The aim was to address beliefs described by young people related to the feeling of shame and not belonging in environments geared towards physical activity, such as gyms. Reels can be considered one of the most effective strategies for reaching a large number of users today, due to the configuration of the social network algorithm.

Polls were also created in the form of stories on the profile, the aim of which is to find out more about users' perceptions of a particular subject and thus use this information to create content that is geared to their real needs (Figure 4).

Figure 4. Dynamic story. Brazil and Portugal, 2022

Note: Image representing an interactive and dynamic story (Instagram story) seeking to understand the barriers to self-acceptance.

After evaluating the Instagram profile, it was possible to register it as a technical-technological product licensed under Creative Commons as: "Instagram profile @multi.brasilportugal © 2022 by Lia Araruna de Lima & Fernanda Jorge Magalhães is licensed under Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International."

Discussion

Following the recommendation of the FG participants, the Instagram® profile begins with a brief presentation of the persona behind the profile, with the aim of contextualizing the scenario, clarifying the purpose of the profile and beginning to create a bond with the young user. The decision to build her as a woman with vitiligo was based on the fact that it is a pathology still shrouded in stigma and prejudice, especially when it affects women, due to the possibility of causing dissatisfaction with self-image, intense psychological distress and serious problems such as depression and social isolation.[11] As mentioned above, the content of the posts was defined on the basis of the results identified in the third stage. On the theme "Distorted perception of weight and its prevalence in women", a post was created in the format of a carousel, or that is, more than one image contained in the post, the first of which displays daily reminders, which were constructed from the speeches of young people collected in some of the publications found.[12] Its aim is to promote the breaking down of concepts.

The next post, on the subject of "Overweight, obesity and self-esteem", discusses the subject of self-esteem and its relationship with body shape and dissatisfaction with it, as described in some

of the studies presented above.[13] Three images associated with the theme were produced with a related caption arranged in a carousel format. The images begin with the concept of self-esteem, since it is closely linked to body satisfaction.[14] Next, the persona promotes self-acceptance through its positioning and, finally, displays a question for the user to reflect on. In addition to this post, we used the stories format and the question box tool offered by Instagram® to promote communication with users. Young people tend to be more comfortable in the virtual space, feeling free to express their opinions, insecurities and desires anonymously or not.[15]

The fourth post reflects on the meaning of physical exercise, going beyond its use to obtain the perfect body. To do this, it used the strategy of listing reasons that can encourage young people to exercise, according to discourses observed in a study on the subject.[16] The fifth and final post addresses the myths involved in the concept of healthy eating and healthy bodies discussed in publications. To do this, four static images and a caption were created to promote the movement of "making peace" with food (Figure 3). With this figure it is possible to discuss the concept of healthy eating, the divergence from the imposed obligation of thinness as a synonym for health and the encouragement of balance when eating.[13,17] As well as the use of digital tools with current generations, in order to bring closer together and make them useful for reaching young people, especially due to the flexibility, convenience and portability of technology, combined with the familiarity of such platforms and social media.[18]

The lives of millions of people around the world have already changed, and will continue to change, as a result of the impact of mobile technologies.[19] Young people can be called digital natives, and the ease of access and the amount of technological resources available today can act as a bridge to connect them with health systems.[20] It is also essential to highlight how challenging it is to develop mHealth technology that is actually effective in changing behavior and requires more than easy handling and accessibility.[21] The main purpose of an mHealth technology is to disseminate access to health information and services with a focus on promoting personal well-being, health prevention and chronic disease management.[22] Or that is, it must be incorporated into a dynamic of prevention and health promotion.[23]

When evaluating the technology as useful for achieving its objective of promoting the health of young people/adults, it is known that, in order to change health- related risk behaviors, the health care model must be based on promoting discussions about the reasons that lead to the adoption of healthier behaviors.[24] Therefore, putting on the agenda and discussing some beliefs rooted in today's society, and thus seeking to reframe them, is an important strategy for changing behaviors. When talking specifically about the Instagram® tool, it is perceived as an important, albeit relatively new, tool for health professionals to use in their business, and in the health education process, giving them more freedom to market their products, publicize specific items, in order to increase the likelihood of broadening and reaching a certain audience.[25]

A netnographic study carried out to investigate the work process of nurses on Instagram found that the tool also contributes to the dissemination of these professionals as freelancers, providing an innovative and effective approach to influence and being an excellent platform for disseminating important information, thus corroborating the results obtained.[26] In this context, nurses play an important role in developing a reflexive awareness to protect and promote the health of individuals when, through activities that generate knowledge, they help to break down the concept of vertical transmission of information and generate a feeling of co-responsibility in making decisions about social and health behaviors.[27]

Conclusion. An Instagram® social network profile called @multi.BrasilPortugal was built

and initially evaluated, with the aim of promoting the health of young Brazilians and Portuguese by strengthening their self-perception and self-image. The use of the DT was a very favorable strategy, since it enabled the ideation and prototyping processes to be carried out by young people and health experts of young people, getting to know their real pains and needs and making it possible to develop a technology that is more likely to achieve its results. It is suggested that the research be continued by other researchers, with the aim of carrying out evaluations with a larger sample, especially in Brazil, so that it can be made available to the general public and be a health promotion tool for both the target public and health professionals. Clinical validation studies of the technology are also suggested, with the target public and in the clinical practice of health education and health promotion.

References

1. United Nations Population Fund. The power of 1.8 billion: adolescents, youth and the transformation of the future. State of World Population 2014. New York: UNFPA; 2014. Available from: https://www.unfpa.org/swop-2014
2. Brazil. Ministry of Health. Health Care Secretariat. Adolescent and Youth Health Area. Legal framework: health, an adolescent right. Series A. Normas e Manuais Técnicos. 2007. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/07_0400_M.pdf.
3. Santos Monteiro Machado A, Benevides Soares A. Review systematic literature on socio-emotional skills interventions for university students. Revista Pesquisa Qualitativa. 2024; 12(32):353-76
4. Peron S, Neufeld CB. Health promotion for adolescents: Specific characteristics of group programs. Revista Psicologia: Teoria e Prática. 2022; 24(2): ePTPCP13479.
5. Kemp S. Digital 2024: Global overview report. DataReportal. 2024. Available from: https://datareportal.com/reports/digital-2024-global-overview-report.
6. Ku B, Lupton E. Health design thinking: Creating products and services for better health. Cooper Hewitt; 2020.
7. Paiva ED, Zanchetta MS, Londoño C. Innovation in thinking and scientific action: the method of design thinking for nursing. Escola Anna Nery. 2020; 24(4): e20190304.
8. Silva SLFR. Mhealth technology to support the promotion of mental health in young university students [dissertation]. Fortaleza: Unifor; 2022.
9. Oliveira GS, Cunha AMO, Cordeiro EM, Saad NS. Focus group: a data collection technique in qualitative research? Cadernos FUCAMP. 2020; 19(41):14-23.
10. Davis FD. Perceived usefulness, perceived ease of use, and user acceptance information technology. MIS Quarterly. 1989; 13(3):319-340.
11. Albuquerque RN, Oliveira A. Vitiligo and the impact on women's image. Disciplinarum Scientia. 2021; 22(1):353-68.
12. Peres-Neto L, Pereira GA. Ethics, freedom of expression and gender hate speech on social networking sites. In: E-Compós. 2019. Available from: https://e-compos.org.br/e
13. Do Vale AMO, Elias LR. Eating disorders: a behavior-analytic perspective. Revista Brasileira Terapia Comportamental e Cognitiva. 2011; 13(1):52-70.
14. Martelli A., Teixeira VM, Oliveira RC, Oliveira JRL, Oliveira HFR, Silio LF, et al. Challenges to the healthy balance between self-esteem and body image. Rev CPAQV-Centro de Pesquisas Avançadas em Qualidade de Vida. 2022; 14(3):1-8.
15. Nascimento MLV, Caniato ÂMP. Adolescence and youth in contemporary times: reflections from a psychopolitical approach. Brazilian Journal os Development. 2019; 5(11):22664-84.
16. Dourado CS, Fustinoni SM, Schirmer J, Brandão-Souza C. Body, culture and meaning. Journal of Human Growth and Development. 2018; 28(2):206-12.

17. Nascimento KS, Cezar LC, Santos LF. Beauty standards disseminated on Instagram and their influences on the self-esteem and consumption behavior of university students. Revista Brasileira de Marketing. 2024; 23(2):844-900.
18. Suárez Gómez M, Pisco Costa R. The potential of WhatsApp in a qualitative study on eating practices in the millennial generation. Revista Pesquisa Qualitativa. 2021; 9(21):392-409.
19. World Health Organization. M-health: new horizons for health through mobile technologies [Internet]. Geneva: WHO; 2015 [cited 2025 Mar 5]. Available from: http://www.who.int/goe/publications/goe_mhealth_web.pdf
20. Slater H, Campbell JM, Stinson JN, Burley MM. End user and implementer experiences of mHealth technologies for noncommunicable chronic disease management in young adults: systematic review. Journal of Medical Internet Research. 2017; 19(12):406-501.
21. Drake C, Cannady M, Howley K, Shea C, Snyderman R. An evaluation of mHealth adoption and health self-management in emerging adulthood. AMIA Annual Symposium Proceedings. 2020: 1022-30.
22. Medeiros RA, Leite CRM, Guerreiro AMG, Rosa SSRF. MHealth: Definition, interests, challenges and future. In: Leite CRM, Rosa SSRF, editors. New technologies applied to health: Integration of areas transforming society. EDUERN; 2017. p. 107-22. Available from: http://repositorio2.unb.br/jspui/bitstream/10482/38824/1/CAPITULO_MHealthDefinitionInterests.pdf.
23. Lucena TFR, Bueno GR, Velho APM. MHealth and health promotion: possibilities and approaches to the use of mobile technologies. In: Leite CRM, Rosa SSRF, editors. New technologies applied to health: Integration of areas transforming society. EDUERN; 2017. p. 123-48. Available from: https://iris.paho.org/handle/10665.2/56003.
24. Bazil. Ministry of Health. Health Care Secretariat. Department of Programmatic and Strategic Actions. Protecting and caring for the health of adolescents in primary care. 2017. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/proteger_cuidar_adolescentes_atencao_basica.pdf.
25. Rahman MO, et al. Technology-based innovative healthcare solutions for improving maternal and child health outcomes in low-and middle-income countries: A network meta-analysis protocol. Nursing Open. 2023; 10(1):367-76.
26. Jácome Unias AC, Barroso ELFN, Farias BER, Costa MCO, Magalhães FJ. Digital entrepreneurship in maternal and child nursing: a netnographic study using Instagram [Internet]. XXIX Semana Universitária UECE: inclusão e interdisciplinaridade na produção do conhecimento. 2024 [cited 2025 Aug 22]. Available from: file:///C:/Users/ferna/Downloads/867777919-RES07092024-183659%20(2).pdf
27. Carvalho KM, Silva CRDT, Figueiredo MLF, Nogueira LT, Andrade EMLR. Educational interventions for the health promotion of the elderly: integrative review. Acta Paulista de Enfermagem. 2018; 31(4):446-54.

Silent Harm: How Ambient Air Pollution Threatens Prenatal and Neonatal Health. A Systematic Review

Original Article

Dr. Ranjana Chavan[1,3]
https://orcid.org/0000-0001-6246-7886
Dr. Jasneet Kaur [2,3]
https://orcid.org/0000-0001-6897-9137

Silent Harm: How Ambient Air Pollution Threatens Prenatal and Neonatal Health. A Systematic Review

Abstract

Objective. To examine the link between ambient air pollution and poor pregnancy and neonatal outcomes. **Methods.** This systematic study searched numerous databases, including PubMed, Scopus, Web of Science, and Cochrane Library, revealed 26 papers that met established criteria. This research looked at how pollutants such as Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers, Nitrogen Dioxide, Sulfur Dioxide, Ozone, and black carbon affected maternal and new-born health, including miscarriage, preeclampsia, preterm delivery, low birth weight, and neonatal respiratory and neurological abnormalities. **Results.** Findings repeatedly revealed that enhanced the danger of gestational problems & poor neonatal consequences, with pollutants including Particulate matter smaller than 2.5 microns and Nitrogen Dioxide substantially related to hypertensive disorders,

1 Assistant Professor, Ph.D. Email: ranjanachavan@scon.edu.in
2 Professor, Ph.D. Email: jasneetkaur@scon.edu.in
3 Symbiosis College of Nursing, Symbiosis International (Deemed University), Pune, India.

Conflicts of interest: None
Received: June 13, 2025.
Approved: September 10, 2025.
How to cite this article: Chavan Ranjana, Jasneet Kaur. Silent Harm: How Ambient Air Pollution Threatens Prenatal and Neonatal Health. A Systematic Review. Investigación y Educación en Enfermería. 2025; 43(3):e08.

DOI: https://doi.org/10.17533/udea.iee.v43n3e08

before the expected time of delivery, low birth weight, and reduced new-born immune and respiratory function. The paper also discusses how pollution impacts health via biological processes such as oxidative stress and epigenetic alterations. Variability in research designs, exposure assessment methodologies, and regional pollution levels were observed. **Conclusion.** This review underscores the link between ambient air pollution, particularly Particulate matter smaller than 2.5 microns and Nitrogen Dioxide, and poor pregnancy and neonatal outcomes. Recognizing these risks is crucial for nursing care, allowing nurses to educate, identify early risks, and advocate for policies that protect mothers and newborns. Strengthening interventions will improve health outcomes for both.

Descriptors: ambient air pollution; neonatal outcomes; pregnancy complications; particulate matter; maternal health.

Daño silencioso: cómo la contaminación ambiental del aire amenaza la salud prenatal y neonatal. Una revisión sistemática

Resumen

Objetivo. Examinar la relación entre la contaminación del aire en ambiente y los resultados adversos prenatales y neonatales. **Métodos.** Revisión sistemática en la que se buscó información en bases de datos, entre ellas PubMed, Scopus, Web of Science y Cochrane Library. Esta investigación analizó cómo los contaminantes, como las partículas de menos de 2.5 micras, las partículas de ≤10 micras, el dióxido de nitrógeno, el dióxido de azufre, el ozono y el carbono negro, afectaban a la salud materna y neonatal, incluyendo abortos espontáneos, preeclampsia, partos prematuros, bajo peso al nacer y anomalías respiratorias y neurológicas neonatales**.** **Resultados.** Se analizaron 26 artículos que cumplían los criterios establecidos. Los hallazgos revelaron repetidamente que la contaminación ambiental aumentaba el riesgo de problemas gestacionales y de consecuencias neonatales adversas; y que contaminantes como las partículas de menos de 2.5 micras y el dióxido de nitrógeno estaban relacionados de manera significativa con trastornos hipertensivos, partos antes de la fecha prevista, bajo peso al nacer y disminución de la función inmunológica y respiratoria del recién nacido. También se analizó cómo la contaminación afecta la salud a través de procesos biológicos como el estrés oxidativo y las alteraciones epigenéticas. Se observó variabilidad en los diseños de las investigaciones, las metodologías de evaluación de la exposición y los niveles de contaminación regional. **Conclusión.** Esta revisión subraya la relación entre la contaminación del aire, en particular las partículas de menos de 2.5 micras y el dióxido de nitrógeno, con los resultados adversos prenatales y neonatales. Reconocer

estos riesgos es fundamental para la atención de enfermería, ya que permite a las enfermeras educar, identificar los riesgos tempranos y promover políticas que protejan a las madres y a los recién nacidos. El fortalecimiento de las intervenciones mejorará los resultados de salud para ambos.

Descriptores: contaminación del aire ambiente; resultados neonatales; complicaciones del embarazo; material particulado; salud materna.

Danos Silenciosos: Como a Poluição do Ar Ambiente Ameaça a Saúde Pré-natal e Neonatal. Uma Revisão Sistemática

Resumo

Objetivo. Examinar a relação entre poluição do ar ambiente e desfechos pré-natais e neonatais adversos. **Métodos.** Foi realizada uma revisão sistemática com busca de informações em bases de dados como PubMed, Scopus, Web of Science e Biblioteca Cochrane. Este estudo analisou como poluentes, como material particulado menor que 2.5 mícrons, material particulado ≤ 10 mícrons, dióxido de nitrogênio, dióxido de enxofre, ozônio e carbono negro, afetaram a saúde materna e neonatal, incluindo abortos espontâneos, pré-eclâmpsia, parto prematuro, baixo peso ao nascer e anormalidades respiratórias e neurológicas neonatais**. Resultados.** Vinte e seis artigos que atenderam aos critérios estabelecidos foram analisados. Os resultados revelaram repetidamente que a poluição do ar ambiente aumentou o risco de problemas gestacionais e desfechos neonatais adversos; e que poluentes como material particulado menor que 2.5 mícrons e dióxido de nitrogênio foram significativamente associados a distúrbios hipertensivos, parto prematuro, baixo peso ao nascer e diminuição da função imunológica e respiratória do recém-nascido. Também analisamos como a poluição afeta a saúde por meio de processos biológicos, como estresse oxidativo e alterações epigenéticas. Variabilidade foi observada em delineamentos de pesquisa, metodologias de avaliação de exposição e níveis regionais de poluição. **Conclusão.** Esta revisão destaca a relação entre poluição do ar, particularmente material particulado menor que 2.5 mícrons e dióxido de nitrogênio, com desfechos pré-natais e neonatais adversos. Reconhecer esses riscos é fundamental para o cuidado de enfermagem, pois permite que os enfermeiros eduquem, identifiquem riscos precoces e promovam políticas que protejam mães e recém-nascidos. O fortalecimento das intervenções melhorará os desfechos de saúde para ambos.

Descritores: poluição do ar ambiente; desfechos neonatais; complicações na gravidez; material particulado; saúde materna.

Introduction

Ambient air pollution, a major global health issue, is one of the leading causes of premature death and disease burden. It causes 6.7 million deaths globally, making it the third most significant risk factor for death.[1] The World Health Organisation (WHO) describes pollution in the air as any chemical, physical, or biological agent that contaminates the interior or outdoor environment and alters the atmosphere's inherent properties.[2] Rapid urbanization, industry, and high vehicle emissions are major causes of air pollution. The elevated amounts of greenhouse pollutants, The combustion of fossil fuels has resulted in a rise in carbon dioxide, methane, nitrous oxide, ozone , and fluorinated gases.[3] These heat-trapping GHGs increase the frequency and severity of wildfires, sand and dust storms, and global surface temperatures, as well as contributing to air pollution, particularly particulate matter (PM), a complex mixture of solids and aerosols varying in size, shape, and chemical composition. PM is made up of metals, dust or soil particles, natural and synthetic compounds, and allergens.[4] Those that have an aerodynamic diameter of less than 10μm (Particulate Matter $\leq$10 micrometers), which is small enough to penetrate the lungs and be deposited in the upper airways, are especially concerning. Aerodynamic diameters smaller than 2.5μm can enter the circulatory system via the alveoli of the lungs (Particulate matter smaller than 2.5 microns) are considerably more dangerous.[5]

The World Health Organization (WHO) suggests that air pollution causes around seven million premature mortality per year primarily due to respiratory and cardiovascular diseases. Furthermore, 99 percent of people worldwide breathe air that exceeds permissible limits, with low- and middle-income countries bearing the brunt of this burden.[6] Ambient air pollution has a more harmful impact on vulnerable individuals, including children, the elderly, pregnant women, and people with comorbidities. [1,7,8] Because of their special physiology, expectant mothers and their unborn kids are especially vulnerable to the impacts of air pollution. Physiological changes during pregnancy include a 20% increase in oxygen intake, a 40% to 50% increase in minute breathing, and a 40% increase in cardiac output.[9] These modifications raise exposure by increasing the quantity of pollutants that are breathed in and circulated. The new-born is especially at risk and may have already been negatively affected by air pollution while still in the womb. Pollutants cross the placenta and reach the fetal circulation. According to a study, carbonaceous air pollution particles breathed by mothers during pregnancy had the capability to enter through the placenta and enter embryonic organs.[10] Once in the maternal circulation, these pollutants activate many biological processes that affect prenatal and neonatal health. Oxidative stress is a primary mechanism in which pollution exposure produces reactive oxygen species (ROS) that damage placental and fetal cells, increasing the likelihood of problems such preeclampsia,

gestational hypertension and intrauterine growth restriction.[11]

Pollutant exposures such as Particulate matter smaller than 2.5 microns and Nitrogen Dioxide triggers pro-inflammatory cytokines such as IL-1ß and TNF-α, which can damage placental function and raise the risk of premature delivery.[12,13] Pollutant exposure also causes placental malfunction, since alterations in vascularization and nutritional transport pathways can result in fetal hypoxia and malnutrition, raising the risk of low birth weight , preterm birth[14] and young kids death, and adverse lung and respiratory effects.[15] Air pollution has also been linked to epigenetic alterations in placental DNA, such as changes in DNA methylation patterns that affect gene expression during fetal development,[16] These changes might have long-term effects on the health of the children.[17] Notably, individuals trying to conceive are also at significant risk for prolonged time to conception,[18] miscarriage,[19-21] infertility[22] and decreased success rate with in-vitro fertilization (IVF) treatment due to the effects of high air pollution exposure.[23]

In addition to gestational exposures, new-borns' lungs are still developing, making them susceptible to airborne pollutants.(24) Neonatals have a greater resting metabolic rate than older children and adults, resulting in increased oxygen consumption, upper and lower airway resistance, reduced lung capacity, and respiratory muscle endurance.[25] Because infants breathe in twice as much air per body weight as adults do, twice as many air contaminants may potentially enter an infant's lungs. Since newborns' airways are smaller, even a slight restriction brought on by inflammation from exposure to environmental contaminants or infection in lung has a unreasonable effect on airway obstruction. [26] [27]

Despite the well-established harmful health effects of air pollution of expectant mothers and new-borns, especially in low-income areas where data collection and air quality monitoring are few, there are still research gaps. Furthermore, although a number of studies have examined links between air pollution and unfavourable birth outcomes, more longitudinal research is required to demonstrate direct pathways, and causative mechanisms are currently being examined.[28] With an emphasis on developing nations, where the burden of pollution-related health issues is disproportionately large, this study attempts to methodically evaluate the available data regarding the effects of ambient air pollution on maternal and neonatal outcomes.

The objective of this review was to assess the relationship among ambient air pollution and adverse prenatal and neonatal outcomes. It examines the impact of key pollutants (Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers, Nitrogen Dioxide, Sulfur Dioxide, Ozone) on maternal and neonatal health, explores underlying biological mechanisms, and identifies key research gaps and future directions for intervention.

Methods

The aim of this systematic review is to put together what is now known about how air pollution affects pregnancy and neonatal outcomes. The study looks at a range of health outcomes for pregnant women and new-borns, including preeclampsia, pregnancy-related hypertension, premature birth, low birth weight, intrauterine growth restriction, and new-born respiratory distress syndrome. To enhance methodological transparency and reproducibility, this systematic review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) recommendations.[29] It provides a formal framework for performing and reporting systematic reviews, guaranteeing that the review process is complete, neutral, and methodologically sound.

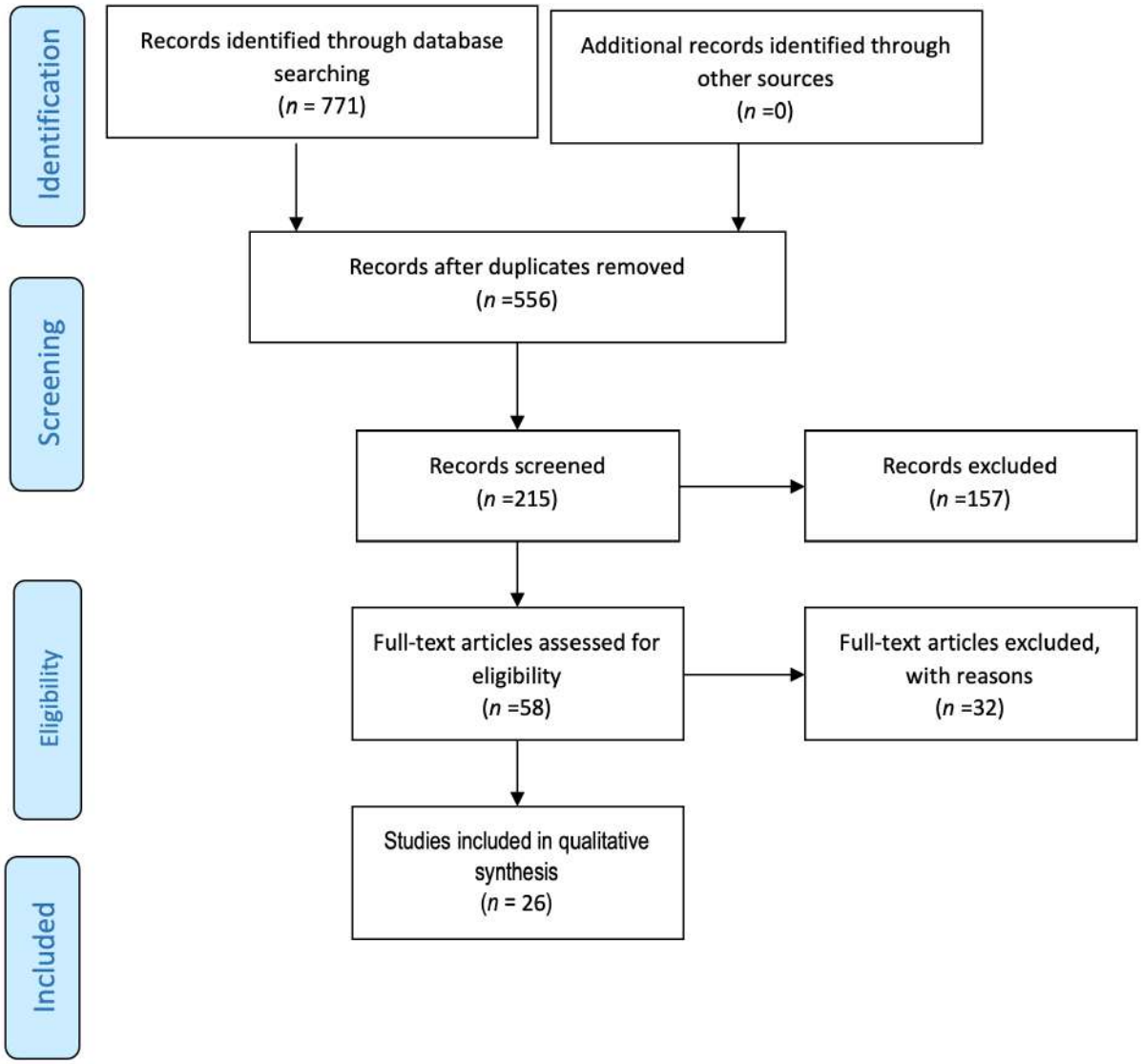


Figure 1. Schematic presentation of PRISMA flowchart

Eligibility criteria. *(i) Inclusion criteria*. The individuals selected for this review must meet the PECOS criteria: Pregnant women during all stages of their pregnancy, including birth; Prenatal exposure to air pollution is one example of an exposure; Pregnant women had less exposure levels, with or without bad delivery results, compared to those with higher exposure and unfavorable birth outcomes; Unfavourable birth outcomes include birth of neonate before expected date, low birth weight, and perinatal death; Furthermore, papers written in English, research conducted between 2018 and 2024 were included. *(ii) Exclusion criteria.* Research Article lacking a full report; Qualitative studies, systematic reviews, short communications, and commentaries were excluded; and Studies focusing on occupational or indoor air pollution.

Search strategy. To study the relationship of environmental air pollution & maternal & neonatal consequences, a comprehensive search strategy was developed. The primary research question focused on how exposure associate ambient air pollution with gestation and outcomes of neonates such as birth weight, preterm birth, and neonatal mortality. Searches were conducted in major scientific databases, including PubMed, Scopus, Web of Science, Cochrane Library, and ScienceDirect. Search queries combined these terms using for example: ((“Air pollution, ”[MeSH Terms] OR(“Ambient Particulate Matter”[MeSH Terms] OR(“Traffic-Related Pollution”[MeSH Terms])))) AND ”[Title/Abstract] ((“Maternal Health”*OR “Pregnancy Outcome”* (Pre-Eclampsia, Eclampsia, Diabetes, Gestational, Abortion, Spontaneous]) [Title/Abstract] “AND (((“Newborn Health”* OR Infant Health* ((“Infant, Low Birth Weight”[Title/Abstract] OR “Premature Birth ” [Title/ Abstract] OR “Cerebral Palsy”[Title/ Abstract]))). PRISMA flowchart was employed to document study selection

Study Selection. In order to find pertinent papers on the outcome of environment air pollution on pregnant & newborn outcomes, two researchers independently carried out a thorough search. The chosen studies were also evaluated for methodological rigor and relevance. Full-text publications of the pertinent research were obtained and carefully examined in order to guarantee the review’s objectivity and legitimacy. Each study’s eligibility was assessed independently by two researchers, lowering the possibility of selection bias. To ensure openness and consistency in the selection process, the procedure involved carefully recording the justifications for rejecting research that did not fit the predetermined standards. This thorough method improves the validity and dependability of the review’s conclusions while also being in line with standards for research quality.

Data extraction. An organized data extraction form was created in order to methodically gather important data from chosen studies. The retrieved data contained research study features such as author, year of publication, country, research design, and sample size. Exposure measures were also recorded, detailing the type of pollutant, measurement methods and exposure duration. Additionally, relevant outcome factors such as gestational age at birth, birth weight, neonatal death, congenital anomalies, stillbirth, intrauterine growth restriction, neonatal respiratory distress were systematically documented. To ensure consistency and minimize bias, two reviewers independently extracted the data. Any disagreements arising during the process were resolved through discussion.

Quality of Bias. The Joana Briggs Institute (JBI) critical assessment checklist for cohort and case-control studies (30) was utilized to evaluate the standard of the appropriate studies. Two reviewers did an independent quality evaluation. Any inconsistencies discovered during the quality evaluation were resolved through evidence-based conversations with the assistance of a third researcher. Only papers with a quality evaluation score of more than 50% were chosen for this review, [30] [31] as shown in Table 1. All studies got score from 7 to 10. One cross-sectional study [32] included in this review had a poorer quality score (4/11) based on the Joanna Briggs Institute criteria, owing mostly to its research design. Regardless of its shortcomings, this study provides important early information on the association of air pollution in the environment and outcomes of neonatal. Interestingly, its findings are similar with those of higher-quality cohort studies included in this review, indicating an overall trend of increased risk linked with particulate matter (Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers) & nitrogen dioxide (Nitrogen Dioxide).

Search Results. A total of 771 studies from PubMed, Scopus, Web of Science, Cochrane Library, Science Direct, were found through the methodical search. There were 215 papers left

for title and abstract screening after duplicates 556 studies were eliminated. Studies that were deemed irrelevant to ambient air pollution and maternal or neonatal outcomes were eliminated after the first screening procedure 157. Predetermined inclusion and exclusion criteria were used to assess eligibility of the complete texts of 58 research. Following the full-text evaluation, papers with methodological flaws, insufficient data, or no pertinent exposure assessment were disqualified 32. Lastly, the studies included 26 studies as presented in the PRISMA flowchart (Figure 1).

Table 1. Features of the research articles

Sr. No	Cite	Author /Year / Country	Title	Research design	Samples	Exposure	Research findings
1	(33)	Gaskins *et al.*, 2019 USA	Pollution in the Air and Miscarriage Threat	Prospective cohort study	19308	Proximity to roads and PM	Air pollution linked to increased miscarriage risk in sensitive subgroups.
2	(34)	Mitku *et al*., 2023 South Africa	Impact of Ambient Air Pollution during Pregnancy on Birth Outcomes	Mother and Child in the Environment birth cohort	996	Particulate matter smaller than 2.5 microns, Sulfur Dioxide	Preterm birth, low birthweight/ Small for gestational age
3	(35)	Sun *et al*., 2024 USA	Exposure during pregnancy of Black Carbon Particles and Fetal Impact	Retrospective cohort study	386 361	Particulate matter smaller than 2.5 microns, black carbon, and organic matter	Increased Pre-eclampsia – Eclampsia risk associated with exposure.
4	(36)	Yuan *et al*., 2023 China	Pollution of air and Hypertension during the Pregnancy	Cohort Study	22 821	Particulate matter smaller than 2.5 microns and PM1	Increased de novo hypertensive disorders of pregnancy risk, especially in early pregnancy.
5	(37)	Niedzwiecki *et al*., 2020 Mexico	Air Pollution and Postpartum Depression	Cohort study	509	Prenatal and postpartum exposure to Particulate matter smaller than 2.5 microns	Higher postpartum depression risk at six months

Table 1. Features of the research articles (Cont.)

Sr. No	Cite	Author /Year / Country	Title	Research design	Samples	Exposure	Research findings
6	(38)	Duan *et al.*, 2022 China	Air Pollution and Postpartum Depression Risk	Cohort study	10 209	Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers, sulfer oxide Carbon Monoxide, Nitrogen Dioxide, and Ozone	Increased exposure during pregnancy significantly elevated postpartum depression risk at 6 months
7	(39)	Bastain *et al*., 2021 US	Prenatal Air Pollution and Maternal Depression	Maternal and developmental risks from environmental and social stressors cohort	800	Nitrogen Dioxide, Particulate matter smaller than 2.5 microns, and Particulate Matter ≤10 micrometers	Increased second trimester exposure linked to postpartum depression.
8	(40)	Ananth *et al.*, 2018 USA	Air Pollution and Placental Abruption Risk	Case-crossover design	1190	Nitrogen Dioxide, Particulate matter smaller than 2.5 microns	Specific lag days increased the odds of abruption.
9	(41)	Cocchi *et al*., 2023 taly	Air Pollution and Aeroallergens as Preterm Birth Triggers	Retrospective cohort design	Not specified	Particulate matter smaller than 2.5 microns**,** Ozone**,** Nitrogen Dioxide**,** and aeroallergens	Acute air pollution exposure prior to delivery linked to increased preterm birth risk.
10	(42)	Yu *et al*., 2020 China	Maternal Particulate matter smaller than 2.5 microns Exposure and GDM"	Cross sectional study	54 517	Particulate matter smaller than 2.5 microns	Increased exposure during the 2nd trimester was linked to higher Gestational Diabetes Mellitus risk.
11	(43)	Gaskins *et al*., 2020 England	Air Pollution and Pregnancy Loss Risk in assisted reproductive technologies	Prospective cohort study	275	Particulate matter smaller than 2.5 microns, Black Carbon, Nitrogen Dioxide, Ozone	Higher exposure of Nitrogen Dioxide after 30 days of pregnancy was linked to increased loss risk
12	(44)	Xu *et al*., 2023 China	Air Pollution, Pregnancy Hormones, and Early Miscarriage	Case–control study	440	Carbon Monoxide, Sulfur Dioxide	Short-term exposure increases early miscarriage risk via progesterone changes.

Table 1. Features of the research articles (Cont.)

Sr. No	Cite	Author /Year / Country	Title	Research design	Samples	Exposure	Research findings
Neonatal Outcomes							
13	(45)	He *et al.*, 2019 China	Early-Life Air Pollution and Lung Function	Cohort Study	2942	Particulate Matter ≤10 micrometers, Nitrogen Dioxide, Nitrogen oxide	Reduced lung function and increased wheezing risk.
14	(46)	Pedersen *et al*., 2023 Denmark	Prenatal Air Pollution and Immune Disruptions	Prospective mother–child cohort	700	Nitrogen Dioxide, Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers	Prenatal exposure associated with immune changes, allergies, and asthma risk at 6 years of age of Child
15	(47)	Martins Costa Gomes *et al*., 2021 US	Antenatal Air Pollution Linked to Altered Cord Blood Immunity	Prospective cohort design	91	Particulate matter smaller than 2.5 microns, Sulfur Dioxide	Gestational vulnerability associated with immune cell alterations in newborns.
16	(48)	García-Serna *et al*., 2021 Spain	Traffic Pollution in pregnancy Impairs Newborn Immunity	New-borns and Environmental Air Pollution Cohort	NA	Nitrogen Dioxide, Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometersOzone	Prenatal Air Pollution and Immune Cell Changes
17	(49)	Madhloum *et al*., 2019 Belgium	Prenatal Air Pollution and Blood Pressure of Neonates	Prospective Birth Cohort Study	427	Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers Black Carbon, Nitrogen Dioxide	Prenatal air pollution exposure linked to higher newborn BP
18	(50)	Ghazi *et al*., 2021 South Africa	Air Pollution, Placental Methylation, and Foetus Health	Epidemiological cohort study	Not specified	Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers Nitrogen Dioxide, Ozone, Black carbon	Prenatal air pollution alters placental epigenetics, impacting fetal health

Table 1. Features of the research articles (Cont.)

Sr. No	Cite	Author /Year / Country	Title	Research design	Samples	Exposure	Research findings
19	(51)	Gu *et al.*, 2024 China	Association between environmental pollutants and the risk of premature infant	Retrospective cohort study	7288	Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers, Nitrogen Dioxide, Sulfur Dioxide, Carbon Monoxide	Exposure to air pollution during pregnancy is strongly linked to an increased risk of preterm birth
20	(32)	Kaiser *et a*l., 2023 Austria	Prenatal exposure to per- and polyfluoroalkyl substances Exposure and Pregnancy Outcomes	Cross-sectional study	136	Prenatal exposure to per- and polyfluoroalkyl substances	Prenatal exposure to per- and polyfluoroalkyl substances exposure was linked to placental Perfluorodecanoic acid in Small for gestational age births and Perfluorohexane sulfonic acid in preterm birth
21	(52)	McGuinn *et al.*, 2020 Mexico	Prenatal Particulate matter smaller than 2.5 microns Exposure and Child Behavior	Prospective birth cohort	539	Particulate matter smaller than 2.5 microns	Prenatal first-trimester Particulate matter smaller than 2.5 microns exposure was linked to higher attention problem and hyperactivity scores.
22	(53)	Shih *et al.*, 2020 Taiwan	Prenatal Traffic Pollution and Hyperactivity"	Birth Cohort Study	16 376 mother-infant pairs	Nitrous Oxide	Prenatal nitric oxide exposure significantly increased hyperactivity risk in children before age eight.
23	(54)	Irizar *et al*., 2021 Spain	Prenatal Air Pollution and Newborn Thyroxine	Prospective cohort study	463	Particulate matter smaller than 2.5 microns, Nitrogen Dioxide	Prenatal Particulate matter smaller than 2.5 microns exposure increased newborn TT4 levels, with stronger effects later in pregnancy

Table 1. Features of the research articles (Cont.)

Sr. No	Cite	Author /Year / Country	Title	Research design	Samples	Exposure	Research findings
24	(15)	Johnson *et al.*, 2024 Canada	Prenatal Pollution and Newborn Respiratory Distress	Prospective cohort study	2001	Particulate matter smaller than 2.5 microns, Nitrogen Dioxide	Pollution exposure increases neonatal interventions, particularly ventilation and antibiotic treatments
25	(55)	Y. Zhang *et al*., 2024 Canada	Prenatal Pollution and Cerebral Palsy Risk	Cohort study	1 587 935	Particulate matter smaller than 2.5 microns, Nitrogen Dioxide, Ozone	Higher prenatal Particulate matter smaller than 2.5 microns linked to increased cerebral palsy risk in newborns.
26	(56)	Soesanti *et al.*, 2023 Indonesia	Traffic Pollution Effects on Birth Size	Prospective cohort study	413	Particulate matter smaller than 2.5 microns, soot, Nitrogen Oxide, and Nitrogen Dioxide	High air pollution linked to shorter birth length but not weight.

Abbreviations: PM 2.5 microns: Particulate matter smaller than 2.5 microns; SO2 Sulfur Dioxide; PM10 – Particulate Matter ≤10 micrometers; NO: Nitric Oxide; CO – Carbon Monoxide; NO2 – Nitrogen Dioxide; O3 – Ozone; MACE: Mother and Child in the Environment; HDP: HF; Black Carbon (BC); MADRES Maternal and developmental risks from environmental and social stressors; NELA: New-borns and Environmental Air Pollution; ENVIRONAGE (ENVIRonmental influence ON early AGEing); ART: assisted reproductive technologies; PFAS: prenatal exposure to per- and polyfluoroalkyl substances

Results

Around 26 research articles were finalized as per criteria developed by researcher. The results of these studies are more broadly applicable because they were carried out in a variety of geographical locations, such as the USA (5), China (5), South Africa (2), Mexico (2), Spain (2), Belgium (1), Canada (2), Denmark (1), Taiwan (1), Indonesia (1), Italy (1), Austria (1), and England (1). With 528802 participants, the entire sample size offers strong evidence for the link between prenatal exposure to atmospheric air pollution and unfavourable gestational and new-born consequences. According study's findings, exposure to pollutants like Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers, Nitrogen Dioxide, Sulfur Dioxide, Ozone, Carbon Monoxide, and black carbon poses serious risks for miscarriage, hypertensive disorders of pregnancy, gestational diabetes mellitus, postpartum depression, preterm birth, low birth weight, nervous system dysfunction, immunological dysfunction, and neurodevelopmental disorders in new-borns. These findings underscore the urgent need for targeted policies and interventions to mitigate the harmful outcomes of air pollution on mother and new-born health.

Maternal Outcomes

Miscarriage & Pregna ncy Loss. Gaskins *et al.*[21] performed a prospective cohort study in the USA include 19 308 expectant mothers. Their research discovered that exposure to air pollution, particularly fine particulate matter (Particulate matter smaller than 2.5 microns) and proximity to roads, significantly augmented the danger of miscarriage. This effect was more pronounced in sensitive subgroups, such as those with previous health problems. Likewise, Xu *et al* [44] China performed a case-control study with 440 participants and reported that early contact to carbon monoxide and sulfur dioxide (Sulfur Dioxide) linked with early abortion. They suggested that air pollution might disrupt hormone levels, particularly progesterone, leading to pregnancy loss. Furthermore, Gaskins *et al.*[43] in England studied 275 ladies experienced assisted reproductive technologies. They found that greater prominence to nitrogen dioxide (Nitrogen Dioxide) and Particulate matter smaller than 2.5 microns after 30 days of pregnancy significantly increased the risk of pregnancy loss, highlighting the vulnerability of assisted reproductive technologies pregnancies to air pollution.

Pregnancy Hypertension & Preeclampsia. Yuan *et al.*[36] in China conducted a cohort study involving 22 821 women and found that vulnerability to Particulate matter smaller than 2.5 microns and PM1 during early pregnancy was connected to a more risk of de novo hypertensive disorders of pregnancy. Their study emphasized that the risk was modified by age of the mother and education status, suggesting socioeconomic factors might influence susceptibility. Similarly, Sun *et al.*[35] in the USA analysed data from 386 361 pregnancies in a retrospective cohort study and found vulnerability to black carbon, Particulate matter smaller than 2.5 microns, and organic matter highly danger of preeclampsia and eclampsia. This study exhibits the part of air pollution in maternal cardiovascular complications, which can lead to life-threatening conditions if untreated.

Placental & Birth Complications. Ananth *et al.*[40] in the USA conducted a case-crossover study on 1190 women and found that vulnerability to Nitrogen Dioxide & Particulate matter smaller than 2.5 microns on specific lag days significantly increased the odds of placental abruption. Placental abruption is a severe pregnancy complication leading to heavy bleeding and potential foetal distress. Kaiser *et al*.[32] in Austria investigated a cross-sectional study on 136 pregnancies and found that prenatal exposure to per- and polyfluoroalkyl substances was linked to small-for-gestational-age births and preterm birth. Ghazi *et al.*[50] in South Africa explored the molecular mechanisms behind these outcomes and discovered that prenatal vulnerability to Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers, Nitrogen Dioxide, and Ozone led to DNA methylation changes in the placenta. These epigenetic alterations can impact fetal development, birth outcomes, and long-term disease susceptibility

Postpartum Depression. Niedzwiecki *et al*.[37] in Mexico conducted a cohort study with five zero nine women discovered the prenatal and postpartum vulnerability to Particulate matter smaller than 2.5 microns significantly highly danger of postpartum depression at six months. A similar study by Duan *et al*.[38] in China involving 10 209 women confirmed these findings, reporting that vulnerability to Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers, Sulfur Dioxide, Nitrogen Dioxide, and Ozone during gestation heightened postpartum depression risk. Bastain *et al*.[39] in the USA studied 800 women in the Maternal and developmental risks from environmental and social stressors cohort and discovered that increased vulnerability to Nitrogen Dioxide, Particulate matter smaller than 2.5 microns, & Particulate Matter ≤10 micrometers throughout the second trimester particularly related to postpartum depression, suggesting that mid-pregnancy is a critical period of susceptibility.

Gestational Diabetes. Yu *et al.*[42] in China conducted a cross-sectional study with 54 517 women and discovered that increased vulnerability to Particulate matter smaller than 2.5 microns throughout the 2nd trimester was significantly more prone of gestational diabetes mellitus (GDM). This finding suggests that air pollution may provide to metabolic disorders in pregnancy, potentially affecting both maternal and fetal health.

Neonatal Outcomes

Premature Birth & Underweight. Mitku *et al*.[34] in South Africa conducted a birth cohort study with 996 participants and discovered vulnerability to Particulate matter smaller than 2.5 microns and Sulfur Dioxide was related with more frequencies of preterm birth and underweight, particularly small-for-gestational-age infants. Cocchi *et al.*[41] in Italy performed a retrospective cohort study and discovered that acute vulnerability to Particulate matter smaller than 2.5 microns, Ozone, Nitrogen Dioxide, and aeroallergens just before delivery significantly increased the risk of preterm birth. Similarly, Gu *et al*.[51] in China analysed 7288 pregnancies and found that exposure to Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers, Nitrogen Dioxide, Sulfur Dioxide, and Carbon Monoxide throughout gestation substantially increased the risk of preterm birth. Soesanti *et al*.[56] in Indonesia studied 413 new-borns and discovered that high vulnerability to Particulate matter smaller than 2.5 microns, Nitric Oxide, and Nitrogen Dioxide related with shorter birth duration, although birth weight was not significantly affected.

Immune System & Allergy Risks. Pedersen *et al.*[46] in Denmark conducted a prospective mother-child cohort study with 700 participants and established that antenatal vulnerability to Nitrogen Dioxide, Particulate matter smaller than 2.5 microns, and Particulate Matter ≤10 micrometers was linked to immune system disruptions, leading to increased risks of allergies and asthma in kids at the 6 years of age. Martins Costa Gomes *et al.*[47] in the USA studied 91 new-borns and found that prenatal exposure to Particulate matter smaller than 2.5 microns and Sulfur Dioxide altered immune cell profiles in cord blood, potentially affecting the child's long-term immunity. Similarly, García-Serna *et al*. [48] in Spain analysed data from the New-borns and Environmental Air Pollution cohort and found that traffic-related air pollution, particularly Nitrogen Dioxide, Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers, and Ozone, impaired new-born immune function by altering immune cell counts

Respiratory and Neurological Risks. He *et al.*[45] in China conducted a cohort study with 2942 infants and found that prenatal and early postnatal vulnerability to Particulate Matter ≤10 micrometers and Nitrogen Dioxide reduced respiratory activities and increased wheezing risk. Johnson *et al.*[15] in Canada studied 2,001 new-borns and discovered that vulnerability to Particulate matter smaller than 2.5 microns and Nitrogen Dioxide significantly enhanced the likelihood of neonatal respiratory distress, often demanding management such as ventilation and antibiotic treatments. Y. Zhang *et al* [55] in Canada performed a large cohort study with 1 587 935 births and identified that antenatal ventilation to Particulate matter smaller than 2.5 microns was related to an increased risk of cerebral palsy, highlighting the prone to get neurotoxic impacts of air pollution.

Neurodevelopmental Effects. McGuinn *et al.*[52] in Mexico performed a prospective birth cohort study with 539 children & discovered that first-trimester exposure to Particulate matter smaller than 2.5 microns was related with higher attention problem & hyperactivity scores. Shih *et al.*[53] in Taiwan studied 16 376 mother-infant pairs and found that prenatal exposure to nitric oxide suggestively amplified the danger of hyperactivity in kids before the age of eight. Madhloum *et al.*[49] in Belgium conducted a prospective birth cohort

study with 427 new-borns and vulnerability during gestation to Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers, black carbon & Nitrogen Dioxide was linked to more neonatal blood pressure. Irizar *et al.*[54] in Spain studied 463 pregnancies and found that prenatal Particulate matter smaller than 2.5 microns exposure increased newborn thyroxine (TT4) levels, with stronger effects when exposure occurred later in pregnancy, suggesting a possible disruption in thyroid function

Discussion

A full look at the data shows that pollution in the air around us has a big effect on the health of mothers and their babies. The results show that being around pollutants like Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers, Nitrogen Dioxide, Sulfur Dioxide, and black carbon is strongly linked to bad pregnancy outcomes like miscarriage, high blood pressure, gestational diabetes, and postpartum depression. Also, being exposed to anything before birth has been linked to a higher chance of giving birth too early, having a low birth weight, having breathing issues, having problems with the immune system, and having cognitive impairments in new-borns. There are, however, discrepancies in the literature; other studies show that there is no association in some populations, which shows that additional research is needed.

The results of this study are in line with what other studies have shown on the links between air pollution and poor health outcomes for mothers and new-borns Gaskins *et al*.[33] , Xu *et al*.[44] observed that being around Particulate matter smaller than 2.5 microns and Nitrogen Dioxide increased the risk of miscarriage. However, a European study indicated that lifestyle and genetic factors had a bigger impact. Similarly, Yuan *et al*.[36] and Sun *et al.*[35] found that being around pollution made people more likely to have high blood pressure, although a Nordic study did not detect this relationship, perhaps because pollution control strategies were different. The link between prenatal exposure to air pollution and immune dysfunction in new-borns, found by Pedersen *et al.*[46] and Martins Costa Gomes *et al.*[47] supports the idea that environmental pollutants have a big impact on developmental health. However, studies that don't agree with this suggest that some adaptive immune mechanisms may lessen the long-term effects. These differences show how important it is to think about differences in genetics, socioeconomic status, and location when looking at findings.

This review's main result was that Particulate matter smaller than 2.5 microns and other types of air pollution can make it more likely for a woman to lose her baby. This link is in line with what Gaskins *et al*. and Xu *et al*., found: that being around more particulate matter and carbon monoxide made it more likely that a woman would lose her pregnancy early.[33,44] Oxidative stress, which is a recognized effect of being around pollution, might be the cause of this. Oxidative stress can mess with hormonal signals and the function of the placenta, which might cause the fetus to die. For example, Particulate matter smaller than 2.5 microns exposures has been found to cause inflammation, which might affect blood flow to the uterus and placenta, which is important for keeping a pregnancy going. Also, research like Gaskins *et al.*[17] backs up the idea that greater levels of Nitrogen Dioxide and Particulate matter smaller than 2.5 microns exposure led to higher rates of pregnancy loss, even in pregnancies that were helped by assisted reproductive technologies[43] This demonstrates that pollution-related hormonal changes may impair both spontaneous and aided pregnancies. This shows how sensitive the reproductive system is to stresses in the environment.

Researchers have shown a strong association between exposure to pollutants such Particulate matter smaller than 2.5 microns, Nitrogen Dioxide, and black carbon and hypertensive

diseases during pregnancy, such as preeclampsia. It is found that when a mother is exposed to these pollutants, her chance of having new high blood pressure problems during pregnancy goes up.[35,36] Systemic inflammation and oxidative stress are probably what link air pollution with preeclampsia. Researchers have shown that pollutants including Particulate matter smaller than 2.5 microns and black carbon can cause the release of pro-inflammatory cytokines, which are thought to have a role in the development of preeclampsia. Pollutants like Particulate matter smaller than 2.5 microns can cause the body to produce interleukins (IL-6, IL-1ß, which can contribute to endothelial dysfunction, a common sign of preeclampsia.[11] In this case, studies evidence that being exposed to something during important times in pregnancy, like the first trimester, may have the worst effects on how well a woman's blood pressure is controlled.[35,36] This result shows how important it is to think about when people are exposed in future research.

This review also found a strong link between exposure to air pollution and preterm delivery and low birth weight, especially with pollutants such Particulate matter smaller than 2.5 microns, Particulate Matter ≤10 micrometers, and Nitrogen Dioxide. Researcher said that being around more Particulate matter smaller than 2.5 microns and Sulfur Dioxide during pregnancy greatly boosted the chance of having a baby too early or with a low birth weight.[34,41] One possible explanation for these links is that pollution might create inflammation and oxidative damage that makes the placenta less effective. For instance, when a mother is exposed to pollutants, it can interfere with the development of the placenta by affecting blood flow, food transfer, and oxygen exchange. This can lead to fetal hypoxia, which is a known risk factor for low birth weight and premature birth.[12] Also, research has indicated that air pollution can disrupt the DNA methylation of the placenta itself, which could have an effect on how the fetus grows. Ghazi *et al*.[50] discovered that being exposed to Particulate matter smaller than 2.5 microns and Nitrogen Dioxide before birth changed the DNA methylation in the placenta, which can affect gene expression that is important for fetal development. This change in molecules could explain why some pollutants are linked to low birth weight and preterm birth: they interfere with normal fetal development at the genetic level.

Studies like those by Niedzwiecki *et al.*[37] and Duan *et al*.[38] are discovering more and more evidence that being around air pollution can lead to postpartum depression. According to this research, being around Particulate matter smaller than 2.5 microns through gestation & the first few months after giving birth raises the risk of depression. This might work in a way similar to how air pollution affects high blood pressure by changing the chemistry of the brain and how it controls mood. This research shows that environmental pollution is a foremost issue that has to be addressed since it impacts both the physical and mental health of mothers. Women who breathe in a lot of polluted air may be more likely to develop mental health problems, which might have long-term effects on the health of both the mother and the baby.

The effect of prenatal air pollution exposure on neonatal health, particularly respiratory and immune function, has been well-documented. Pedersen *et al*.[46] and Martins Costa Gomes *et al.*[47] demonstrated that exposure to pollutants like Nitrogen Dioxide & Particulate matter smaller than 2.5 microns through gestation alters immune cell profiles in neonates, making them more susceptible to respiratory diseases, allergies, and asthma. The immune system of a newborn is still developing, and prenatal exposure to pollutants may alter its development, leading to long-term health consequences. This finding is in line with existing research that links antenatal vulnerability to environmental pollution with immune dysfunction, highlighting the need for early interventions to protect infants from these environmental stressors. Also, research articles

have revealed that environmental pollution might make new-borns' lungs work worse, which makes them more likely to have wheezing and other breathing problems. Researchers showed that being exposed to Particulate Matter ≤10 micrometers and Nitrogen Dioxide before birth greatly impaired lung function and raised the incidence of wheeze in new-borns.[45] This study shows how important it is to lower prenatal exposure to air pollution since the respiratory system is very sensitive to pollutants in the environment when a person is still developing.

Strength and limitations. One of the best things about this systematic review is that it looks at 26 different studies in depth, giving it a worldwide perspective and a large sample size of 528 802 people. Adding different research designs makes the results more generalizable, and molecular insights from studies help us understand how biological processes work. However, limitations include methodological variability across studies, potential exposure misclassification, and residual confounding from unaccounted factors. Additionally, the heterogeneity of pollutants examined complicates conclusions, and the geographical and temporal variability across studies may limit the applicability of findings to current conditions.

Conclusion. This systematic investigation corroborates the significant correlation between ambient air pollution and detrimental maternal and new-born outcomes, such as miscarriage, hypertensive disorders, preterm birth, and low birth weight. These findings provide essential insights for enhancing nursing care, facilitating early risk detection, maternal education, and the promotion of cleaner surroundings. Public health policy must mitigate exposure, while next research should concentrate on longitudinal cohort studies and targeted interventions to enhance evidence-based mother and child health nursing practices.

References

1. Ritchie H, Roser M. CO_2 and other Greenhouse Gas Emissions [Internet]. Available from: https://ourworldindata.org/co2-and-greenhouse-gas-emissions
2. Air pollution [Internet]. [cited 2025 Feb 13]. Available from: https://www.who.int/india/health-topics/air-pollution
3. US EPA O. Overview of Greenhouse Gases [Internet]. 2015 [cited 2025 Feb 13]. Available from: https://www.epa.gov/ghgemissions/overview-greenhouse-gases
4. US EPA O. Particulate Matter (PM) Basics [Internet]. 2016 [cited 2025 Feb 13]. Available from: https://www.epa.gov/pm-pollution/particulate-matter-pm-basics
5. Guilbert A, Bernard JY, Peyre H, Costet N, Hough I, Seyve E, et al. Prenatal and childhood exposure to ambient air pollution and cognitive function in school-age children: Examining sensitive windows and sex-specific associations. Environmental Research. 2023; 235:116557.
6. New WHO Global Air Quality Guidelines aim to save millions of lives from air pollution [Internet]. [cited 2025 Feb 19]. Available from: https://www.who.int/news/item/22-09-2021-new-who-global-air-quality-guidelines-aim-to-save-millions-of-lives-from-air-pollution
7. Ambient (outdoor) air pollution [Internet]. [cited 2025 Feb 13]. Available from: https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health
8. National Institute of Environmental Health Sciences [Internet]. [cited 2025 Feb 13]. Air Pollution and Your Health. Available from: https://www.niehs.nih.gov/health/topics/agents/air-pollution
9. Fan W, Zlatnik MG. Climate Change and Pregnancy: Risks, Mitigation, Adaptation, and Resilience. Obstetrical & Gynecological Survey. 2023; 78(4):223–36.

10. Bongaerts E, Lecante LL, Bové H, Roeffaers MBJ, Ameloot M, Fowler PA, et al. Maternal exposure to ambient black carbon particles and their presence in maternal and fetal circulation and organs: an analysis of two independent population-based observational studies. Lancet Planet Health. 2022; 6(10):e804–11.
11. Aouache R, Biquard L, Vaiman D, Miralles F. Oxidative Stress in Preeclampsia and Placental Diseases. International Journal of Molecular Sciences. 2018; 19(5):1496.
12. Wang X, Lin Y, Ge Y, Craig E, Liu X, Miller RK, et al. Systemic oxidative stress levels during the course of pregnancy: Associations with exposure to air pollutants. Environmental Pollution. 2024; 357:124463.
13. Ibrahim A, Khoo MI, Ismail EHE, Hussain NHN, Zin AAM, Noordin L, et al. Oxidative stress biomarkers in pregnancy: a systematic review. Reproductive Biology and Endocrinology. 2024; 22(1):93.
14. Sarizadeh R, Dastoorpoor M, Goudarzi G, Simbar M. The Association Between Air Pollution and Low Birth Weight and Preterm Labor in Ahvaz, Iran. International Journal of Women's Health. 2020; 12:313–25.
15. Johnson M, Mazur L, Fisher M, Fraser WD, Sun L, Hystad P, et al. Prenatal Exposure to Air Pollution and Respiratory Distress in Term Newborns: Results from the MIREC Prospective Pregnancy Cohort. Environmental Health Perspectives. 2024; 132(1):17007.
16. Singh S, Goel I, Tripathi S, Ahirwar A, Kumar M, Rana A, et al. Effect of environmental air pollutants on placental function and pregnancy outcomes: a molecular insight. Environmental Science and Pollution Research. 2024; 31(50):59819–51.
17. Broséus L, Guilbert A, Hough I, Kloog I, Chauvaud A, Seyve E, et al. Placental DNA methylation signatures of prenatal air pollution exposure and potential effects on birth outcomes: an analysis of three prospective cohorts. Lancet Planet Health. 2024; 8(5):e297–308.
18. Wesselink AK, Wang TR, Ketzel M, Mikkelsen EM, Brandt J, Khan J, et al. Air pollution and fecundability: Results from a Danish preconception cohort study. Paediatric and Perinatal Epidemiology. 2022; 36(1):57–67.
19. Xue T, Tong M, Li J, Wang R, Guan T, Li J, et al. Estimation of stillbirths attributable to ambient fine particles in 137 countries. Nature communications. 2022; 13(1):6950.
20. Mahalingaiah S, Missmer SE, Cheng JJ, Chavarro J, Laden F, Hart JE. Perimenarchal air pollution exposure and menstrual disorders. Human Reproduction. 2018; 33(3):512–9.
21. Gaskins AJ, Hart JE, Chavarro JE, Missmer SA, Rich-Edwards JW, Laden F, et al. Air pollution exposure and risk of spontaneous abortion in the Nurses' Health Study II. Human Reproduction. 2019; 34(9):1809–17.
22. Mahalingaiah S, Hart JE, Laden F, Farland LV, Hewlett MM, Chavarro J, et al. Adult air pollution exposure and risk of infertility in the Nurses' Health Study II. Human Reproduction. 2016; 31(3):638–47.
23. Conforti A, Mascia M, Cioffi G, De Angelis C, Coppola G, De Rosa P, et al. Air pollution and female fertility: a systematic review of literature. Reproductive Biology and Endocrinology. 2018; 16(1):117.
24. Lepeule J, Pin I, Boudier A, Quentin J, Lyon-Caen S, Supernant K, et al. Pre-natal exposure to Nitrogen Dioxide and PM 2.5 microns and newborn lung function: An approach based on repeated personal exposure measurements. Environmental Research. 2023; 226:115656.
25. Trachsel D, Erb TO, Hammer J, von Ungern□Sternberg BS. Developmental respiratory physiology. Pediatric Anesthesia. 2022; 32(2):108–17.
26. Vijayasekaran S. Pediatric Airway Pathology. Frontiers in Pediatrics. 2020; 8:246.
27. Trachsel D, Erb TO, Hammer J, von Ungern-Sternberg BS. Developmental respiratory physiology. Pediatric Anesthesia. 2022; 32(2):108–17.
28. Ha S, Yeung E, Bell E, Insaf T, Ghassabian A, Bell G, et al. Prenatal and early life exposures to ambient air pollution and development. Environmental Research. 2019; 174:170–5.
29. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Systematic Review. 2021; 10(1):89.
30. JBI Manual for Evidence Synthesis [Internet]. [cited 2025 Mar 31]. Available from: https://jbi-global-wiki.refined.site/space/MANUAL
31. Munn Z, Moola S, Lisy K, Riitano D, Tufanaru C. Methodological guidance for systematic reviews of observational epidemiological studies reporting prevalence and cumulative incidence data. International Journal of Evidence-Based Healthcare. 2015; 13(3):147–53.

32. Kaiser AM, Forsthuber M, Widhalm R, Granitzer S, Weiss S, Zeisler H, et al. Prenatal exposure to per- and polyfluoroalkyl substances and pregnancy outcome in Austria. Ecotoxicology and Environmental Safety. 2023; 259:115006.
33. Gaskins AJ, Hart JE, Chavarro JE, Missmer SA, Rich-Edwards JW, Laden F, et al. Air pollution exposure and risk of spontaneous abortion in the Nurses' Health Study II. Human Reproduction. 2019; 34(9):1809–17.
34. Mitku AA, Zewotir T, North D, Jeena P, Asharam K, Muttoo S, et al. Impact of ambient air pollution exposure during pregnancy on adverse birth outcomes: generalized structural equation modeling approach. BMC Public Health. 2023; 23(1):45.
35. Sun Y, Bhuyan R, Jiao A, Avila CC, Chiu VY, Slezak JM, et al. Association between particulate air pollution and hypertensive disorders in pregnancy: A retrospective cohort study. PLoS Medicine. 2024; 21(4):e1004395.
36. Yuan Z, Li Q, Su T, Yang J, Chen J, Peng Y, et al. Effects of fine ambient particulate matters on de novo hypertensive disorders of pregnancy and blood pressure before 20 weeks. Environmental Research. 2023; 218:115023.
37. Niedzwiecki MM, Rosa MJ, Solano-González M, Kloog I, Just AC, Martínez-Medina S, et al. Particulate air pollution exposure during pregnancy and postpartum depression symptoms in women in Mexico City. Environmental International. 2020; 134:105325.
38. Duan CC, Li C, Xu JJ, He YC, Xu HL, Zhang D, et al. Association between prenatal exposure to ambient air pollutants and postpartum depressive symptoms: A multi-city cohort study. Environmental Research. 2022; 209:112786.
39. Bastain TM, Chavez T, Habre R, Hernandez-Castro I, Grubbs B, Toledo-Corral CM, et al. Prenatal ambient air pollution and maternal depression at 12 months postpartum in the MADRES pregnancy cohort. Environmental Health. 2021; 20(1):121.
40. Ananth CV, Kioumourtzoglou MA, Huang Y, Ross Z, Friedman AM, Williams MA, et al. Exposures to Air Pollution and Risk of Acute-onset Placental Abruption: A Case-crossover Study. Epidemiology (Cambridge, Mass.). 2018; 29(5):631–8.
41. Cocchi E, Bellisario V, Cresi F, Plazzotta C, Cassardo C, Siniscalco C, et al. Air Pollution and Aeroallergens as Possible Triggers in Preterm Birth Delivery. International Journal of Environmental Research and Public Health. 2023; 20(2):1610.
42. Yu G, Ao J, Cai J, Luo Z, Martin R, Donkelaar A van, et al. Fine particular matter and its constituents in air pollution and gestational diabetes mellitus. Environment International. 2020; 142:105880.
43. Gaskins AJ, Mínguez-Alarcón L, Williams PL, Chavarro JE, Schwartz JD, Kloog I, et al. Ambient air pollution and risk of pregnancy loss among women undergoing assisted reproduction. Environmental Research. 2020; 191:110201.
44. Xu Q, Guan Q, Lu Y, Xu J, Deng S, Dong C, et al. Effect of short-term ambient air pollution exposure on early miscarriage and pregnancy hormones with critical window identification. Journal of Hazardous Materials. 2023; 460:132328.
45. He B, Huang JV, Kwok MK, Au Yeung SL, Hui LL, Li AM, et al. The association of early-life exposure to air pollution with lung function at ~17.5 years in the "Children of 1997" Hong Kong Chinese Birth Cohort. Environment International. 2019; 123:444–50.
46. Pedersen CET, Eliasen AU, Ketzel M, Brandt J, Loft S, Frohn LM, et al. Prenatal exposure to ambient air pollution is associated with early life immune perturbations. Journal of Allergy and Clinical Immunology. 2023; 151(1):212–21.
47. Martins Costa Gomes G, Karmaus W, Murphy VE, Gibson PG, Percival E, Hansbro PM, et al. Environmental Air Pollutants Inhaled during Pregnancy Are Associated with Altered Cord Blood Immune Cell Profiles. International Journal of Environmental Research and Public Health. 2021; 18(14):7431.
48. García-Serna AM, Hernández-Caselles T, Jiménez-Guerrero P, Martín-Orozco E, Pérez-Fernández V, Cantero-Cano E, et al. Air pollution from traffic during pregnancy impairs newborn's cord blood immune cells: The NELA cohort. Environmental Research. 2021; 198:110468.
49. Madhloum N, Nawrot TS, Gyselaers W, Roels HA, Bijnens E, Vanpoucke C, et al. Neonatal blood pressure in association with prenatal air pollution exposure, traffic, and land use indicators: An ENVIRONAGE birth cohort study. Environment International. 2019; 130:104853.
50. Ghazi T, Naidoo P, Naidoo RN, Chuturgoon AA. Prenatal Air Pollution Exposure and Placental DNA Methylation Changes: Implications on Fetal Development and Future Disease Susceptibility. Cells. 2021; 10(11):3025.

51. Gu J, Li J, Liu L, Cao M, Tian X, Wang Z, et al. Exploring the association between atmospheric pollutants and preterm birth risk in a river valley city. Frontiers in Public Health. 2024; 12:1415028.
52. McGuinn LA, Bellinger DC, Colicino E, Coull BA, Just AC, Kloog I, et al. Prenatal PM2.5 Exposure and Behavioral Development in Children from Mexico City. Neurotoxicology. 2020; 81:109–15.
53. Shih P, Huang CC, Pan SC, Chiang TL, Guo YL. Hyperactivity disorder in children related to traffic-based air pollution during pregnancy. Environmental Research. 2020; 188:109588.
54. Irizar A, Txintxurreta A, Molinuevo A, Jimeno-Romero A, Anabitarte A, Álvarez JI, et al. Association between prenatal exposure to air pollutants and newborn thyroxine (T4) levels. Environmental Research. 2021; 197:111132.
55. Zhang Y, Hu Y, Talarico R, Qiu X, Schwartz J, Fell DB, et al. Prenatal Exposure to Ambient Air Pollution and Cerebral Palsy. JAMA Network Open. 2024; 7(7):e2420717.
56. Soesanti F, Uiterwaal CSPM, Meliefste K, Chen J, Brunekreef B, Idris NS, et al. The effect of exposure to traffic related air pollutants in pregnancy on birth anthropometry: a cohort study in a heavily polluted low-middle income country. Environmental Health. 2023; 22(1):22.

Original Article

Check for updates

UNIVERSIDAD DE ANTIOQUIA
1803

Effect of a mobile-based, family-centered self-care education program on Health Literacy and Self-Care in Patients with Heart Failure: A Randomized Controlled Trial

Zohreh Badiyepeymaiejahromi[1,4]
https://orcid.org/0000-0001-6643-036X
Mahsa Khorramkish[2,4]
https://orcid.org/00000-0003-3571-1470
Ali Asghar Rahmaniankushkaki[3,4]
https://orcid.org/0000-0001-9516-833X

Effect of a mobile-based, family-centered nursing education program on Health Literacy and Self-Care in Patients with Heart Failure: A Randomized Controlled Trial

Abstract

Objective. To evaluate the effect of family-centered self-care education via tele-nursing on health literacy and the self-care status of patients with heart failure. **Methods.** This study is a randomized, controlled clinical trial. Sixty heart failure patients were randomly allocated into two groups: intervention (n=30) y control (n=30). The researcher conducted six 20-minute sessions on how to take care of yourself in heart failure for active family members of patients in the intervention group via mobile phone on Eitaa APP messenger. Before the intervention and one

1 Faculty member, Ph.D. Assistant Professor. Email: z.badiyepeyma@gmail.com
2 Nurse, M.Sc. Email: Khoramkish68@gmail.com
3 Lecturer, M.Sc. Email: Lynurse8@gmail.com. Corresponding author.
4 Department of Medical- Surgical Nursing, Jahrom University of Medical Sciences, Jahrom, Iran.

Conflicts of interest: None
Received: May 23, 2025.
Approved: September 12, 2025.

How to cite this article: Badiyepeymaiejahromi Z, Khorramkish M, Rahmaniankushkaki AA. Effect of a mobile-based, family-centered self-care education program on Health Literacy and Self-Care in Patients with Heart Failure: A Randomized Controlled Trial. Investigación y Educación en Enfermería. 2025; 43(3):e09.

DOI: https://doi.org/10.17533/udea.iee.v43n3e09

month after it, patients completed the Heart Failure Health Literacy Questionnaire and the Self-Care Assessment Questionnaire. **Results.** Inter-group comparisons using the Mann-Whitney test showed that before the intervention, there was no statistically significant difference between the intervention and control groups in terms of mean health literacy scores and self-care behaviors($p<0.05$). However, after the intervention, a significant difference emerged, with the intervention group exhibiting higher mean scores than the control group in both questionnaires ($p<0.001$). Intra-group comparisons further revealed that the intervention group's mean scores for health literacy and self-care behaviors increased significantly after the intervention compared to before ($p<0.001$). **Conclusion.** Family-centered education via mobile phone on Eitaa APP messenger improved both health literacy and self-care status among heart failure patients. Thus, employing tele-nursing to engage the family members of heart failure patients can be an effective strategy for delivering educational interventions as part of the treatment program.

Descriptors: self-care; family-centered; heart failure; randomized controlled trial; health literacy; cell phone; health education; cell phone; mobile applications.

Efecto de un programa educativo de enfermería basado en dispositivos móviles y centrado en la familia sobre la alfabetización en salud y el autocuidado de pacientes con insuficiencia cardíaca. Un ensayo controlado aleatorizado

Resumen

Objetivo. Evaluar el efecto de una intervención educative de enfermería, centrada en la familia, basada en el uso de dispositivos móviles en el mejoramiento de los conocimientos de salud y del estado de autocuidado de los pacientes con insuficiencia cardíaca. **Métodos.** Este estudio es un ensayo controlado aleatorizado. Se asignaron sesenta pacientes con insuficiencia cardíaca a dos grupos: intervención ($n=30$) y control ($n=30$). El investigador llevó a cabo seis sesiones educativas de veinte minutos sobre el autocuidado a los familiares de las personas con insuficiencia cardíaca del grupo de intervención, utilizando en los teléfonos móviles la aplicación de mensajería Eitaa. Antes y un mes después de la intervención, los pacientes completaron el Cuestionario de Alfabetización Sanitaria sobre Insuficiencia Cardíaca y el Cuestionario de Evaluación del Autocuidado. **Resultados.** Las comparaciones entre grupos mostraron que, antes de la intervención, no habían diferencias estadísticamente significativas en cuanto a las puntuaciones medias de conocimientos sobre salud y en los comportamientos de autocuidado ($p<0.05$). Sin embargo, después de la intervención, se observó que el grupo de intervención obtuvo puntuaciones medias más altas que el grupo de control en ambos cuestionarios ($p<0.001$). Las comparaciones intragrupales confirmaron, además, que las puntuaciones medias del grupo de intervención en cuanto a conocimientos sobre salud y comportamientos de autocuidado aumentaron significativamente después de la intervención en comparación con la evaluación basal ($p<0.001$). **Conclusión.** El programa de educación de enfermería centrada en la familia basado en el uso del

teléfono móvil con la aplicación de mensajería Eitaa mejoró tanto la alfabetización en salud como el estado de autocuidado entre los pacientes con insuficiencia cardíaca. Por lo tanto, el uso de intervención que involucra a los familiares de los pacientes con esta enfermedad puede ser una estrategia eficaz para llevar a cabo el componente educativo como parte del programa del tratamiento.

Descritores: autocuidado; cuidado centrado na família; insuficiência cardíaca; ensaio clínico controlado aleatório; letramento em saúde; telefone cellular; educação em saúde; aplicativos móveis

Efeito de um Programa de Educação em Enfermagem Centrado na Família e Baseado em Dispositivos Móveis na Alfabetização em Saúde e no Autocuidado em Pacientes com Insuficiência Cardíaca: Um Ensaio Clínico Randomizado

Resumo

Objetivo. Avaliar o efeito de uma intervenção de educação em enfermagem centrada na família e baseada em dispositivos móveis na melhoria da alfabetização em saúde e do autocuidado em pacientes com insuficiência cardíaca. **Métodos.** Este estudo é um ensaio clínico randomizado. Sessenta pacientes com insuficiência cardíaca foram divididos em dois grupos: intervenção (n = 30) e controle (n = 30). O pesquisador conduziu seis sessões educativas de autocuidado, com duração de vinte minutos, com familiares de pessoas com insuficiência cardíaca no grupo intervenção, utilizando o aplicativo de mensagens Eitaa em seus celulares. Antes e um mês após a intervenção, os pacientes responderam ao Questionário de Alfabetização em Saúde para Insuficiência Cardíaca e ao Questionário de Avaliação de Autocuidado. **Resultados.** As comparações entre os grupos mostraram que, antes da intervenção, não houve diferenças estatisticamente significativas nas médias de alfabetização em saúde e comportamentos de autocuidado ($p<0.05$). No entanto, após a intervenção, o grupo de intervenção obteve pontuações médias mais altas do que o grupo controle em ambos os questionários ($p<0.001$). As comparações intragrupo também confirmaram que as pontuações médias do grupo de intervenção em alfabetização em saúde e comportamentos de autocuidado aumentaram significativamente após a intervenção em comparação com a avaliação inicial ($p<0.001$). **Conclusão.** O programa de educação em enfermagem centrado na família, baseado no uso de telefones celulares com o aplicativo de mensagens Eitaa, melhorou tanto a alfabetização em saúde quanto o status de autocuidado entre pacientes com insuficiência cardíaca. Portanto, o uso de uma intervenção envolvendo familiares de pacientes com insuficiência cardíaca pode ser uma estratégia eficaz para implementar o componente educacional como parte do programa de tratamento.

Descriptores: autocuidado; cuidado centrado en la familia; insuficiencia cardíaca; ensayo clínico controlado aleatorio; alfabetización en salud; teléfono celular; educación en salud; aplicaciones móviles.

Introduction

Heart failure (HF) has been defined as a global pandemic, with 64.3 million people estimated to suffer from HF worldwide in 2017.[1] The 2021 American Heart Association Heart Disease and Stroke Statistics based their HF prevalence estimates on the NHANES data collected between 2015 and 2018. Around 6.0 million Americans aged ≥20 years had HF, which increased from around 5.7 million according to National Health and Nutrition Examination Survey data collected between 2009 and 2012. The prevalence of HF in the USA was 2.4% in 2012, which is projected to rise to 3.0% in 2030.[2] At least 50% of heart failure patients do not follow the treatment recommendations related to dietary regimens and medication instructions, which leads to their re hospitalization.[3] According to recent heart failure guidelines, it can be concluded that patients with heart failure need to have knowledge about their condition, including both pharmacological and non-pharmacological treatments, as well as the ability to recognize symptoms and understand what may worsen them.[4] The results of Bagheri Saveh et al.' study indicated that the self-care status of patients with heart failure is moderate.[5]The effects of self-care behaviors in people with heart failure are equivalent to drug regimens. In people with heart failure, optimal self-care can lead to maintaining physical health, preventing disease exacerbations, improving clinical outcomes, reducing mortality and morbidity, reducing hospitalizations, and improving quality of life.[6-8]

One of the factors influencing patient adherence to treatment recommendations is health literacy.[9] Health literacy is defined as the extent of individuals' capacity to acquire, interpret, and understand the health information and services necessary for making appropriate decisions.[10] Low health literacy is not only a fundamental issue for patients, but also for healthcare providers and health systems.[11] In the study by Marzangi *et al*., it was found that 85% of heart failure patients lacked sufficient information regarding the nature of the disease, 92.5% lacked adequate information about the dietary regimen, 95% lacked sufficient information regarding the medication regimen, 82.5% lacked the necessary information about rest and sexual activity, and 85% lacked adequate information regarding treatment follow-up.[12]

Education for family members in the control and even prevention of disease can be extremely beneficial, given the strong connection between the family and the health status of its members. Individuals, especially those with chronic illnesses, rely on their family members, and even their attitudes are influenced by their family. In family-centered education, the family actively participates in identifying needs and providing the necessary training for patients, as it is believed that the onset of an illness in an individual involves each family member in the patient's overall disease process.[13] Today, the concept of patient and family empowerment has taken on a special

significance. By operationalizing this concept and involving family members of patients, it is possible to help them take effective steps toward quicker problem resolution and improvement of the patient's condition. This is achieved by increasing their knowledge of care, enhancing their understanding of the disease, and reducing both physical and psychological stresses.[14,15] Educating patient caregivers and providing them with sufficient and useful information will lead to improved recovery and better adaptation to the disease for both the patient and their family.[16] This educational approach, in addition to being applied in HF,[17] has also been implemented in other conditions, including type 2 diabetes[18] and multiple sclerosis[19] and has demonstrated a positive impact.

Today, with the increasing spread of mobile internet, smartphones, and portable personal applications, remote healthcare has become accessible. Remote healthcare or virtual health education encompasses educational programs, motivating adherence to self-care patterns, and assisting in the regular monitoring of symptoms. Digital technology and multimedia environments are among the tools that can aid in enhancing patients' self-care. Important features of virtual education include easy access, flexibility, the elimination of costly travel, and the ability to revisit the content.[20] Mobile phone education services can be provided for all age groups, from newborns to the elderly. One of the key benefits of mobile phone education programs is the reduced risk of exposure to infections for both patients and healthcare personnel while ensuring safe care and treatment. Additionally, mobile phone education offers an opportunity to deliver higher-quality care and expand access to nursing services. Through mobile phone education, nurses can remotely monitor, educate, follow up, collect data, provide interventions, manage pain, support families, and deliver multidisciplinary care in an innovative manner, ultimately reducing healthcare and treatment costs for patients.[21] Family-centered self-care education through mobile phone education has been implemented in patients with COVID-19,[22] type 2 diabetes,[23] and heart attack,[24] showing positive effects. Barkhordari *et al.* also demonstrated the positive impact of virtual health literacy education on the self-care behaviors of heart failure patients.[25]

Although the effectiveness of family-centered self-care education through mobile phone has been proven in the aforementioned studies, it cannot be definitively concluded that this method of education has a positive or negative effect on patients with heart failure, Because the nature of this disease is different from other diseases, and therefore the self-care education that the patient and family must receive is also different, it is necessary to conduct this study to draw the correct conclusion. Considering the above, the purpose of the present study is effect of mobile-based, family-centered self-care education program on Health Literacy and Self-Care in Patients with Heart Failure.

Methods

Study Design. This study is a randomized controlled clinical trial, which has been adhered the Consolidated Standards of Reporting Trials (CONSORT) Guidelines.[26] The study population includes all patients with heart failure who visited a cardiologist at the Imam Reza Clinic, affiliated with Jahrom University of Medical Sciences, located in southern Iran. To estimate the sample size based on the health literacy variable, a study by Kobraei *et al.*[27] was used. Considering a Type I error of 5%, an effect size of 0.801, and a power of 80%, the sample size for each group was calculated as 26 participants. Accounting for a 10% dropout rate, the final sample size in each group was determined to be 30 participants, resulting in a total of 60 participants. The sample size was calculated using the formula below with G*Power software.

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 (\sigma_1^2 + \sigma_1^2)}{(\mu_1 - \mu_2)^2} = \frac{(3.5^2 + 2.84^2)(\mathbf{20.2 + 4.27})^2}{(37.63 - 25.93)^2} \approx \mathbf{26}$$

Sampling and Randomization. Sampling was conducted using a convenience sampling method at Imam Reza Clinic, affiliated with Jahrom University of Medical Sciences. The process began in October 2023 to March 2024. Patients were gradually assessed and selected by the principal investigator based on predefined inclusion criteria during their routine visits to the cardiologist. Eligible participants were then randomly assigned to either the intervention or control group using simple randomization via computer software (Random Allocation Software). The randomization sequence was generated prior to recruitment by an independent statistician using the same software. Allocation concealment was ensured through the use of opaque, sealed, and sequentially numbered envelopes, which were opened only after participant enrollment. Participant enrollment and group assignment were carried out by a research assistant who was blinded to the randomization sequence and was not involved in outcome assessment, thereby minimizing potential allocation bias.

Inclusion and Exclusion Criteria. (i) Patient Inclusion Criteria: Diagnosis of heart failure confirmed by the cardiologist, Classification as NYHA (New York Heart Association) class II or III, Age between 18 and 65 years, having active family members with accessible contact, Willingness to participate in the study; (ii) Patient Exclusion Criteria: Presence of psychological disorders based on self-report,Worsening of the disease condition, Death of the patient; (iii) Family Member Inclusion Criteria: Being an active caregiver for the patient as confirmed by the patient, Age 18 years or older, Basic literacy (ability to read and write), Owning a smartphone with the Eitaa app installed, Willingness to participate in the study; and (iv) Family Member Exclusion Criteria: Presence of psychological disorders, Missing more than two educational sessions.

Blinding. Given that the intervention was implemented by the researchers themselves and the sampling was conducted at a single center, it was not feasible to blind either the researchers or the participants. However, the individual responsible for data analysis remained blinded to group allocation throughout the study. Although the outcome assessor was the principal investigator and blinding was not implemented during data collection, all outcomes were measured using validated and standardized questionnaires. All questionnaires were completed through telephone interviews conducted by the researcher, following standardized instructions to ensure consistency across all participants and minimize potential bias in data collection. This approach helped reduce subjective interpretation and thereby limited the risk of bias in outcome assessment.

Intervention. The study received the code of IRCT20210114050037N2 in the Clinical Trial Registration Center of Iran. After obtaining informed consent, the relevant questionnaires were completed via telephone by patients in both the intervention and control groups. In the intervention group, patients were asked to identify an active family member who played the most significant role in their care and could participate in the educational program. Once the patient selected an active family member, their contact information was obtained, and the researcher coordinated with them, explaining the study details. It is important to note that a patient's family member could be their child, spouse, or a relative (either by blood or marriage) who actively supports the patient's recovery and overall health improvement.[28] The selected active family member was expected to be capable of providing

support, making decisions, and understanding the patient's condition better than others. After completing the initial questionnaires, a six-session educational program on self-care for heart failure patients was delivered to the active family member of the intervention group via the Eitaa app.

A dedicated group was created on Eitaa, where all active family members in the intervention group were added. Educational content was shared in the form of short instructional videos, uploaded on a designated day each week. Active family members were given time to watch the videos. One to two days after each session, the researcher followed up with active family members via phone to confirm that they had watched the videos, received appropriate feedback, and conveyed the information to the patient. Each session lasted approximately 20 minutes. Throughout the program, the Eitaa group remained active, allowing caregivers to ask questions and engage in discussions. During the intervention, both the control and intervention group patients continued their routine medical visits and received standard care and education provided by their physician, without any additional training.

Educational Session Topics: Session 1: Understanding heart failure and its treatment options, Session 2: Medication management and adherence in heart failure patients, Sessions 3 & 4: Nutrition for heart failure patients, Session 5: Physical activity for heart failure patients, Session 6: Mental health in heart failure patients.

One month after the intervention, the questionnaires were re-administered via telephone. The researcher contacted each patient, read the questionnaire items, and recorded their responses (Figure 1). Fortunately, no participants dropped out during the study. As a result, the final sample size exceeded the minimum required, which enhanced the statistical power and precision of our findings. Although a one-month follow-up period may be considered relatively short for evaluating long-term behavior change, this timeframe was selected based on several practical and methodological considerations. First, it allows for the assessment of immediate post-intervention effects, providing insight into early behavioral responses and short-term adherence. Second, a shorter follow-up enhances participant retention and reduces the risk of attrition, which is particularly important in pilot studies or when working with vulnerable populations. Third, logistical and resource constraints necessitated a concise follow-up window to ensure feasibility within the scope of the current study.

Nevertheless, the importance of long-term evaluation is acknowledged. Accordingly, extended follow-up assessments (e.g., at 3 or 6 months) are planned to examine the sustainability of behavioral changes over time and to identify potential relapse or adaptation patterns. This limitation was acknowledged in the discussion section, where the relatively short one-month follow-up period was noted as a constraint in evaluating long-term behavioral outcomes.

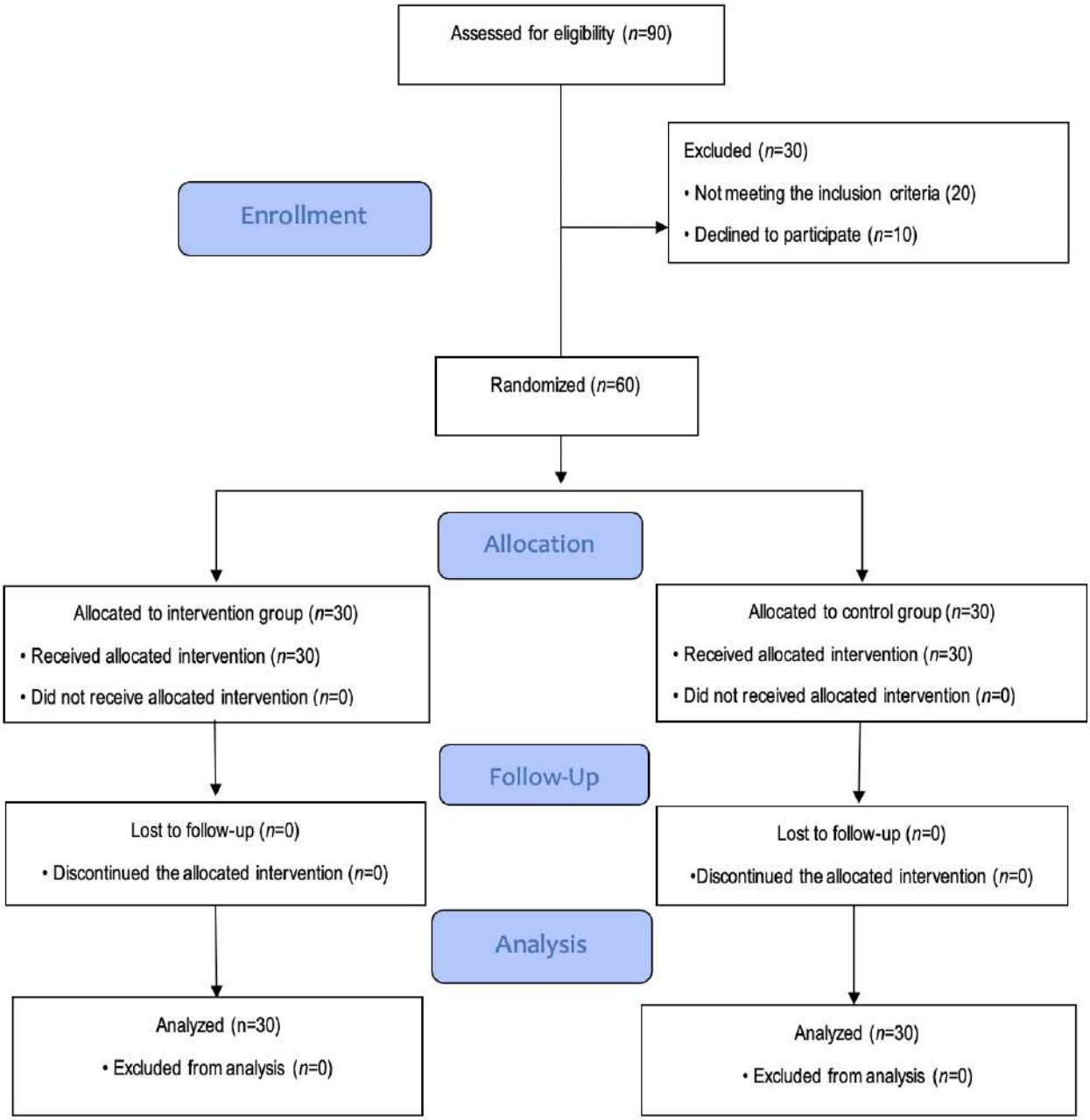


Figure1. CONSORT Diagram

Data Collection Tools. Data were collected using the following instruments: (*i) Demographic Information Form*: This form included variables such as age, gender, marital status, education level, occupation, disease duration, place of residence, number of hospitalizations, and history of underlying diseases; *(ii) Heart Failure Health Literacy Questionnaire (HFHLQ)*: This questionnaire consists of 12 items measuring three subscales of health literacy in heart failure patients: Functional health literacy (4 items), Communicative health literacy (4 items), Critical health literacy (4 items). The items are rated on a 4-point Likert scale (1 = not at all, to 4 = very much), with a total score ranging from 12 to 48. Some items are reverse-scored. Higher scores indicate better health literacy. The validity and reliability of the original version of this questionnaire have been confirmed.[29] In Iran, Farghadani *et al.* validated the Persian version through a translation-back translation process by two independent bilingual translators. Content validity was assessed by 10 experts, with recommended modifications applied. The content validity index for clarity, relevance, and simplicity was between 0.8 and 1.0. Reliability was confirmed with a Cronbach's alpha of 0.78[30]; *(iii) Self-Care of Heart Failure Index (SCHFI)*: The questionnaire developed by Riegel *et al.*, this questionnaire contains 15 questions across three subscales: Self-care maintenance (5 items), Self-care management (6 items), Self-care confidence (4 items). Responses are rated on 4- or 5-point Likert scales (scored from 0–4 or 1–4, depending on the item). Each subscale is standardized to a 100-point score, with higher scores indicating better self-care.[31] The validity and reliability of the Persian version were assessed by Moadab *et al.*[32] Content validity was evaluated by 12 faculty members from Guilan University of Medical Sciences, and after collecting feedback and applying necessary revisions, the final version was prepared. The content validity index for this questionnaire was above 0.83. Internal consistency reliability was measured using Cronbach's alpha, which was greater than 0.80.

Ethical Considerations. This study was approved by the Ethics Committee of Jahrom University of Medical Sciences under the approval number IR.JUMS.REC.1402.054. Participants were fully informed about the study procedures, duration, confidentiality, and anonymity of their data. Participation was voluntary, and both verbal and written informed consent were obtained.

Statistical Analysis. Data were analyzed using SPSS version 22, with a significance level of 0.05. Descriptive statistics (mean, standard deviation, frequency, and percentage) and inferential statistics with a 95% confidence level were applied. The Shapiro-Wilk test was used to assess the normality of variable distribution. Within-group comparisons were performed using the Paired sample t-test and Wilcoxon test. Between-group comparisons were conducted using the Independent Sample t-test and Mann-Whitney U test.

Trial Registration Code and Date: IRCT20210114050037N2 in the Clinical Trial Registration Center of Iran (Registration date: 02/09/2023).

Results

Baseline demographic characteristics were comparable between the two groups. The mean age was 60.26 ± 10.52 years in the intervention group and 61.03 ± 10.72 years in the control group (p=0.781). The proportion of male participants was similar in both groups (p=0.85). No significant differences were observed in other baseline variables (Table 1).

Table 1. Comparison of Intervention and Control Groups Based on Demographic Variables

Variables		Groups		*p*-value
		Intervention	Control	
		n (%)	*n* (%)	
Sex	Male	20 (66.7)	16 (53.3)	0.125*
	Female	10 (33.3)	14 (46.7)	
Education	High school	27 (90.0)	25 (83.3)	0.737**
	Diploma	2 (6.7)	3 (10.0)	
	University education	1 (3.3)	2 (6.7)	
Job	Freelance	18 (60.0)	12 (40.0)	0.482**
	employee	2 (6.7)	3 (10.0)	
	Housekeeper	9 (30.0)	13 (43.3)	
	Unemployed	1 (3.3)	2 (6.7)	
Marital status	Married	26 (86.7)	24 (80.0)	0.365*
	Single	4 (13.3)	6 (20.0)	
Residence	Urban	21 (70.0)	21 (70.0)	
	Rural	9 (30.0)	9 (30.0)	0.611*
History of hospitalization	Once	5 (16.7)	5 (16.7)	0.309**
	Twice	6 (20.0)	11 (36.7)	
	More than twice	19 (63.3)	13 (43.3)	
	Never	0 (0)	1 (3.3)	
Underlying disease	Yes	25 (83.3)	23 (76.7)	
	No	5 (16.7)	7 (23.3)	0.374*
Smoking	Yes	1 (3.3)	4 (13.3)	
	No	29 (96.7)	26 (86.7)	0.177*

*Fisher's exact test, **Chi-square, ***Independent t-test

The findings indicated that the overall SCHFI had a normal distribution before and after the intervention in both the intervention and control groups; therefore, parametric tests were used. However, the subscales of the SCHFI did not follow a normal distribution. The HFHLQ and its subscales did not follow a normal distribution before and after the intervention in both groups; thus, non-parametric tests were applied. In Within-Group Comparison Wilcoxon test results showed a significant increase in the mean health literacy score and its subscales in the intervention group after the intervention compared to before ($p<0.001$). Likewise, the mean self-care score and its subscales significantly increased in the intervention group after the intervention ($p<0.001$). In Between-Group Comparison Mann-Whitney test results revealed no significant statistical differences between the intervention and control groups in terms of health literacy, its subscales, self-care, and its subscales before the intervention. However, after the intervention, a significant difference was observed between the two groups in the mean scores ($p<0.05$), with the intervention group showing higher scores than the control group (Table 2).

Table 2. Comparison of the mean score of health literacy and self-care in the intervention and control group, before and after the intervention

Variables	Moment	Groups		*p*-value (between-groups)	t/z
		Intervention	Control		
Health literacy	Before	31.03 ±5.40	31.20±6.06	0.810*	0.241
	After	41.54±7.56	31.33±6.14	0.001*	-4.493
p-value (within groups)***		<0.001	0.257		
Z		4.221	1.134		
Functional health literacy	Before	9.87±2.52	10.63±3.75	0.343*	0.948
	After	12.89±3.76	10.63±3.75	0.027*	-2.217
p-value (within groups)***		0.001	0.999		
Z		3.480	-		
Communicative health literacy	Before	10.77±2.03	10.93±2.78	0.724*	0.353
	After	14.50±2.33	11.03±2.77	<0.001*	-4.509
p-value (within groups)***		<0.001	0.083		
Z		4.127	1.732		
Critical health literacy	Before	10.40±1.79	9.63±2.41	0.185*	-1.327
	After	14.14±2.40	9.67±2.41	<0.001*	-5.443
p-value (within groups)***		<0.001	0.655		
Z		4.230	0447		
Self-care	Before	51.13±8.97	50.43±12.62	0.609**	-0.512
	After	79.41±13.69	50.28±12.66	<0.001**	-5.601
p-value (within groups)****		<0.001	0.662		
t		4.288	-0447		
self-care main-tainance	Before	36.89±13.98	37.11±15.82	0.905**	-0.120
	After	61.43±18.62	37.11±15.82	<0.001**	-4.617
p-value (within groups)****		<0.001	0.999		
t		4.04	-		
Self-care manage-ment	Before	56.83±12.49	58.00±14.60	0.922**	0.098
	After	88.04±15.30	57.67±14.78	<0.001**	-5.343
p-value (within groups)****		<0.001	0.655		
t		4.291	-0447		
Self-care confi-dence	Before	59.44±13.44	54.44±20.73	0.384**	-0.871
	After	87.50±15.63	54.44±20.73	<0.001**	-5.063
p-value (within groups)****		<0.001*	0.999		
t		4.131	-		

*Mann Whitney U tests, **Independent t-test, ***Wilxacon, ****Paired t test

Discussion

This study aimed to determine the effect of family-centered self-care education via mobile phone education on health literacy and self-care in patients with heart failure. The results showed that family-centered education through smartphones led to an improvement in health literacy and self-care status in the intervention group.

In the present study, the target group for education consisted of active family members of patients, and virtual education for them successfully increased health literacy and self-care behaviors in patients. Consistent with the findings of this study, Barkhordari *et al.* investigated the impact of improving health literacy through virtual education in patients with heart failure and found that virtual education led to enhanced health literacy in these patients. However, in their study, the Ispring Play software was used for education, which differs from the software utilized in the present study, though the variable under investigation and the educational approach remained the same.[25] In the study by Khajavi *et al.*, which examined the effect of a web-based family-centered supportive educational program on adherence to the treatment regimen in heart failure patients after discharge, it was also found that this program had positive effects on treatment adherence. In their study, educational content was sent to patients and their families via the Soroush application, and weekly follow-ups were conducted by researchers through phone calls. This study aligns with the present research in terms of implementing family-centered education virtually and its positive impact.[33] In the study by Huang *et al.*, it was also found that the use of a smart application installed on patients' mobile phones had a significant impact on the self-care of patients with lung cancer.[34]

Dunbar *et al.* examined the impact of family involvement and educational interventions on heart failure. In this study, heart failure patients and one of their family members were included and divided into three groups. The first group received standard care, the second group participated in group education sessions, and the third group, in addition to attending an educational session, received support via the internet and email. At the end of the study, at both 4-month and 8-month follow-ups, the third group demonstrated better dietary adherence compared to the other two groups.[35] In line with these findings, the study by Jafari *et al.*, which conducted an eight-session, two-hour, in-person family-centered empowerment training for patients with heart failure and their primary caregivers, found that this model can improve daily living activities in elderly patients with heart failure. Although the type of training and the variables examined in their study differ from those in the present research, both studies are consistent in highlighting the positive impact of family-centered education on patients with heart failure.[36]

Similarly, in the study conducted by Srisuk *et al.*, which aimed to determine the effect of a family-centered educational program on the level of awareness, quality of life, self-care behaviors, and perceived control of caregivers in managing the symptoms of patients with heart failure, it was found that patients and caregivers who participated in the family-centered educational program achieved higher average scores in all examined variables compared to the control group at 3 and 6 months after the intervention. This difference was statistically significant.[37] In the study conducted by Pashaei *et al.* on the effect of family-centered educational support on the quality of life of patients with permanent cardiac pacemakers, it was found that implementing family-centered educational support was effective in improving the quality of life of these patients. The educational intervention in this study was conducted in four in-person sessions, attended by both the patient and an active family member.[38]

Studies have been conducted on the impact of family-centered education on various diseases. Among them, the study by Katebi *et al.* compared the effects of family-centered education with

individual-centered education on the quality of life of patients with type 2 diabetes. The results showed that family-centered education, similar to individual-centered education, can effectively improve the quality of life of diabetic patients [18]. Additionally, in the study by Kiani *et al.* on the effect of the family-centered empowerment model on the resilience of family caregivers of patients undergoing hemodialysis, it was found that this empowerment model enhances the resilience of caregivers.[39]

Studies have also been conducted on the implementation of self-care education through both in-person and virtual methods for patients themselves, some of which will be examined in relation to the present research. For example, in the study by Eghtedar *et al.*, positive effects were observed in terms of treatment adherence and hospital readmission rates among heart failure patients who received self-care education via smartphone.[40] Additionally, in the study by Ahmadi *et al.*, it was found that virtual education had a positive impact on self-care and quality of life in patients with heart failure.[41] Similarly, the study by Khezerlou *et al.* demonstrated that virtual education positively influenced self-care behaviors in heart failure patients.[42]These studies align with the present research regarding the positive effects of virtual education on heart failure patients. However, while the mentioned studies provided virtual education directly to the patients, the present study implemented virtual education in a family-centered manner.

In the study by Sharifzadeh *et al.*, which examined the effect of virtual self-care education related to COVID-19 on the life expectancy of pregnant women—delivered via WhatsApp—it was found that virtual self-care education did not significantly impact their life expectancy. The results of this study do not align with the present research, which could be attributed to differences in the target group and the messaging platform used for education.[43] Similarly, in the study by Badiyepeyma *et al.* on the effect of remote self-care education on functional status and quality of life in patients with rheumatoid arthritis, it was found that distance education alone did not have a significant impact on these patients. The results of this study also do not align with the present research, which may be due to differences in the target group and the educational content.[44]

In the study by Hsu *et al.*, which examined the impact of a self-regulation program on self-care behaviors in heart failure patients, it was found that self-regulation programs can effectively improve self-care behaviors in these patients.[45] The implementation method in this study differs from the present research, as the education was provided in-person and directly to the patients. However, the examined variable is the same, and the intervention ultimately led to an increase in self-care behaviors in these patients. Similarly, in the study by Kobraei *et al.*, it was found that in-person education can enhance health literacy in heart failure patients. This study included five in-person educational sessions covering physical activity, diet, treatment recommendations, follow-up, and medication adherence for the patients themselves. Although the intervention method was in-person and directed at the patients, the educational content was similar to that of the present study, leading to an improvement in health literacy. Therefore, from this perspective, the findings align with the present research.[27]

The most significant strength of the present study was the use of mobile phone for education, which offered several advantages. First, patients received essential health recommendations without wasting time or incurring costs, indirectly reducing economic burden, improving accessibility, and increasing convenience. Second, the ability to send educational files in video and audio formats made this platform more engaging and acceptable for patients and their families compared to SMS. Third, heart failure patients and their families could potentially share the educational video in their family and social group, influencing the lifestyle and disease management practices of a broader audience.

This study has several limitations. First, the sample size was relatively small, and the sampling period was extended, which may affect the representativeness of the findings. Second, the study was conducted at a single center, limiting the generalizability of the results to other patient populations. Third, there was no long-term follow-up to assess the sustainability of the intervention's effects. Future studies are recommended to include longer follow-up periods to better evaluate the lasting impact of this educational method. Another limitation is the lack of blinding during data collection, as both the researchers and participants were aware of group allocation. This was due to the nature of the intervention and the single-center design. Additionally, the outcome assessor was the investigator, which may introduce potential bias. However, to mitigate this risk, all data were collected using validated questionnaires through structured telephone interviews, following standardized instructions for all participants. Moreover, the data analyst was blinded to group allocation, which helped maintain objectivity in the statistical analysis.

Conclusion. The findings demonstrated that implementing a mobile-based, family-centered self-care education program increased health literacy and self-care behaviors in heart failure patients. Therefore, it is recommended that mobile phone education be integrated into routine care for heart failure patients, particularly for those who cannot attend in-person educational sessions due to physical limitations, distance, cost, or other barriers. Additionally, leveraging the active participation of family members in patient education can contribute to improving patients' overall health outcomes. It is recommended that future research explore mobile phone using other virtual education platforms with larger sample sizes and over longer durations follow up to better determine its long-term effectiveness.

Availability of data and materials. The data that support the findings of this study will be available from the corresponding author upon reasonable request.

Funding. This work was supported by the Jahrom University of Medical Sciences.

Acknowledgement. This study was derived from the research project No. IR.JUMS.REC.1402.054, approved by the Ethics Committee of the Vice-Chancellor for Research and Technology at Jahrom University of Medical Sciences. The authors sincerely appreciate all stakeholders, officials, and staff of Jahrom University of Medical Sciences, as well as the esteemed officials and personnel of Imam Reza Clinic, for their invaluable support in conducting this research.

References

1. Collaborators GBoD. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017; 2018.
2. Heidenreich PA, Albert NM, Allen LA, Bluemke DA, Butler J, Fonarow GC, et al. Forecasting the impact of heart failure in the United States: a policy statement from the American Heart Association. Circulation: Heart Failure. 2013; 6(3):606-19.
3. Rubio-Gracia J, Demissei BG, Ter Maaten JM, Cleland JG, O'Connor CM, Metra M, et al. Prevalence, predictors and clinical outcome of residual congestion in acute decompensated heart failure. International journal of cardiology. 2018; 258:185-91.

4. Sionis A, Sionis Green A, Manito Lorite N, Bueno H, Coca Payeras A, Diaz Molina Bea. Comments on the 201 6ESC Guidelines for the Diagnosis and Treatment of Acute and Chronic Heart Failure. Revista Española de Cardiología. 2016; 69:7.
5. Bagheri–Saweh M, Lotfi A, Salawati Ghasemi S, . Self-care behaviors and related factors in chronicheart failure patients. International Journal of Biomedic Public Health. 2018; 1(1):5.
6. Jaarsma T, Årestedt KF, Mårtensson J, Dracup K, Strömberg A. The European Heart Failure Self-care Behaviour scale revised into a nine-item scale (EHFScB-9): a reliable and valid international instrument. European Journal of Heart Failure. 2009; 11(1):99-105.
7. Aghajanloo A, Negarandeh R, Janani L, Tanha K, Hoseini-Esfidarjani SS. SelF-care status in patients with heart failure: Systematic review and meta-analysis. Nursing Open. 2021; 8(5):2235-48.
8. Negarandeh R, Ghasemi E, Janani L. Psychometric evaluation of the nine-item heart failure self-care behavior scale (9-EHFScBS). Nursing Practice Today. 2021;9(1):46-53.
9. Cajita MI, Cajita TR, Han H-R. Health literacy and heart failure: a systematic review. The Journal of cardiovascular nursing. 2016;31(2):121.
10. Mirmohammadkhani M, Ziari A, Momeni M. Systematic review and meta-analysis of health literacy in Iranian older adults. Iranian Journal of Ageing. 2020; 15(1):2-13.
11. Barati M, Taheri-Kharameh Z, Farghadani Z, Rásky É. Validity and reliability evaluation of the Persian version of the heart failure-specific health literacy scale. International Journal of Community Based Nursing and Midwifery. 2019; 7(3):222.
12. Marzangi A, Ahangarzadeh Rezaei S, Ghareagaji Asl R. Health literacy in heart disease community that covered by health services centers in south of west Azarbaijan province. Nursing And Midwifery Journal. 2018; 16(1):45-54.
13. Sadeghi M, Pedram Razi S, Nikbakht Nasrabadi A, Ebrahimi H, Kazemnejad A. Comparison of the impact of education based on the empowerrment model and family-center empowerrment model on knowledge and metabolic control of patients with type 2 diabetes mellitus. Journal of Nursing Education. 2013; 2(3):18-27.
14. Tegegn BW, Hussien WY, Abebe AE, Gebre MWS. Adherence to self-care practices and associated factors among outpatient adult heart failure patients attending a cardiac center in Addis Ababa, Ethiopia in 2020. Patient preference and adherence. 2021: 317-27.
15. Sitotaw E, Tsige Y, Boka A. Practice of self-care behaviours and associated factors among patients with heart failure. British Journal of Cardiac Nursing. 2022; 17(1):1-10.
16. Lotfi M, Ghahremaneian A, Aghazadeh A, Jamshidi F. The effect of pre-discharge training on the quality of life of burn patients. Journal of caring sciences. 2018; 7(2):107.
17. Ghajar A, Esmaeili R, Yazdani-Charati J, Ashrafi Z, Mazdarani S, Heidari Gorji MA. Effect of family-centered education on hope in patients with heart failure. Journal of Mazandaran University of Medical Sciences. 2018; 28(166):71-80.
18. Katebi MS, Moudi A, Dehghan F, Ghalenoei M. Comparing the effects of family-center education with person-center on the quality of life in patient with type 2 of diabete. Journal of Sabzevar University of Medical Sciences. 2020; 26(6):755-61.
19. Yousefi S, Nayyeri M, Seirafi MR. The effect of family-centered behavioral activation group training on psychological symptoms in patients with multiple sclerosis. Journal of Fundamentals of Mental Health. 2024; 26(6):399-405.
20. Najafi F, Pishkar Mofrad Z, Ayubi E, Hosseini R. The effect of self-management based discharge planning on treatment adherence in patients with heart failure. Hayat. 2021; 26(4):455-68.
21. Fisk M, Livingstone A, Pit SW. Telehealth in the context of COVID-19: changing perspectives in Australia, the United Kingdom, and the United States. Journal of medical Internet research. 2020; 22(6):e19264.
22. Heidari M, Hosseini M, Vasli P, Nasiri M, Hejazi S, Fasihi M. Comparison of the effect of the person-centered and family-centered training via telenursing on the quality of life in COVID-19 patients. International Journal of Preventive Medicine. 2023; 14(1):12.
23. Shahabi N, Kolivand M, Salari N, Abbasi P. The effect of telenursing training based on family-centered empowerment pattern on compliance with diet regimen in patients with diabetes mellitus type 2: a randomized clinical trial. BMC endocrine disorders. 2022; 22(1):36.
24. Madadkar S, Noorian K. The effect of multimedia education on the family-centered approach of telephoning (tele nursing) on quality of life and self-efficacy of patients with myocardial infarction. Nursing And Midwifery Journal. 2021; 19(3):181-92.

25. Barkhordari-Sharifabad M, Saberinejad K, Nasiriani K. The effect of health literacy promotion through virtual education on the self-care behaviors in patients with heart failure: A Clinical Trial. Journal of Health Literacy. 2021; 6(1):51-60.
26. Moher D, Hopewell S, Schulz KF, Montori V, Gøtzsche PC, Devereaux PJ, et al. CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised trials. Bmj. 2010; 340.
27. Kobraei A, Adib-Hajbaghery M, Kargar K, Miranzadeh S. The effect of educational package on adherence to treatment and health literacy in patients with heart failure. Feyz. 2022; 26(3):8.
28. Shojaee A, Nehrir B, Naderi N, Zareiyan A. Effect of patient education and telephone follow up by the nurse on the level of hope in patients suffering from heart failure. 2013; 2(1):16-26.
29. Nutbeam D. Defining and measuring health literacy: what can we learn from literacy studies? : Springer; 2009. p. 303-5.
30. Farghadani Z, Taheri-Kharameh Z, Amiri-Mehra A, Ghajari H, Barati M. The relationship between health literacy and self-care behaviors among patients with heart failure. Hayat Journal. 2018; 24(2):186-96.
31. Riegel B, Carlson B, Moser DK, Sebern M, Hicks FD, Roland V. Psychometric testing of the self-care of heart failure index. Journal of Cardiac Failure. 2004; 10(4):350-60.
32. Fatemeh M, Atefeh G, Arsalan S, Ehsan K, Mitra SS, Ezzat P. Study Status Of Self-Care Behaviors And Gender Differences In Patients With Heart Failure. Payavard Salamat. 2014;8(3):220-34.
33. Khajavi A, Moeini M, Shafiei D. The Impact of a Web-Based Family-Oriented Supportive Education Program in Adher-ence to Treatment of The Heart Failure Patients After Discharge From Hospital; A Randomized Clinical Trial. Journal of Clinical Nursing and Midwfery. 2019; 7(4):286-95.
34. Huang C-C, Kuo H-P, Lin Y-E, Chen S-C. Effects of a web-based health education program on quality of life and symptom distress of initially diagnosed advanced non-small cell lung cancer patients: a randomized controlled trial. Journal of Cancer Education. 2019; 34:41-9.
35. Dunbar SB, Clark PC, Reilly CM, Gary RA, Smith A, McCarty F, et al. A trial of family partnership and education interventions in heart failure. Journal of Cardiac Failure. 2013; 19(12):829-41.
36. Jafari-Diziche S, Izadi-Avanji F-S, Atoof F, Derakhshandeh S-M, Azizi-Fini I. Effect of family-centered empowerment model on the care burden of the caregivers of older adults with heart failure. Journal of Client-Centered Nursing Care. 2021; 7(4):275-84.
37. Srisuk N, Cameron J, Ski CF, Thompson DR. Randomized controlled trial of family-based education for patients with heart failure and their carers. Journal of Advanced Nursing. 2017; 73(4):857-70.
38. Sholeh P, Moradi Y, Hossein J, Alireza R. Effect of The Family-Centered Educational Support on the Quality of Life in Patients With Permanent Cardiac Pacemaker. Nursing And Midwifery Journal. 2021; 18(11):904-12.
39. Kiani F, Salmani F, Azarbarzin M. Effect of an Intervention Based on the Family-centered Empowerment Model on the Resilience of Family Caregivers of Hemodialysis Patients: A Randomized Controlled Clinical Trial. Qom University of Medical Sciences Journal. 2023; 16(10):844-57.
40. Eghtedar S, PourShojaei A, Jasemi M. Comparing the effect of self-care education through whatsapp social network and face-to-face training along with telephone follow-up on adherence to treatment and readmission in the patients with heart failure. Nursing And Midwifery Journal. 2024; 21(10):773-88.
41. Ahmadi M, Oshvandi K, Tapak L, Hosseini SK, Azizi A. Comparing the Effects of Face-to-Face and Virtual Self-Care Training Methods on Self-Care and Quality of Life among Patients with Heart Failure: A Randomized Clinical Trial Study. Avicenna Journal of Nursing and Midwifery Care. 2023;31(4):265-74.
42. Khezerloo Z, Aghakhani N, Cheraghi R, Alonejad V. Comparison of the effect of virtual and feedback-based self-care training on the self-care behaviors of heart failure patients referred to seyyed al-shohada urmia medical training center in 2020-2021. Nursing And Midwifery Journal. 2023; 21(4):311-20.
43. Sharifzadeh M, Davarinia Motlagh Quchan A, Mohamadzadeh Tabrizi Z, Navi Nezhad M. The effectiveness of self-care virtual education related to Covid 19 disease on life expectancy of pregnant mothers. Iranian Journal of War and Public Health. 2020; 12(4):207-12.
44. Badiyepeyma Z, Niknam M. The Effect of Distance education for self-care training on functional status and the quality of life of patients with rheumatoid arthritis. Iranian Journal of Rehabilitation Research. 2024; 11(1):13-23.
45. Hsu M-Y, Chiang C-W, Chiou A-F. The effects of a self-regulation programme on self-care behaviour in patients with heart failure: A randomized controlled trial. International Journal of Nursing Studies. 2021; 116:103778.

Coping strategies used by migrant women during pregnancy. An integrative review

Original Article

Ivett Adriana Herrera Zuleta[1,5]
https://orcid.org/0000-0002-1426-6382

Angélica María Ospina Romero[2,5]
https://orcid.org/0000-0001-7845-1889

Abraham Isaac Esquivel Rubio[3,6]
http://orcid.org/0000-0001-6675-5439

Claudia Jennifer Domínguez Chavez[4,6]
http://orcid.org/0000-0001-6230-8308

Adaptation Strategies for Pregnant Migrants: An Integrative Review

Abstract

Objective. To analyze the coping strategies for the adaptation of the migrant during pregnancy described in the literature. **Methods.** Integrative review using the method approached by Whittemore and Knafl. MeSH terms Pregnancy, Migrants and immigrants, and Psychological adaptation, were incorporated in addition to their variants in the databases of Pubmed, Scopus, EBSCO, Science Direct, and Web of Science. Articles that examined the coping strategies used by pregnant migrants to adapt during pregnancy were included. Only the articles published from 2003 to 2023 was considered. After applying the inclusion and exclusion criteria, the articles were analyzed with the CASPe critical reading tool in which quality and consistency were reviewed. Using the

1 Nurse, Ph.D. student. Email: ivetthezu@unisabana.edu.co Corresponding author.
2 Nurse, Ph.D. Professor. Email: angelica.ospina@unisabana.edu.co
3 Nurse, Ph.D. Professor. Email: abraham.esquivel@uabc.edu.mx
4 Nurse, Ph.D. Professor. Email: jennifer.dominguez@uabc.edu.mx
5 Universidad de la Sabana. Chía, Colombia
6 Universidad Autónoma de Baja California. Mexicali, México.

Conflicts of interest: None
Received: July 2, 2025.
Approved: September 12, 2025.

How to cite this article: Herrera-Zuelta IA, Ospina-Romero AM, Esquivel-Rubio AI, Dominguez-Chavez CJ. Coping strategies used by migrant women during pregnancy. An integrative review. Investigación y Educación en Enfermería. 2025; 43(3):e10.

DOI: https://doi.org/10.17533/udea.iee.v43n3e10

software, Atlas.ti, version 23.2.1, content analysis for the categorical construction of data was performed. These strategies were analyzed with the middle-range theory adaptation to life events by Callista Roy. **Results.** A total of 416 articles were considered. The reviewed articles show 14 coping strategies used by the pregnant migrant, which were grouped into 5 strategies called social support, emotional regulation and transfer, positive attitude strategy, cultural adaptation strategy, and comprehensible language strategy. **Conclusion.** It was found that the strategy most used by the migrant pregnant woman is social support, followed by positive attitude strategies and comprehensible language; when using these strategies, the results show migrant pregnant women with a decrease in anxiety, fear and a positive attitude towards life and health.

Descriptors: pregnancy; emigrants and immigrants; psychological adaptation.

Estrategias de afrontamiento utilizadas por las mujeres migrantes durante el embarazo. Una revisión integradora

Resumen

Objetivo. Analizar las estrategias de afrontamiento para la adaptación de la migrante durante la gestación descritas en la literatura**. Métodos.** Revisión integradora utilizando el método propuesto por Whittemore y Knafl. Se incorporaron para la búsqueda los términos MeSH de: Embarazo; Emigrantes e inmigrantes; y Adaptación psicológica; además de sus variantes en las bases de datos Pubmed, Scopus, EBSCO, Science Direct y Web of Science. Se incluyeron artículos que examinaban las estrategias de afrontamiento utilizadas por las migrantes embarazadas para adaptarse durante la gestación. La revisión incluyó los artículos publicados de 2003 a 2023, en idiomas inglés, español y portugués. A los artículos recuperados se les revisó la calidad y la coherencia con la herramienta de lectura crítica CASPe. Se utilizó el software Atlas.ti, versión 23.2.1. para el análisis de contenido necesario para la construcción categórica de los datos con la teoría de alcance medio «adaptación a los acontecimientos de la vida» de Callista Roy**. Resultados.** Se consideraron un total de 416 artículos. Tras su revisión, 17 artículos mostraban 14 experiencias de estrategias de afrontamiento utilizadas por las migrantes embarazadas, las cuales se agruparon en cinco categorías denominadas: apoyo social, regulación y transferencia emocional, actitud positiva, adaptación cultural, y lenguaje comprensible**. Conclusión.** Las mujeres migrantes durante la gestación utilizan estrategias de afrontamiento para la disminución de la ansiedad y el miedo, y adoptan una actitud positiva hacia la vida y la salud. En este sentido, es necesario

fortalecer en el personal de salud la competencia cultural ante los fenómenos migratorios con el fin de para garantizar el cuidado humano, equitativo y de alta calidad en la materna.

Descriptores: embarazo; emigrantes e inmigrantes; adaptación psicológica

Estratégias de Enfrentamento Utilizadas por Mulheres Migrantes Durante a Gravidez: Uma Revisão Integrativa

Resumo

Objetivo. analisar as estratégias de enfrentamento descritas na literatura para a adaptação de mulheres migrantes durante a gravidez. **Métodos.** revisão integrativa utilizando o método proposto por Whittemore e Knafl. Os termos MeSH: gravidez; migrantes e Imigrantes; e adaptação psicológica foram incorporados à busca, juntamente com suas variantes, nas bases de dados Pubmed, Scopus, EBSCO, Science Direct e Web of Science. Foram incluídos artigos que examinavam as estratégias de enfrentamento utilizadas por migrantes grávidas para se adaptarem durante a gravidez. A revisão incluiu artigos publicados de 2003 a 2023, em inglês, espanhol e português. Os artigos recuperados foram revisados quanto à qualidade e consistência utilizando a ferramenta de leitura crítica CASPe. O software Atlas. ti, versão 23.2.1, foi utilizado para a análise de conteúdo necessária à construção categorial dos dados, utilizando a teoria de médio alcance de Callista Roy, "adaptação aos eventos da vida". **Resultados.** Foram considerados um total de 416 artigos. Após a revisão, 17 artigos apresentaram 14 experiências de estratégias de enfrentamento utilizadas por gestantes migrantes, que foram agrupadas em cinco categorias: apoio social, regulação emocional e transferência, atitude positiva, adaptação cultural e linguagem compreensível. **Conclusão.** Mulheres migrantes durante a gravidez utilizam estratégias de enfrentamento para reduzir a ansiedade e o medo e adotar uma atitude positiva em relação à vida e à saúde. Nesse sentido, é necessário fortalecer a competência cultural dos profissionais de saúde em relação aos fenômenos migratórios, a fim de garantir um atendimento humano, equitativo e de alta qualidade na maternidade.

Descritores: gravidez; emigrantes e imigrantes; adaptação psicológica.

Introduction

The mobility of people between countries is permanent and sometimes occurs unexpectedly. Some causes are: climate change; the search for quality of life; economic, political, social conflicts; and gender violence, which have been considered determinants for more women to carry out the migratory process.[1,2] According to the International Organization for Migration (IOM), women represent 48% of people who migrate, which has been increasing in recent decades; especially for those who do it alone, being pregnant or the head of the household, care becomes a challenge for health services.[3,4] The pregnancy of women who migrate, their physical, psychological and social condition, the lack of accessibility to healthcare, the deficit in prenatal care, and the growing maternal and neonatal morbidity and mortality place them in a vulnerable condition.[5] According to the United Nations (UN) report, migration is linked to structural transformations in the lives of Migrant Pregnant Women (MPW), thus leading them to generate strategies to deal with the changes that occur during pregnancy and migration.[6]

A theoretical contribution that has attempted to explain the processes of coping and adaptation to life events, such as pregnancy and unexpected situations such as migration, is that described by Callista Roy, with the middle-range theory of "Adaptation to life events". Roy defines the process of adaptation as the ways in which a person responds to changes in the environment, based on patterns of responses that lead to the use of coping styles and strategies to effectively adapt to situational health challenges such as pregnancy. If coping strategies are effective, they lead to positive adaptation to the environment.[7] Coping strategies can be innate or acquired by the individual, with which he/she responds to internal and external demands that arise from changes in the environment such as during migration.[8] In the middle-range theory of situational events proposed by Roy, nursing practice aims to promote people's adaptation by assessing factors that influence adaptive capacity to support environmental management and promote coping.[9,10]

No evidence was found in the literature of the application of the theory of adaptation to life events in migrant pregnant women. Therefore, it is necessary to find what are the coping strategies are used in this population and thus, the following research question is posed: ¿What are the coping strategies for the adaptation of migrant pregnant women described in the literature?

Methods

Integrative literature review taking into account the steps proposed by Whittemore and Knafl [11] complying with the methodological rigor with the following five stages:

Identification of the problem, in which the description of the phenomenon to be investigated described by the coping strategies used by the pregnant migrants was carried out.

(ii) The literature search was carried out in 5 databases (Pubmed, Scopus, EBSCO, Science direct, and the Web of Science platform) to find the coping strategies MPW develop to adapt to the migration process. Studies with any type of methodology was accepted. Publications from 2003 to 2023 were considered given the first approaches to the topic for this population; for the search strategy, the following keywords were used: Pregnancy, Emigrants and Immigrants, and Psychological Adaptation, included in the Descriptors in Health Sciences (DeCS) and the Medical Subject Headings (MeSH), as well as synonyms, related terms, spelling variations and abbreviations. The Boolean operators AND OR were incorporated for the search. All research designs, written in English, Spanish and Portuguese were considered. An example of a complete search strategy is: N1 [(((((((((Immigrants and Emigrants) OR (Immigrants)) OR (Immigrant)) OR (Foreigners)) OR (Foreigner)) OR (Aliens)) OR (Alien)) OR (Emigrants)) OR (Emigrant)] AND N2 [((((((((((Pregnancy) OR (Pregnant)) OR (Maternal)) OR (Maternity)) OR (Midwifery)) OR (Birth)) OR (Perinatal)) OR (Intrapartum)) OR (Antenatal)) OR (Postnatal)) OR (Childbearing)) OR (Prenatal)) OR (Motherhood)] and N3 [(((((((((((((((((Adaptation, Psychological) OR (Adaptation, Psychologic)) OR (Psychologic Adaptation)) OR (Psychological Adaptation)) OR (Adjustment)) OR (Coping Behavior)) OR (Behavior, Coping)) OR (Behaviors, Coping)) OR (Coping Behaviors)) OR (Coping Skills)) OR (Coping Skill)) OR (Skill, Coping)) OR (Coping Strategies)) OR (Strategies, Coping)) OR (Behavior, Adaptive)) OR (Adaptive Behavior)) OR (Adaptive Behaviors)) OR (Behaviors, Adaptive)]. Articles examining MPW'S coping strategies used for adaptation during pregnancy were included. The exclusion criteria were studies that were outside the topic of interest, that is, with non-pregnant migrant women and studies with internal migrants (urban to rural area of the same country where they were carried out).

(iii) Data evaluation, after the search for articles, they were moved to the Rayyan QCRI platform® (the Systematic Reviews web application) for analysis. A total of 416 studies were recovered, assessed, and selected for relevance for inclusion based on the information provided in the title and abstract. After using Rayyan application, 124 duplicate articles were removed; two authors made the selection simultaneously and disagreements about the inclusion of studies were solved through discussion with a third researcher (Figure 1).

(iv) Data analysis, the methodological guidelines of the Critical Appraisal Skills Programme (CASPe) were used to analyze the data quality of the articles, taking into account the type of study design, methodological consistency, quantitative methodological rigor (validity and reliability) and qualitative rigor (confirmability, credibility), coherence between the elements of the study and the relevance of the phenomenon.[12] A matrix was made in Microsoft Excel, for analysis of each article in which data were extracted related to authors, year, country, title, purpose of the study, study design, conclusions, the main findings of the study, the coping strategy used by the pregnant migrant woman, and the result obtained when using the strategy. These results were analyzed in a data extraction form for subsequent analysis and synthesis.

(v) The results are presented below.
To categorize the information, the content analysis technique was used by means of the qualitative information analysis program Atlas. ti, version 23.2.1, which made it possible to simplify and compile the information from 17 articles in an analysis matrix with which categories were generated, which were related to the coping strategies proposed by the mid-range theory of adaptation to life events proposed by Callista Roy.[13]

Results

As shown in Table 1, seventeen articles were reviewed that documented the coping strategies used by MPW for adaptation during pregnancy; 9 studies were with qualitative design, 3 with quantitative analytical designs, 1 mixed study, 2 integrative reviews, and 2 systematic reviews. Of these, 9 were carried out on the American continent from 2004 to 2023; 4 in Europe, from 2015 to 2023; 1 in Oceania in 2019 and 3 in Asia in 2012, 2014 and 2016. The articles identified 14 coping strategies that migrants used in the form of skills and tools to maintain health during pregnancy.[14]

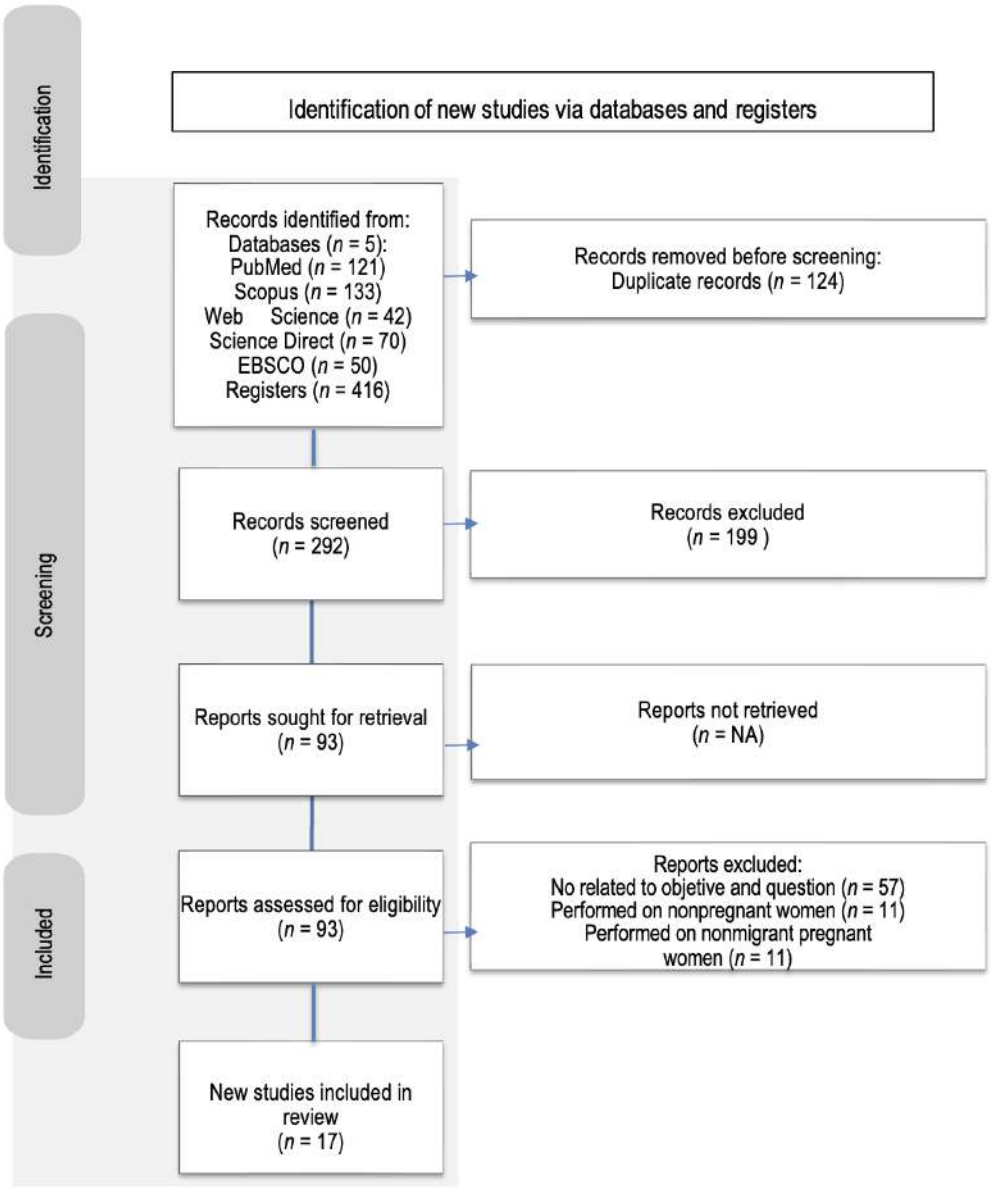


Figure 1. Flow Chart of the article selection process

Table 1. Description of articles Selected for Analysis

Author(s) / year of publication/ country / Citatios	Objective of study	Title	Methods	Conclusions
Sibrian N. 2021 / Chile.[15]	To identify the role of emotions in the trajectory of a pregnant Venezuelan user of the Chile Crece Contigo program.	Emotional adjustments of a pregnant woman and immigrant in Chile: strategies to reduce suffering.	Case study, with biographical approach and ethnographic perspective.	Patience in the face of waiting, laughter in the face of pain and gratitude in the face of a right become adaptation strategies of a social group facing a certain type of hospitality. Generally, all hospitality is conditional and is almost never free of debt. But, if we add to this social class, skin color, country of origin or political orientation of the guest, these characteristics could be additional arguments for hospitality to become a strongly demarcated boundary. Strategies of emotional regulation or transference would be a reflection not only of ways of coping with suffering, but also the product of a differentiated mode of insertion of migrants.
Song JE, *et al.,* / 2016 / Korea.[16]	To synthesize the evidence of immigrant women's experiences of maternal adaptation in Korea.	A qualitative review of immigrant women's experiences of maternal adaptation in South Korea.	A qualitative systematic review was performed by means of thematic synthesis.	These findings demonstrate the importance of understanding and improving maternal adaptation of immigrant women living in Korea. This can be achieved by enhancing social support, providing culturally sensitive maternal healthcare services, and expanding opportunities for immigrant women in education, job training, and economic independence.
Higginbottom GMA, *et al.,* / 2014 / Canada.[17]	To synthesize data on immigrant women's experiences of maternity services in Canada.	Immigrant women's experience of maternity services in Canada: A meta-ethnography.	A qualitative systematic literature review using a meta-ethnographic approach.	In order to implement woman centered care, to enhance access to maternity services, and to promote immigrant women's health, it is important to consider these women's social position, cultural knowledge and beliefs, and traditional customs in the health care.

Table 1. Description of articles Selected for Analysis (Cont.)

Author(s) / year of publication/ country / Citatios	Objective of study	Title	Methods	Conclusions
Lukin TT, *et al.,* / 2023 / Sweden.[18]	To describe Syrian women's experiences of being pregnant and receiving care at antenatal clinics for the first time after migration.	Syrian women's experiences of being pregnant and receiving care at antenatal clinics in Sweden for the first time after migration.	A phenomenological life-world approach was used.	Syrian women's experiences reveal a heterogeneous group with different experiences and background. The study highlights the first visit and emphasizes the importance of this visit for future quality of care. It also points out the negative occurrence of the transferring guilt from the midwife to the migrant woman in case of cultural insensitivity and clashing norm systems.
Lin ML, Wang HH./ 2008 / Taiwan.[19]	To examine the relationships between the knowledge of pregnancy, attitude toward pregnancy and experience of medical services, and prenatal examination behavior of pregnant Southeast Asian women in Taiwan.	Prenatal examination behavior of Southeast Asian pregnant women in Taiwan: A questionnaire survey	This was a cross-sectional study with a structured questionnaire administered to participants.	The attitude toward childbearing of the participants was significantly correlated with their prenatal examination behavior. They require professional help in seeking out appropriate medical services that will improve their healthcare quality during pregnancy.
Viken B, *et al.,* / 2015/ Norway.[20]	To explore the maternal health coping strategies of migrant women in Norway. The ethnic and cultural. background of the Norwegian population have become increasingly diverse	Maternal health coping strategies of migrant women in Norway	In this study a qualitative exploratory, descriptive design with a hermeneutic approach was employed.	To provide quality care, healthcare professionals should focus on the development of migrant women's capabilities. Adaptation of maternal health services for culturally diverse migrant women also requires a culturally sensitive approach on the part of healthcare professionals.
Kim P./ 2020 / United States.[21]	Review of emerging literature on the role of stress in brain adaptation of human mothers during the perinatal period.	How stress can influence brain adaptations to motherhood.	Literature review.	I have reviewed available evidence that exposure to different types of stress, from childhood to the perinatal period, is associated with disrupted brain adaptation to motherhood, which can further increase risks for difficulties in developing sensitive parenting behaviors among new mothers.
González-Mesa E, *et al.,* / 2018 / Spain.[22]	To determine the influence of social and cultural factors on the mood state of a multicultural sample of 514 Turkish and Spanish pregnant women at the beginning of the pregnancy.	Cultural factors influencing antenatal depression: A cross-sectional study in a cohort of Turkish and Spanish women at the beginning of the pregnancy	Quantitative study designs. Cohort Study.	Our results confirm the existence of important differences in prevalence between Turkish (30.0%) and Spanish (9.9%) pregnant women. Some sociocultural features like having more children, unplanned pregnancies, or perceiving poor support from the partner, become important vulnerability factors.

Table 1. Description of articles Selected for Analysis (Cont.)

Author(s) / year of publication/ country / Citatios	Objective of study	Title	Methods	Conclusions
Qian Y, Mao Y / 202 1/ United States.[23]	Explores how Chinese immigrant mothers use the ethnic social media—WeChat to engage in health information sharing and coping with cultural differences in healthcare between the U.S. and China.	Coping with cultural differences in healthcare: Chinese immigrant mothers' health information sharing via WeChat.	Qualitative, integrative review, content analysis.	They adopt various acculturation strategies to manage the cultural differences in healthcare beliefs, practices, and systems.
Page RL / 2004 / United States.[24]	To provide an integrated review of the literature of potential explanations for better-than-expected pregnancy outcomes in Mexican immigrants, focusing on socioeconomics, social support, desirability of pregnancy, nutrition, substance use, religion, acculturation, and prenatal care.	Positive pregnancy outcomes in Mexican immigrants: what can we learn?	Literature was selected from refereed publications in the areas of nursing, medicine, public health, family, and sociology.	Low birth weight and prematurity are public health concerns in the United States. Through further study of the factors that lead to superior birth outcomes among Mexican immigrant women, rates of low birth weight and prematurity in the United States may be reduced.
Nguyen N / 2023 / United States. [25]	This empirical research aims at shedding light on how such mothers use social media groups for social support seeking/ providing regarding health utilization during their acculturation process.	Strangers helping strangers in a strange land: Vietnamese immigrant (expectant) mothers in the US use social media to navigate health issues in acculturation.	Drawing from Andersen's Behavioral Model of Health Utilization, acculturation, and online social support conceptual frameworks, this study analyzes 18 in-depth interviews with immigrant Vietnamese (expectant) mothers in the United States on the use of social media in navigating health acculturation during their pregnancy and motherhood.	This research provides insights into personal experience on the uses of social media in navigating health behavior in the process of acculturation among Vietnamese immigrant (expectant) mothers in the United States. Their search seeks to contribute to the conceptual frameworks and practical experience of behavioral model of health utilization among immigrant Vietnamese ethnic immigrant pregnant women and mothers of babies and toddlers in navigating health during acculturation process in the United States. The limitations and future research suggestions are also discussed.
McLeish J, Redshaw M. / 2020 / England.[26]	To explore the experiences of disadvantaged mothers who received social support from a volunteer, through the lens of the theoretical framework of stress and coping and a multidimensional model of social support	She come like a sister to me': a qualitative study of volunteer social support for disadvantaged women in the transition to motherhood in England.	This qualitative study in two stages was informed by the theoretical perspective of phenomenological social psychology.	Volunteer social support may have particular salience for mothers who lack structural support and need skilled functional support.

Table 1. Description of articles Selected for Analysis (Cont.)

Author(s) / year of publication/ country / Citatios	Objective of study	Title	Methods	Conclusions
Qureshi R, Pacquiao DF / 2013 / Pakistan and United States.[27]	Describe the comparative birthing experiences of Pakistani immigrant women in Pakistan and the United States.	Ethnographic study of experiences of Pakistani women immigrants with pregnancy, birthing, and postpartum care in the United States and Pakistan.	Qualitative design using purposive sample of 26 women immigrants who originated from any province in Pakistan and experienced childbirth in Pakistan and in the United States.	The study has implications for designing culturally congruent and competent care for Pakistani women and their families. Planning and implementation of care must be informed by their own priorities on how valued practices should be accommodated. Involvement of social services and culturally congruent support network can facilitate meaningful access to health care services. Fostering link age between health care organizations and immigrant families can help design culturally competent services for this group.
Stanhope KK, *et al.,* / 2021 / United States.[28]	To examine how external stressors and coping strategies prior to and during pregnancy are reflected in Latina women's narratives about their lives through an Ecosocial framework.	Perceptions of stress and resilience among Latina women enrolled in prenatal care in Metro Atlanta through an ecosocial lens	This mixedv methods research study explores pregnant Latina women's psychosocial wellbeing before and during pregnancy based on ecosocial theory.	The majority of women felt they should control emotional responses to external stressors during pregnancy to protect their baby's health. Women described motherhood and previous challenges as sources of maturity and improved coping. Familial financial and emotional support were perceived as critical to women's successful coping.
Knorr DA, Fox M. / 2023 / United States.[29]	We assessed social support, geographic proximity, and communication between the fetus' grandmothers and pregnant mother.	An evolutionary perspective on the association between grandmother-mother relationships and maternal mental health among a cohort of pregnant Latina women.	Quantitative study designs. Cohort Study.	This study explores whether grandmother relationship characteristics are associated with prenatal mental health, motivated by the premise that positive associations are beneficial to the success of the pregnancy. Here, we suggest that grandmaternal allomothering includes the prenatal period. We observe that social support and communication with MGMs, but not PGMs, are associated with mental health benefits for mothers. More work is needed to connect this prenatal grandmaternal influence to offspring postnatal outcomes.

Table 1. Description of articles Selected for Analysis (Cont.)

Author(s) / year of publication/ country / Citatios	Objective of study	Title	Methods	Conclusions
Quintanilha M, *et al.,* RC/2016/ Canada. [30]	We explored migrant women's perceptions and experiences of health during pregnancy and postpartum, while participating in a perinatal program offered through a community-based organization. Additionally, we examined sociocultural factors that might have shaped women's health upon migration to the Canadian city of Edmonton, Alberta.	Contrasting "back home" and "here": how Northeast African migrant women perceive and experience health during pregnancy and postpartum in Canada.	A community-based participatory research approach was used to engage migrant women connected to a community-based perinatal program in Edmonton. A focused ethnography was conducted with four Northeast African communities and involved 10 focus groups with women (n = 8, per group) and direct observations of weekly perinatal program activities. Data generation and analysis occurred concurrently, and all generated data were analyzed using qualitative content analysis to inductively derive codes and categories.	A complex network of factors seem to influence Northeast African women's health during pregnancy and postpartum upon migration to Canada. It is of the utmost importance to provide these women with the immediate sociocultural and environmental factors they need to successfully thrive during pregnancy and postpartum, especially while establishing social and support networks "here".
Rao VS, *et al.,* / 2020 / Australia.[31]	To explore the experiences of motherhood and postpartum support of Indian migrant mothers.	Indian migrant women's experiences of motherhood and postnatal support in Australia: A qualitative study.	A Qualitative descriptive natural is inquiry was adopted, with data collected through face-to-face, semi-structured, in depth interviews with a purposive sample of 11 English speaking Indian migrant women over 18 years old, (6 weeks to 6 months postpartum) in 2016. The data were thematically analyzed.	This study gives a unique insight into the experiences of Indian migrant women following birth. There is a need for culturally sensitive and appropriate postnatal services that encourage Indian men to support their partners and help women to find alternative sources of culturally appropriate support. It is vital that mental health support is a key component of any such program of care.

In Table 2, the coping strategies found in the literature are shown and categorized through content analysis into five coping strategies for adaptation that were related to the strategies proposed in Callista Roy's middle-range theory of adaptation to life events. The analysis highlights that the main challenge the articles mention is "maintaining health in pregnancy during migration," which becomes the main health challenge. This content analysis shows that by using the migrant's adaptation strategies during pregnancy, anxiety and fear are reduced and individualized attention and a positive attitude to life and health are promoted. [32]

Table 2. Coping strategies for adaptation during pregnancy found in the literature, categorized through content analysis related to the strategies proposed by Callista Roy. Health Challenge: Maintain pregnancy health during migration

Adaptation strategies identified in the literature	Categorization of strategies according to content analysis	Callista Roy's Coping Strategy of Adaptation to Life Events
1. Patience in the face of waiting, laughter in the face of pain and gratitude in the face of a right.[15]	1. Strategies for emotional regulation and transfer for maternal health	Duty to be strong
2. a. Search for meaningful relationships with the culture of origin, with the people around them, and the effort to find information with the people around them and/or through books and the Internet. b. Continuous negotiation with themselves and reconstruction of their new identities. c. integration to the new reality.[16]	2. Cultural adaptation strategy: Connections to herself, her ancestors and the future	Bonding and unique connections
3. Cultural adaptation, social support, communication with professional health care personnel. [17]	3. Comprehensible language strategy: A constant two-way challenge	Common language
4. a. Feelings of being welcomed and treated as an equal. b. A good relationship with the midwife. c. Good communication despite language difficulties and cultural differences.[18]		
5. Positive attitude towards motherhood.[19]	4. Positive attitude strategy to promote maternal health	Focus on the good
6. a. Be open to new opportunities. b. Balancing the sense of belonging. c. Maintaining the original traditions and at the same time be willing to integrate into society. d. Seeking information and support from family and health professionals.[20]		
7. Positive interventions towards motherhood and social support.[21]	5. Social support strategy: A predictor of maternal health	Count on others
8. Family structure and perceived support and how spirituality is integrated.[22]		
9. Social networks.[23–25]		
10. Multidimensional models of social support.[26]		
11. Maintenance of transnational bonds with family members.[27]		
12. Family financial and emotional support.[28]		
13. Social support and communication with maternal grandparents.[29]		
14. Social support.[30,31]		

Strategies for emotional regulation and transfer for maternal health. This strategy begins with the psychological and physical structuring of the woman and from the attitude towards motherhood that she has during the migration process; that is, how the MPW carry out empowerment, exercise leadership, self-control, improve self-esteem, and fight for their future despite adversity.[25] When carrying out the analysis of the literature, it was identified that when the MPW, during the

migratory process, are left alone and want to continue, they feel the need and the impulse to move forward to improve their health and that of their children.[33,34] Thus, being pregnant, they can present different psychological alterations, such as depression, anxiety and fear, which can be exacerbated by the migration process.[25] If the migrant woman has emotional stability prior to pregnancy, she will better manage the changes she may face. If a woman previously presents psychological disorders, a complicated pregnancy, stressful life circumstances, she will face emotional imbalances during pregnancy such as anxiety and depression, which will lead to a deficit in maintaining her health.[15]

Cultural adaptation strategy: Connections with herself, her ancestors and the future. The articles reviewed indicate that the MPW's traditions, habits, and cultural practices are still present in the migration process and are presented and shared with the people with whom they interact in the place of transit and/or destination. These connections with culture are an adaptation strategy and a challenge to be explored by the person who cares for them. According to the evidence, this strategy is usually the most complex to carry out by the community receiving migrants but the most important in the process of integration into a territory, a language, educational opportunities, professional training and economic independence, which allows MPW to ensure a future for themselves, their unborn baby, their family, and achieve a reality consistent with their experience.[35,36]

Comprehensible language strategy: A constant two-way challenge. The challenge that the pregnant woman faces when trying to be understood in the new reality in which she lives occurs in two situations: the first comes from her reality and projection to the environment, and the second from the communication and relationship with others when aiming to receive support and improve the health situation and the bond with her unborn child. In the reviewed literature, the MPW's constant search for a comprehensible language to improve her health, reduce anxiety and fear, through communication with the people who care for her is highlighted.[17,18] One of the ways in which the migrant pregnant woman makes her situation known is by making herself visible, another is by achieving understandable communication with the person who cares for her, and the last is by making her culture and customs in health care manifest for her reality to be understood.[37, 38] In the last aspect, the literature considers it relevant that the health professional who cares for the MPW has knowledge about their beliefs, customs, rituals, traditions, and provides comprehensive and individualized care.[18]

Positive attitude strategy to promote maternal health. The most effective strategy to cope with the adversities of the life events or health challenges that arise during the migration process for the MPW is to concentrate and use selective attention to create a positive attitude towards pregnancy, life and health to carry a healthy pregnancy.[26, 39,40] In general terms, the support provided in preparation courses for motherhood and fatherhood, attendance at prenatal check-ups, accompaniment and follow-up of indications, timely access to health services, and motivation to carry out activities pleasant for the migrant pregnant woman could reduce the negative stimulus triggered by the problems associated with migration and thus improve health conditions, promoting the well-being of the maternal-fetal relationship.[19,20]

Social support strategy: A predictor of maternal health. This strategy will have an effect on the outcome of pregnancy depending on the strength with which it occurs, that is, the greater the social support, the better the outcome of the pregnancy and vice versa.[28-30] This strategy is developed when it is evident in the literature that one of the factors generating the most effects during the gestation of MPW is anxiety about loneliness, which manifests itself with emotional and muscular tension, easy crying, startle, trembling; thus, it constitutes a negative factor influencing health status.[21,28] It is also evident that MPW with adequate family support in their

destination express greater satisfaction with the way they and their family share time, space or money, which generates a positive strategy for adaptation.[22] According to the reviewed articles; although the support of others is declared, it is not always perceived by the migrant pregnant woman; therefore, the MPW network could be made up of relatives, friends and social networks, which reduce anxiety and fear. It was found that the main source of emotional support for MPW are people not related to their family.[41]

Discussion

The articles review shows the coping strategies for the adaptation of MPW with respect to their health. These strategies are related and applied to those proposed by Callista Roy, in the Middle-Range Theory of Adaptation to Life Events, taking into account that migration, as a life event, when presented with pregnancy, becomes a health challenge [13]

Social support is the strategy most evidenced in literature, which is related to the strategy of counting on others proposed by Roy.[42,43] The two strategies are intended to demonstrate the importance of support networks to generate a safe and quality pregnancy, which is consistent with studies carried out in Asia on the experiences of migrant women, which found that the adaptation of migrants was carried out through the development of social networks, strong bonds with non-family groups in receiving countries, and the maintenance of transnational ties with relatives from the country of origin and the partner, given that if a MPW has a weak family and marital relationship, this becomes a predictor of anxiety, depression and other mental health problems during pregnancy. [27,47] The social support available to the migrant pregnant woman can be a predictor for the positive outcome of pregnancy, so it is important to characterize them in the transit and destination territories as a support strategy for maintaining her health during pregnancy.[44, 45]

Comprehensive language, as a strategy, relates to common language and the unique union and connections found in Callista Roy's middle-range theory.[13] These strategies seek to generate an alert for the staff and institutions that provide care in the search for an understanding, empathetic, humanized, and inclusive relationship with the MPW.[46] To confirm the above, a review of qualitative synthesis carried out in 2018 evidences that the access and use of health care for the pregnant migrant was hindered by structural, organizational, social, personal, and cultural barriers of the health institution; care experiences included negative communication, discrimination, poor relationships with health professionals, cultural shocks, and negative experiences of clinical intervention, which generated anxiety and fear.[48] A study carried out in South America indicates that the practices carried out by migrant pregnant women are rooted in their beliefs, myths, and cultural values inherited from generation to generation, which must be identified by health personnel to offer culturally congruent language and care. [49] In a meta-synthesis carried out on interculturality in pregnant migrant women, it is confirmed that the barriers to care fluctuate within the divergence of concepts, little credibility, lack of knowledge of capabilities and limitations, as well as negative experiences in caring for MPW.[50] In conclusion, it is important to generate intercultural care skills in the people who care for the migrant population that can generate a comprehensive language that involves aspects of humanization and empathy towards the vulnerable population.[51, 52]

The emotional regulation and transfer strategy found in the literature is related to the coping strategy proposed by Roy. Being strong during the physical and psychological changes of pregnancy, generates a potential risk for women, which in combination with those of migration, could trigger a deficit in maternal well-being.[53,54] When migration involves too many challenges, the most effective strategy that MPW applies is emotional regulation and transfer, which, combined with a positive attitude toward motherhood, facilitates

health maintenance.[55,56] This coincides with a study carried out in 2017, in which the migration status has a negative effect on perinatal mental health for those who have a poor family support, who do not have a job, are in a precarious immigration situation and/or relationship conflicts; however, when they present an empowerment of their role, personal strengths, family and community emotional resources they have the strength to resist and continue maintaining their health during pregnancy. [57] Another study reported in North America indicated how pregnant Mexican migrants had a positive outcome of their pregnancy despite not obtaining prenatal medical care. MPW were guided by beliefs, values, and traditions about self-care during pregnancy related to what to eat, what not to eat, how much exercise and sleep to get, how to avoid stress by exercising, sleeping, and how to stay healthy during pregnancy. They turned to Mexican cultural traditions of care during pregnancy, which allowed them a safe birth.[58] Consequently, being strong could represent a state of survival for the migrant pregnant woman and her baby, thus it is considered an important pillar to address it from the motivation and work in health and community networks.[59 60]

Conclusion. According to the literature reviewed and its connection with Roy's Middle-Range Theory of Life Events, the coping strategy most commonly used by pregnant migrant women to preserve their health and support their adaptation during pregnancy is social support. This includes establishing positive relationships with others, as well as forming or participating in support networks in their countries of origin, transit, and destination. The "being strong" strategy reflects a state of survival for both pregnant migrant women and their children, constituting an essential pillar within community support networks and health systems.

The positive behaviors identified in the literature are oriented toward problem-solving and the mobilization of knowledge, skills, and emotional resources that allow them to maintain a positive attitude toward life and health, contributing to the reduction of mental health disorders. Likewise, the use of understanding language by healthcare personnel, working with migrant women in the coping process, reduces anxiety and fear. In this sense, the cultural competence that professionals must develop when faced with migration phenomena is essential to guarantee equitable, high-quality, and humane maternal care.

Finally, connecting with themselves, their ancestors, and the future enables pregnant migrant women to maintain their overall health and build a new reality in their host territories.

Recommendations: This review recommends that public policies and maternal and perinatal health programs, as well as community health programs, recognize the need and importance of creating social support groups in transit and destination countries to welcome, accompany, and support pregnant migrant women in their processes of change and adaptation, creating inclusive, individualized, and culturally sensitive spaces.

Implications for practice: This review will help professionals and health systems understand the situation experienced by pregnant migrant women, as it invites reflection on the importance of implementing care protocols tailored to their needs and developing research projects aimed at achieving better outcomes during pregnancy, childbirth, and the postpartum period for pregnant women during the migration process**.**

Limitations of the study. There is little research on the strategies used by migrants to adapt and take care of themselves during pregnancy in a new territory, in addition to the scarce regulations available to support them. The studies found are approached from specific contexts; there is not enough evidence of literature for the care of the pregnant woman, a situation that demands new studies on pregnancy care during migration.

References

1. Organización Internacional para las Migraciones. Género y Migración. [Internet]. [cited 2025 Jun. 24]. Available from: https://rosanjose.iom.int/es/genero-y-migracion
2. Organización de las Naciones Unidas, Organización Internacional para las Migraciones. Interactivo Informe sobre las migraciones en el mundo 2022 [Internet]. [cited 2025 Jun. 24]. Available from: https://worldmigrationreport.iom.int/wmr-2022-interactive/?lang=ES
3. Portal de Datos sobre Migración. Género y migración. [Internet]. [cited 2025 Jun. 24]. Available from: https://www.migrationdataportal.org/es/themes/genero-y-migracion
4. Van Roosmalen, J., y Van Den Akker, T. Maternal mortality and severe morbidity in a migration perspective. Best Practice & Research Clinical Obstetrics & Gynaecology. 2016; 32:26-38.
5. Organización Internacional para las Migraciones, Ministerio de Desarrollo Social del Gobierno de la Ciudad Autónoma de Buenos Aires. Las mujeres migrantes y la violencia de género. Aportes para la reflexión y la intervención. [Internet]. 2014 [cited 2025 Jun. 24] Available from: https://www.iom.int/sites/g/files/tmzbdl486/files/2018-07/Manual_OIM-digital.pdf
6. Canales AI, Fuentes JA, De León CR. Desarrollo y migración: desafíos y oportunidades en los países del norte de Centroamérica [Internet]. 2019. Available from: http://repositorio.cepal.org/server/api/core/bitstreams/55aaa08e-7c40-4d21-90bf-1402d422b400/content
7. Roy C. Synthesis of middle range theory of Adapting to Life Events. En: Generating middle range theory: From evidence to practice. New York: Springer Publishing Company. 2014
8. Ospina Romero AM, Muñoz Rodríguez L, Ruíz de Cárdenas CH. Coping and adaptation process during puerperium. Colombia Medica. 2012; 43(2):167-74.
9. Roy, C. Research Based on the Roy Adaptation Model: Last 25 Years. Nursing Science Quarterly. 2011; 24(4):312-20.
10. Levesque L, Ricard N, Ducharme F, Duquette A, Bonin J-P. Empirical Verification of a Theoretical Model Derived From the Roy Adaptation Model: Findings From Five Studies. Nursing Science Quarterly. 1998; 11: 31-9.
11. Whittemore R, Knafl K. The integrative review: updated methodology. Journal of advanced nursing. 2005; 52(5):546-53.
12. Redcaspe – Programa de Habilidades en Lectura Crítica Español [Internet]. [cited 2025 Jun. 24]. Available from: https://redcaspe.org/
13. Roy C. Generating Middle Range Theory: From Evidence to Practice. [Internet]. Springer Publishing Company; 2014.
14. Page M J, McKenzie J E, Bossuyt P M, Boutron I, Hoffmann T C, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021; 372(71):n71.
15. Sibrian N. Ajustes emocionales de una gestante e inmigrante en Chile: estrategias para atenuar el sufrimiento. Athenea Digital. Revista de Pensamiento e Investigación Social. 2021; 21(2):1-21.
16. Song JE, Ahn JA, Kim T, Roh EH. A qualitative review of immigrant women's experiences of maternal adaptation in South Korea. Midwifery. 2016; 39:35-43.
17. Higginbottom GMA, Hadziabdic E, Yohani S, Paton P. Immigrant women's experience of maternity services in Canada: A meta-ethnography. Midwifery. 2014; 30(5):544-59.
18. Lukin TT, Saidarab S, Bogren M, Premberg Å. Syrian women's experiences of being pregnant and receiving care at antenatal clinics in Sweden for the first time after migration. Sexual & Reproductive Health Care. 2023; 35:1-6.
19. Lin ML, Wang HH. Prenatal examination behavior of Southeast Asian pregnant women in Taiwan: A questionnaire survey. International Journal of Nursing Studies. 2008 ;45(5):697-705. Available from: https://doi.org/10.1016/j.ijnurstu.2006.12.005
20. Viken B, Lyberg A, Severinsson E. Maternal Health Coping Strategies of Migrant Women in Norway. Nursing Research and Practice. 2015; 2015:1-11. Available from: https://doi.org/10.1155/2015/878040

21. Kim P. How stress can influence brain adaptations to motherhood. Frontiers in Neuroendocrinology. 2021; 60:1-17. Available from: https://doi.org/10.1016/j.yfrne.2020.100875
22. González-Mesa E, Kabukcuoglu K, Körükcü O, Blasco M, Ibrahim N, Kavas T. Cultural factors influencing antenatal depression: A cross-sectional study in a cohort of Turkish and Spanish women at the beginning of the pregnancy. Journal of Affective Disorders. 2018; 238:256-60.
23. Qian Y, Mao Y. Coping with cultural differences in healthcare: Chinese immigrant mothers' health information sharing via WeChat. International Journal of Intercultural Relations. 2021; 84:315-24.
24. Page RL. Positive Pregnancy Outcomes in Mexican Immigrants: What Can We Learn? Journal of Obstetric, Gynecologic & Neonatal Nursing. 2004; 33(6):783-90.
25. Nguyen N. Strangers helping strangers in a strange land: Vietnamese immigrant (expectant) mothers in the US use social media to navigate health issues in acculturation. Digital Health. 2023; 9:1-15.
26. McLeish J & Redshaw M. 'She come like a sister to me': a qualitative study of volunteer social support for disadvantaged women in the transition to motherhood in England. Philosophical Transactions of the Royal Society B Biological Sciences. 2021; 376:1-8.
27. Qureshi R, Pacquiao DF. Ethnographic Study of Experiences of Pakistani Women Immigrants With Pregnancy, Birthing, and Postpartum Care in the United States and Pakistan. Journal of Transcultural Nursing. 2013; 24(4):355-62.
28. Stanhope KK, Comeau DL, Ulloa M, Leon JS, Suglia SF, Hogue CJR, et al. Perceptions of stress and resilience among Latina women enrolled in prenatal care in Metro Atlanta through an ecosocial lens. Health and Social Care in the Community. 2021; 29(6):e348-e358.
29. Knorr DA, Fox M. An evolutionary perspective on the association between grandmother-mother relationships and maternal mental health among a cohort of pregnant Latina women. Evolution and Human Behavior. 2023; 44(1):30-8.
30. Quintanilha M, Mayan MJ, Thompson J, Bell RC. Contrasting "back home" and "here": how Northeast African migrant women perceive and experience health during pregnancy and postpartum in Canada. International Journal for Equity in Health. 2016; 15(1):80.
31. Rao VS, Dahlen HG, Razee H. Indian migrant women's experiences of motherhood and postnatal support in Australia: A qualitative study. Women and Birth. 2020; 33(5):479-89
32. Kyngäs, H. Qualitative Research and Content Analysis. In: Kyngäs, H., Mikkonen, K., Kääriäinen, M. (eds) The Application of Content Analysis in Nursing Science Research. 2020. Springer Nature Link, Cham.
33. Coo S, García MI, Prieto F, Medina F. The role of interpersonal emotional regulation on maternal mental health. Journal of Reproductive and Infant Psychology. 2020; 40(1):3–21.
34. Morelen D, Shaffer A, Suveg C. Maternal Emotion Regulation: Links to Emotion Parenting and Child Emotion Regulation. Journal of Family Issues. 2014; 37(13):1891-916.
35. Downe S, Ng E, Shorey S. Cultural competence and experiences of maternity health care providers on care for migrant women: A qualitative meta-synthesis. Birth: Issues in Perinatal Care. 2021; 48(4): 458-69.
36. Zhi X, Mai D, McKenzie-Mcharg K. Investigating cultural conflicts in everyday self-care among Chinese first-time pregnant migrants in Australia. Midwifery. 2024; 135:104038.
37. Crowther S, Lau A. Migrant Polish women overcoming communication challenges in Scottish maternity services: A qualitative descriptive study. Midwifery. 2019; 72: 30-8
38. Lindskog B, Bains S, Diep L, Owe K, Vangen S, Sørbye I, Sundby J. Communication barriers in maternity care - a questionnaire study among migrants to Norway. European Journal of Public Health. 2020; 30(S5): v14-v15.
39. Nowak A, Kolip P, Mohwinkel L, Kasper A. Maternal health care for refugee women - A qualitative review. Midwifery. 2021; 104.
40. Bains S, Sundby J, Lindskog B, Skråning S, Vangen S, Sørbye I. Challenges and barriers to optimal maternity care for recently migrated women - a mixed-method study in Norway. BMC Pregnancy Childbirth. 2021; 21:686
41. Cremin A, Matvienko-Sikar K, Meaney S, Olander E. Prenatal maternal stress, social support, health behaviours and stress-reduction strategies during pregnancy. Preprint. Available from: https://doi.org/10.31219/osf.io/ycgf5

42. Suryaningsih EK, Gau ML, Kao CH, Liu CY, Kuo SY, Liaw JJ. Effect of Childbirth Education Program on Maternal Anxiety: A Randomized Controlled Trial Using Roy's Adaptation Model. Journal of Health Technology Assessment in Midwifery. 2023; 6(1):36-48.
43. Zlotnick C, Leahy-Warren P, Manor-Lavon I. Relationship between social support and postpartum depression in migrant and non-migrant first-time mothers. Journal of Clinical Nursing. 2022; 32(7-8):1316-26.
44. Fellmeth G, Plugge E, Fazel M, Nosten S, Oo M, Pimanpanarak M, et al. Perinatal depression in migrant and refugee women on the Thai–Myanmar border: does social support matter? Philosophical Transactions of the Royal Society B Biological Sciences. 2021; 376:20200030.
45. Stevenson K, Ogunlana K, Edwards S, Henderson W, Rayment-Jones H, McGranahan M, et al. Interventions to improve perinatal outcomes among migrant women in high-income countries: a systematic review protocol. BMJ Open. 2023; 13:e072090.
46. Stevenson F, Edwards S, Ogunlana K, Alomari M, Agoropopoola R, Henderson W, et al. Public health, policy, and clinical interventions to improve perinatal care for migrant women and infants in high-income countries: a systematic review. eClinicalMedicine. 2024; 78:102938.
47. Omidvar S, Faramarzi M, Hajian-Tilak K, Nasiri Amiri F. Associations of psychosocial factors with pregnancy healthy life styles. Plos One. 2018; 13(1): e0197389.
48. Heslehurst N, Brown H, Pemu A, Coleman H, Rankin J. Perinatal health outcomes and care among asylum seekers and refugees: a systematic review of systematic reviews. BMC Medicine. 2018; 16:89.
49. Correa-Betancoür M. Profesionales de enfermería y el cuidado de migrantes internacionales en chile: rol de la competencia cultural. Ciencia y Enfermería. 2019; 25:14.
50. Shorey S, Ng ED, Downe S. Cultural competence and experiences of maternity health care providers on care for migrant women: A qualitative meta-synthesis. Birth. 2021; 48(4):458-69.
51. Cruz-Riveros C, Urzúa A, Macaya-Aguirre G & Cabieses B. Meanings and Practices in Intercultural Health for International Migrants. International Journal of Environmental Research and Public Health. 2022; 19(20):13670.
52. Bäärnhielm S, Schouler-Ocak M. Training in cultural psychiatry: Translating research into improvements in mental health care for migrants. Transcultural Psychiatry. 2022; 59(2):111-5.
53. Eslier M, Azria E, Chatzistergiou K, Stewart Z, Dechartres A & Deneux-Tharaux C. Association between migration and severe maternal outcomes in high-income countries: Systematic review and meta-analysis. Plos Medicine. 2023; 20(6):e1004257.
54. Gieles N, Tankink J, Van-Midde M, Düker J, Van der Lans P, Wessels C, et al. Maternal and perinatal outcomes of asylum seekers and undocumented migrants in Europe: a systematic review, European Journal of Public Health. 2019; 29(4):714–23.
55. Herrero-Arias R, Hollekim R, Haukanes H & Vagli A. The emotional journey of motherhood in migration. The case of Southern European mothers in Norway. Migration Studies. 2021; 9(3):1230–49.
56. Machado S, Zaki S, Villasin R, Berry N, Lavergne R, Wiedmeyer, M, et al. "When I came to Canada, I almost forgot myself: Where I am, who I am": A qualitative exploration of how im/migration shapes young women's experiences of pregnancy, motherhood, and marriage. SSM - Qualitative Research in Health. 2023; 4:100299.
57. Schmied V, Black E, Naidoo N, Dahlen HG, Liamputtong P. Migrant women's experiences, meanings and ways of dealing with postnatal depression: A meta-ethnographic study. Foster AM, editor. Plos One. 2017; 12(3): e0172385.
58. Sherraden MS, Barrera RE. Culturally-Protective Health Practices: Everyday Pregnancy Care Among Mexican Immigrants. Journal of Ethnic & Cultural Diversity in Social Work. 1997: 6(1-2):93-115.
59. Estrada-Moreno IS, Palma-García M, Gómez J, Hombrados-Mendieta,MI. Resilience in immigrants: a facilitating resource for their social integration. Journal of Ethnic & Cultural Diversity in Social Work. 2025:1–16.
60. Zaman M, McCann V, Friesen S, Noriega M, Marisol M, Bartels S, et al. Experiences of pregnant Venezuelan migrants/refugees in Brazil, Ecuador and Peru: a qualitative analysis. BMC Pregnancy Childbirth. 2024; 24:157.

Original Article

Prenatal care with blind pregnant women: validation of an instrument for nurses on knowledge, attitude and practice

Francisco Jardsom Moura Luzia[1,9]
https://orcid.org/0000-0002-8386-6103

Monaliza Ribeiro Mariano Grimaldi[2,9]
https://orcid.org/0000-0002-8718-4783

Kariane Gomes Cezário Roscoche[3,10]
https://orcid.org/0000-0002-2097-2478

Josemara Barbosa Carneiro[4,9]
https://orcid.org/0000-0003-4650-9809

Antonia Ellen Jardani de Souza Medeiros[5,9]
https://orcid.org/0000-0003-1974-2090

Liliana Andreia Neves da Mota[6,11]
https://orcid.org/0000-0003-3357-7984

Cristina Maria Correia Barroso Pinto[7,12]
https://orcid.org/0000-0002-6077-4150

Paula Marciana Pinheiro de Oliveira[8,9]
https://orcid.org/0000-0001-9091-0478

Conflicts of interest: None

Received: March 26, 2025.

Approved: September 7, 2025.

How to cite this article: Luzia FJM, Grimaldi MRM, Roscoche KGC, Carneiro JB, Medeiros AEJS, Mota LAN, Pinto CMCB, Oliveira PMP. Prenatal care with blind pregnant women: validation of an instrument for nurses on knowledge, attitude and practice. Investigación y Educación en Enfermería. 2025; 43(3):e11.

DOI: https://doi.org/10.17533/udea.iee.v43n3e11

1 Nurse, Ph.D. student. Email: jardsommouraenf@aluno.unilab.edu.br. Corresponding author.

2 Nurse, Ph.D. Professor of the Graduate Program in Nursing. Email monalizamariano@unilab.edu.br.

3 Nurse, Ph.D. Professor of the Nursing Department Email: karianeroscoche@ufpr.br.

4 Nurse, Ph.D. student. Email: josemarabarbosac@gmail.com.

5 Nurse, master's student. Email: jardanimedeiros@hotmail.com.

6 Nurse, Ph.D. RISE-Health Teacher. Email: liliana.mota@essnortecvp.pt.

7 Nurse, Ph.D. Professor of the Nursing Department. Email: cmpinto@esenf.pt.

8 Nurse, Ph.D. Professor of the Graduate Program in Nursing Email: paulapinheiro@unilab.edu.br.

9 University of International Integration of Afro-Brazilian Lusophony, Brazil.

10 Federal University of Paraná, Brazil.

11 Northern School of Health of the Portuguese Red Cross, Portugal.

12 Porto School of Nursing, Portugal.

Prenatal care with blind pregnant women: validation of an instrument for nurses on knowledge, attitude and practice

Abstract

Objective. To verify evidence of validity of the instrument "Knowledge, Attitude, and Practice of Nurses in Prenatal Care for Visually Impaired Pregnant Women". **Methods.** Methodological study to assess content validity with the participation of 22 expert nurses (11 from the area of Sexual and Reproductive Health and 11 from the area of People with Disabilities). The instrument was adapted into a Google Forms questionnaire and assessed Objectivity, Clarity, and Relevance. The data were analyzed using the Content Validity Coefficient and Content Validity Ratio, in addition to calculating Cronbach's Alpha for internal consistency. Ten generalist nurses from Primary Care participated in the semantic validation, evaluating comprehension, relevance, and possible adjustments to the instrument, with calculation of the Semantic Concordance Index. **Results.** The instrument obtained an overall Content Validity Coefficient above 0.90 for objectivity, clarity, and relevance, with internal consistency (Cronbach's Alpha = 0.89). The experts' suggestions improved the wording and structure. In semantic validation, the Semantic Concordance Index was 0.97, reinforcing clarity and applicability. **Conclusion.** The instrument showed evidence of content validity, being objective, clear, and relevant for assessing the Knowledge, Attitude, and Practice of nurses in the prenatal care of pregnant women with visual impairment.

Descriptors: health knowledge, attitudes, and practice; prenatal care; nursing care; primary health care; people with visual impairments.

Atención prenatal a mujeres embarazadas ciegas: validación de un instrumento para enfermeros sobre conocimientos, actitudes y prácticas

Resumen

Objetivo. Evaluar la validez del instrumento "Conocimientos, Actitudes y Prácticas de Enfermeras en la Atención Prenatal de Embarazadas con Discapacidad Visual". **Métodos** Estudio metodológico que analizó la validez de contenido con la participación de 22 enfermeras especialistas, 11 del área de Salud Sexual y Reproductiva y 11 del área de Discapacidad. El instrumento se aplicó en Google Forms y se evaluaron la objetividad, claridad y relevancia de cada una de sus preguntas. Se utilizaron el Coeficiente y la Razón de Validez de Contenido, además del Alfa de Cronbach para evaluación de la consistencia interna. También se realizó

validación semántica con la participación de diez enfermeras generalistas del área de Atención Primaria, considerando comprensión, pertinencia y ajustes, a través del Índice de Concordancia Semántica. **Resultados.** El instrumento alcanzó un Coeficiente de Validez de Contenido superior a 0.90 en los tres criterios y un Alfa de Cronbach de 0.89, indicando consistencia interna adecuada. Las sugerencias de los expertos contribuyeron a mejorar la redacción y la estructura. En la validación semántica, el Índice de Concordancia Semántica fue de 0.97, confirmando claridad y aplicabilidad. **Conclusión.** El instrumento mostró evidencia sólida de validez de contenido, siendo objetivo, claro y relevante para evaluar conocimientos, actitudes y prácticas de enfermeras en la atención prenatal de embarazadas con discapacidad visual.

Descriptores: conocimientos, actitudes y práctica en salud; atención prenatal; atención de enfermería; atención primaria de salud; personas con daño visual.

Pré-natal com gestante cega: validação de instrumento para enfermeiros sobre conhecimento, atitude e prática

Resumo

Objetivo. Verificar evidências de validade do instrumento de "Conhecimento, Atitude e Prática de Enfermeiros no pré-natal de gestantes com deficiência visual". **Métodos.** Estudo metodológico para avaliar a validade de conteúdo com a participação de 22 enfermeiros especialistas (11 da área de Saúde Sexual e Reprodutiva e 11 da área de Pessoas com Deficiência). O instrumento foi adaptado em formulário no *Google Forms* e avaliou Objetividade, Clareza e Relevância. Os dados foram analisados por meio do Coeficiente de Validade de Conteúdo e Razão de Validade de Conteúdo, além do cálculo do Alpha de Cronbach para consistência interna. Dez enfermeiros generalistas da Atenção Primária participaram da validação semântica, avaliando compreensão, relevância e possíveis ajustes no instrumento, com cálculo do Índice de Concordância Semântica. **Resultados.** Instrumento obteve Coeficiente de Validade de Conteúdo global acima de 0.90 para objetividade, clareza e relevância, com consistência interna (Alpha de Cronbach = 0.89). As sugestões dos especialistas aprimoraram redação e estrutura. Na validação semântica, o Índice de Concordância Semântica foi 0.97, reforçando clareza e aplicabilidade. **Conclusão.** O instrumento apresentou evidências de validade quanto ao conteúdo, sendo objetivo, claro e relevante para avaliar o Conhecimento, Atitude e Prática de enfermeiros no pré-natal de gestantes com deficiência visual.

Descritores: conhecimentos, atitudes e prática em saúde; cuidado pré-natal; cuidados de enfermagem; atenção primária à saúde; pessoas com deficiência visual.

Introduction

Sexual and reproductive health care for women with disabilities has often been surrounded by stigmas that directly impact the care provided to this population. However, the equitable process that guides the Unified Health System (SUS) requires professionals to be prepared to serve all individuals, regardless of color, race, ethnicity, disability, or vulnerability, necessitating methods that promote comprehensive care.[1] The lives of women with visual impairments are still hampered by attitudinal barriers on the part of professionals and the community, which reinforce the precept that people are asexual.[2] Furthermore, ableism persists, permeating discourse that characterizes them as incapable of fully developing the role of motherhood, or even of gestation, due to a limited view of their disability, without considering desires and plans these women.[3]

Besides issues related to attitude, the technical and care practices of health professionals, including nurses, face limitations related to their educational path. The lack of classes and content related to the care of Persons with Disabilities (PwD) constitutes a significant gap and can directly impact the quality of services provided to this population.[4] In this context, the development of Knowledge, Attitude, and Practice (KAP) assessment instruments emerges as a relevant tool, as it allows for the assessment of gaps in knowledge, behaviors, or attitudes that can become barriers to care. Furthermore, it can identify irregularities in the care provided, enabling interventions to be established that facilitate practices free from prejudice, discrimination, and ableism.[5]

To ensure an accessible and effective healthcare system, the development of instruments that identify the main gaps in core aspects of prenatal care (Knowledge, Attitude, and Practice) and that present evidence of validity could contribute to the advancement of nursing practices for people with disabilities. Furthermore, it will help to advance policies aimed at guaranteeing the sexual and reproductive rights of the public and enable a situational assessment to promote continuing education methods for professionals. Furthermore, it is noteworthy that no other KAP instrument related to Persons with Disabilities has been identified in the literature, nor with specificity for prenatal consultations, thus presenting an innovative character. Therefore, this study aims to verify evidence of the validity of the Knowledge, Attitude, and Practice of Nurses instrument in the prenatal care of pregnant women with visual impairment.

Methods

This methodological study developed and evaluated the validity of a KAP instrument for assessing nurses' prenatal consultations with women with

visual impairments. The study was conducted in three stages: 1) Selection, content delimitation, and construction of the KAP instrument; 2) Assessment of content validity evidence; and 3) Assessment of semantic validity evidence. The first stage consisted of delimiting the content used in the construction of the KAP instrument and was based on the Nonverbal Communication Model for Nursing Consultations with blind Patients,[6] the Verbal Communication Model with the Blind: Development and Validation in Consultations with the blind patient,[7] and the Healthcare Guide for Women with Disabilities and Reduced Mobility[8] for inquiries directed at consultations with people with disabilities, and the Ministry of Health's Low-Risk Prenatal Care Handbook[9] for inquiries related to prenatal consultations.

In the second stage, judges from the Prenatal and Persons with Disabilities areas assessed content validity evidence. In the third stage, Primary Care nurses conducted semantic evaluation, the target audience for the instrument.

Data collection for the study was conducted online via email and Google Forms between July 2023 and March 2024. The study population consisted of experts in the areas of Persons with Disabilities and Sexual and Reproductive Health, as well as nurses working in Primary Care.

Regarding the experts, the inclusion criteria for defining participants were defined based on attributes that encompassed the experts' academic and professional characteristics. Recruitment initially began with research groups in the areas of health promotion for people with and without vulnerabilities and Sexual and Reproductive Health promotion. Subsequently, the CVs of the previously selected experts were analyzed on the Lattes Platform, through the Portal of the National Council for Scientific and Technological Development (CNPq), and a search was carried out using the terms "Person with Disabilities", "Person with Visual Impairment", "Sexual and Reproductive Health" and "Prenatal" to complement the necessary number. In total, 46 experts were invited via email and instant messaging through the social network WhatsApp, which was part of the researchers' contact network: 16 from the area of People with Disabilities and 30 from the area of Sexual and Reproductive Health; however, 24 experts were discontinued for not confirming participation. The final panel consisted of 22 judges, considering the stratification of 11 from the area of Sexual and Reproductive Health and 11 from the area of People with Disabilities.[10] A deadline of 20 days was established for the experts to respond to the validation instrument. Those who completed the response within this period were included in the sample, discontinuing those who did not return or who left the validation instrument incomplete.

For generalist PHC nurses, we chose to include those with at least one year of experience conducting prenatal consultations. Convenience sampling was conducted through contact via instant messaging on the social network WhatsApp, using the referral network technique. Based on the literature, the number of participants in this stage should be between 10 and 30. For this study, the recommended reference framework was followed, with assessments performed by 10 members of the target audience.[11]

To characterize expert nurses, the following sociodemographic variables were selected: gender, age, current occupation, time since graduation, highest degree, care experience in the areas covered by the instrument, and research conducted in the area in the last five years. In turn, to characterize nurses, the following sociodemographic variables were selected: gender, age, marital status, time since graduation, and time in practice, provision of prenatal consultations for women with visual impairments, and presence of women with visual impairments in their area ofexpertise.

Regarding the variables involved in content validation, all questions were assessed for objectivity, clarity, and relevance. For semantic

validation, the following variables were defined: perception of the instrument, understanding of the questions, response options, importance of the questions, changes and additions to the instrument, and questions not answered. To assess content validity evidence, an invitation letter was sent to the experts, presenting the study's information, objectives, and methodology. After confirmation of participation, the data collection instrument, adapted as a Google Forms® form, was made available. It was structured in three parts: 1st. Informed Consent Form; 2nd. Questionnaire for the judges' sociodemographic and professional characteristics; 3rd. An adapted content validation instrument assessed objectivity (direct, concise, and aligned with the proposal), clarity (understandable and unambiguous wording), and relevance (relevant to the topic and contributing to practice) of each proposed item, using a Likert scale with "Yes," "No," and "Partially" options, as well as a field for additional suggestions from the judges.[12]

To assess the semantic validity evidence, a form was sent to the nurses via Google Forms®, also structured in three parts: 1st. Informed Consent Form; 2nd. Questionnaire for the sociodemographic and professional characterization of the nurses; 3rd. Version of the instrument revised after content validation, in addition to a semantic validation instrument adapted from the DISABKIDS semantic validation instrument in Portuguese.[13] For content validation, the Content Validity Coefficient (CVC) was used, calculating the individual coefficient (CVCi) and the total CVC (CVCt). Only questions with inter-expert agreement equal to or greater than 0.80 were considered valid.[14] The Content Validity Ratio (CVR) was also calculated, assessing inter-rater agreement on the instrument's items using a three-point scale: 3 - Essential to the instrument; 2 - Useful, but not essential to the instrument; and 1 - Not necessary. The critical CVR value considered for the study was 0.418, defined based on the number of experts who participated in the study and a significance level of 0.05.[15]

For semantic validation, the proportion of inter-expert agreement was analyzed using the Semantic Agreement Index (SIC), which assesses relevant characteristics of the instrument.[16] Items were considered semantically validated when they reached an agreement greater than 70% (0.70). An analysis of the construct's internal consistency was also performed using Cronbach's alpha calculations with a 95% confidence interval. For this study, a Cronbach's alpha coefficient equal to or greater than 0.70 was considered acceptable.[17]

All study participants signed the Informed Consent Form and received a copy. The project was submitted to and approved by the Research Ethics Committee (REC), under report number 6.168.208 e CAAE n° 705324423.3.0000.5576.

Results

Once the components for the instrument were selected, adaptations were made to meet the specific needs of prenatal consultations for women with visual impairments, resulting in the first version of the survey. This initial version of the instrument included 40 questions: 13 in the knowledge domain, 13 in the attitude domain and 14 in the practice domain, with two subjective questions. The instrument then underwent content validation.

The content validation stage involved 22 judges, 11 of whom were experts in the area of Persons with Disabilities and 11 in the area of Sexual and Reproductive Health. Of these, 19 (86.36%) were women, with a higher concentration in the 30-40 age group (59.09%) and predominantly in teaching (72.73%). It was also observed that the majority of participants had between 11 and 15 years of training (50%). All sample members held master's degrees, of which 17 (77.27%) held PhD. The same number reported having healthcare experience in the areas covered by the KAP instrument. All had conducted research in the field within the last five years.

Regarding the individual CVC of all the evaluators, 21 items achieved complete agreement among the evaluators across the three criteria assessed (CVCi=1.00). Furthermore, 38 items presented results within the acceptability parameters adopted for the study (>0.80), and only two presented lower results, as shown in Table 1.

Table 1. Content Validity Indices by dimension and items of the KAP Instrument of the 22 expert judges

Content Validity Indices							
		Objectivity		Clarity		Relevance	
Dimension/ Number	Content	CVC	RVC	CVC	RVC	CVC	RVC
Knowledge							
1	Types of Visual Impairment	1.00	1	1.00	1	0.95	0.82
2	Visual impairment as a risk factor	1.00	1	0.98	0.91	1.00	1
3	Accessibility	0.93	0.73	0.84	*0.45*	1.00	1
4	Segregation	0.98	0.91	0.95	0.91	0.98	0.91
5.	Presence of a companion.	1.00	1	1.00	1	1.00	1
6	Ableism	1.00	1	0.93	0.73	1.00	1
7	Sexual and reproductive rights.	0.95	0.82	0.95	0.82	0.98	0.91
8	Changes in the consultation environment.	1.00	1	0.95	0.82	1.00	1
9	Chair position during the consultation.	1.00	1	1.00	1	1.00	1
10	Intimate or Close Personal Distance.	1.00	1	0.93	0.73	1.00	1
11	Observation of facial and body expressions.	0.93	0.82	0.82	*0.36*	0.89	0.73
12	Presentation of palpation materials.	1.00	1	0.95	0.91	1.00	1
13	Restrictions on motherhood.	0.80	*0.18*	*0.73*	*0.09*	0.95	0.82
Attitude							
14	The nurse should stand and the patient should sit during the consultation.	0.84	*0.45*	*0.77*	*0.36*	1.00	1
15	Direct questions to the companion.	1.00	1	1.00	1	1.00	1
16	Greet the pregnant woman at the door and escort her to the room.	1.00	1	1.00	1	1.00	1
17	Introduce yourself to the pregnant woman without introducing the other professionals.	1.00	1	1.00	1	1.00	1
18	Provide audio description before the consultation.	0.98	0.91	0.98	0.91	0.89	0.73
19	Raise your voice.	1.00	1	1.00	1	1.00	1
20	Describe the room.	1.00	1	1.00	1	1.00	1
21	Maintain eye level with the visually impaired pregnant woman.	1.00	1	1.00	1	1.00	1
22	Refer the pregnant woman to high-risk prenatal care.	1.00	1	1.00	1	0.91	0.82
23	The presence of a companion is essential.	1.00	1	1.00	1	0.95	0.82

Table 1. Content Validity Indices by dimension and items of the KAP Instrument of the 22 expert judges (Cont.)

Content Validity Indices							
		Objectivity		Clarity		Relevance	
Dimension/ Number	Content	CVC	RVC	CVC	RVC	CVC	RVC
Attitude							
24	Provide guidance on motherhood.	1.00	1	1.00	1	1.00	1
25	Indicate physical touch.	1.00	1	1.00	1	1.00	1
26	Silence after each question.	1.00	1	1.00	1	0.95	0.91
27	In professional practice, referrals to high-risk prenatal care are common.	1.00	1	1.00	1	1.00	1
Practice							
28	Maintains effective verbal communication.	1.00	1	1.00	1	1.00	1
29	Accessible health education activities (Subjective).	0.98	0.91	0.98	0.91	1.00	1
30a	Collects health, family, and gynecological history.	1.00	1	1.00	1	1.00	1
30b	Explains the procedure that will be performed before the examination.	1.00	1	1.00	1	1.00	1
30c	Explains test results and serology in an understandable manner.	1.00	1	1.00	1	1.00	1
30d	Explains folic acid and ferrous sulfate supplementation in an understandable manner.	1.00	1	1.00	1	1.00	1
30e	Explains the scheduling of necessary vaccinations in an understandable manner.	1.00	1	1.00	1	1.00	1
30f.	Explains vaginal delivery in an understandable manner.	1.00	1	1.00	1	1.00	1
30g	Explains cesarean delivery in an understandable manner.	1.00	1	0.98	0.91	1.00	1
30h	Explains signs of labor onset in an understandable manner.	1.00	1	1.00	1	1.00	1
30i	Explains the stages of labor in an understandable manner.	1.00	1	1.00	1	1.00	1
30j	Explains risk signals in a comprehensible way.	1.00	1	1.00	1	1.00	1
31	Strategies used to maintain effective communication (Subjective)	1.00	1	0.98	0.91	0.95	0.82
CVC Global		**0.98**		**0.99**		**0.98**	

CVC: Content Validity Coefficient, CVR: Content Validity Ratio

Considering the CVR scores, only question 13 scored below the critical value recommended for the study (0.18) for objectivity, and questions 11, 13, and 14 scored below the critical value recommended for clarity (0.36; 0.09; 0.36). All questions scored higher for relevance. Regarding the overall CVR of the evaluations conducted by all experts, the instrument presented agreement scores above 0.90 for all items, exceeding the recommended level for the study (0.80). Cronbach's alpha test was used to assess the instrument's internal consistency, which demonstrated high reliability across all items (α=0.89).

After evaluating each item, space was provided for suggestions. This identified weightings that were considered in the composition and structure of the evaluated questions. All recommendations were evaluated and, when deemed relevant to improving the instrument, were accepted. The main suggestions were to change the wording of some questions to improve understanding, changes in the dimension to which the question belonged and the insertion of practical examples in the questions that addressed definitions as shown in Table 2.

Table 2. Suggestions from the 22 content judges and results of the researchers' analysis

Question	Suggestions made by experts	Accepted
03	Introduce elements of the nurse's daily life to better understand what "urban planning, architecture, communication" means.	Yes
04	Include the term/word/synonym for segregation in parentheses.	Yes
06	Include the term/word/synonym for ableism in parentheses.	Yes
08	Include changes in positioning so the nurse understands the type of change being referred to.	Yes
09	Although it does require prior knowledge, I believe that the way of acting and behaving toward pregnant women with visual impairments is more appropriate to the attitude domain.	No
10	If the value of distance is part of a standard, I suggest a multiple-choice question to assess whether the professional would know how to assess the position between himself and the patient.	No
13	I found the question confusing. I suggest rewording it and checking if any words or punctuation need to be changed to make it clearer.	Yes
14	Rewrite the question to be more objective.	Yes
28	The professional's concept of effective communication can influence the answer. I suggest conceptualizing effective communication applied to PwD.	No

The experts' suggestions resulted in the second version of the KAP assessment instrument for nurses in prenatal consultations for visually impaired pregnant women, which remained with 40 items and underwent semantic validation. The semantic validation stage involved 10 PHC nurses, eight (80%) of whom were women, aged between 20 and 30 years (50%), and single (60%). Furthermore, the results were equal regarding time since graduation (one to five years) and five to ten years (50%), and a predominance of one to three years in the field (50%).

Furthermore, all participants in the sample had already provided prenatal consultations in their care practice. Two (20%) had already provided prenatal consultations for visually impaired pregnant women, and six (60%) were unable to say whether or not there were women with visual impairments in their area of practice. The results obtained from the Semantic Concordance Index (SIC) showed an overall concordance of 97% and all items presented scores above 90%, as shown in Table 3.

Table 3. Semantic Concordance Index (SCI) of the KAP Instrument of the 10 Primary Health Care nurses

Items	Response	Agreement (*n*)	Disagreement (*n*)	SCI (%)
What did you think of the instrument?	Very good/good	10	0	100
Did you understand the questions?	Easy to understand	9	1	90
Did you have difficulty with the answer options?	No	9	1	90
Are the questions important for assessing KAP in prenatal care for visually impaired pregnant women?	They are very important	10	0	100
Would you change anything in the instrument?	No	10	0	100
Would you add anything to the questionnaire?	No	10	0	100
Would you not like to answer any questions?	No	10	0	100
General Semantic Agreement Index				**97**

Discussion

The KAP assessment instrument for nurses providing prenatal care to women with visual impairments showed consistent validity evidence in the evaluation of experts in the field of sexual and reproductive health and people with disabilities, with an overall CVC above 0.98 in objectivity, clarity, and relevance, indicating statistically significant agreement on the comprehensiveness of the content selected for the questionnaire. For the individual CVC of the questions, there was significant agreement for most items. Only one item presented a poor score in objectivity and two in clarity, but it was decided to modify and maintain the instrument due to the favorable results in relevance. Similar results were observed in the evaluation of the validity evidence of the KAP instrument on COVID-19 preventive measures for prison staff, which presented a CVC above 0.96 in all items evaluated, demonstrating consistency in the validation process.[18]

Regarding the experts, despite the prevalence of teaching as an occupation (72.73%), a significant portion reported having healthcare experience in the field (77.27%). The use of expert selection criteria that valued not only academic training but also practical experience contributed to the improvement of the instrument, enabling closer ties to the healthcare context inherent to the

construct's objective.[19] It is noteworthy that the presence of experts with extensive healthcare experience in the instrument's areas of interest, combined with their academic training, allows for accurate assessment, ensuring the improvement of the developed construct and ensuring the credibility of the version that will later be administered to the target audience.[20]

Furthermore, regarding the CVR evaluation, the experts considered most of the questions essential for the instrument, considering the critical values established for the study. However, three questions presented inferior results: one for objectivity and clarity, and two for clarity only. Because they received positive evaluations for relevance, the items remained in the instrument after adjustments for semantic validation. Similar results and procedures were observed in the development and validation of content for a website for patients with coronary artery disease, which presented CVR results above the cut-off mean for most of the website's content items. However, those that did not reach these results were evaluated based on the experts' suggestions and remained for subsequent lay evaluation.[21]

Therefore, to assess the instrument's internal consistency based on the experts' assessment, Cronbach's alpha was calculated, which demonstrated results that ensure high consistency in the combination of questions. In this regard, a study that evaluated the psychometric properties of the dropout factors scale in undergraduate nursing courses showed similar internal consistency in the sum of all items, and it was considered capable of analyzing the situations that influence dropout.[22] Before the instrument was subjected to semantic validation, all opinions expressed by experts aimed at improving the instrument's questions were considered, and those deemed valid by the researchers were accepted. After the modifications that resulted in the second version of the KAP instrument, semantic validation was performed, which consisted of an evaluation by a portion of the instrument's target audience. Regarding the sociodemographic characterization variables, the sociodemographic profile of PHC nurses in the state of Paraiba, northeastern Brazil, showed that of the 462 professionals, just over 93% were female, in contrast to the predominant age group of 36 to 40 years. Another factor that differed from that found in this study was marital status, with a prevalence of married individuals.[23]

In the context of knowledge in the field, it is essential that nurses identify all the social, economic, and health conditions of their assigned population during the territorialization process, so that actions can be planned and agreed upon that ensure the universality advocated by the principles of the Unified Health System (SUS).[24] Regarding the semantic evaluation of the questions, the results show that for the target audience, the instrument is good/very good, and the questions are easy to understand, as are the answer options. Furthermore, everyone considered the questions important and assessed KAP in prenatal care for women with visual impairments. When asked if they would change or add anything, or if there were any questions they did not want answered, the unanimous answer was "no." Furthermore, no suggestions were made.

The results showed an overall SCII of 97%, which represents excellent semantic agreement. A similar outcome was observed in a study that produced and validated a podcast to promote mental health among primary care users, which obtained an SCI of 95%.[25] Therefore, this study hopes to contribute to the improvement of nursing practices aimed at prenatal care for women with visual impairments. This instrument, with evidence of consistent validity, will allow for a situational analysis of care and subsequent implementation of interventions that will ensure comprehensive actions and reduce barriers that directly interfere with motherhood on an equal footing with other women without disabilities.

As a limitation, following the methodological framework, the instrument still needs to undergo

further validation processes with a more representative sample of the target audience, which is the proposed follow-up to the study.

The conclusion of this study is that the instrument presents consistent validity evidence regarding content, being considered objective, clear, and relevant for assessing nurses' KAP in prenatal care for women with visual impairments. Furthermore, the questions were considered essential for the instrument, presenting a CVR above the cutoff mean in most questions and considered semantically clear and easy to understand by a portion of the target audience, demonstrating the effectiveness of the methodological procedures adopted for the study.

Funding: This work is derived from the master's dissertation project: Construction and validity evidence of an instrument on Knowledge, Attitude, and Practice for nurses regarding prenatal care for women with visual impairment. With a master's scholarship awarded to Francisco Jardsom Moura Luzia by the Coordination for the Improvement of Higher Education Personnel (CAPES). There are no conflicts of interest.

References

1. Seidu AA, Malau-Aduli BS, McBain-Rigg K, Malau-Aduli AE, Emeto TI. Sexual lives and reproductive health outcomes among persons with disabilities: a mixed-methods study in two districts of Ghana. Reproductive Health. 2024; 21(1):69.
2. Machado CV. Democracy, citizenship and health in Brazil: challenges to strengthening the Unified Health System (SUS). Ciência e saúde coletiva. 2024; 29(7):e02192024.
3. Qi W, Li H, Lian Q, Zuo X, Yu C, Lou C, Tu X. Knowledge level and access barriers related to sexual and reproductive health information among youth with disabilities in China: a cross-sectional study. Reproductive Health. 2023; 20(1):84.
4. Mheta D, Sibiya MN, Nkosi PB. Experiences of Women with Disabilities in Accessing Maternal Healthcare Services: A South African Case Study. International Journal of Environmental Research and Public Health. 2023; 20(21):6966.
5. Cameron V, Roth J. Disability Through a Nursing Professional Development Lens. Journal for Nurses in Professional Development. 2024; 40(3):177-9.
6. Huang A, Hong W, Zhao B, Lin J, Xi R, Wang Y. Knowledge, attitudes and practices concerning catheter-associated urinary tract infection amongst healthcare workers: a mixed methods systematic review. Nursing Open. 2022; 10(3):1281-304.
7. Rebouças CBA, Pagliuca LM, Sawada NO, Almeida PC. Validation of a non-verbal communication protocol for nursing consultations with blind people. Revista Rene. 2012; 13(1):125-39.
8. Costa KN. Modelo de comunicação verbal com o cego: desenvolvimento e validação em consulta de enfermagem [Dissertation]: Repositório Institucional da UFC; 2009. Available in: http://www.repositorio.ufc.br/handle/riufc/2099.
9. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Guia de Atenção à Saúde das Mulheres com Deficiência e Mobilidade Reduzida. Secretaria de Atenção à Saúde; 2019. Available in: https://bvsms.saude.gov.br/bvs/publicacoes/guia_atencao_mobilidade_reduzida.pdf.
10. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Atenção ao prénatal de baixo risco. Brasília: Ministério da Saúde; 2012. Available in: http://bvsms.saude.gov.br/bvs/publicacoes/cadernos_atencao_basica_32_prenatal.pdf.
11. Pasquali L. Psicometria: Teoria e aplicações. 5ª ed. Brasília, DF: Universidade de Brasília; 2013.

12. Chaves TD, Guedes TG, Perrelli JG, Albuquerque NL, Mangueira SD, Linhares FM. COVID-19 nas prisões: validação de um inquérito de conhecimento, atitude e prática. Acta Paulista de Enfermagem. 2023; 37:eAPE002811.
13. Carona C, Crespo C, Silva N, Lopes AF, Canavarro MC, Bullinger M. Examining a developmental approach to health-related quality of life assessment: Psychometric analysis of DISABKIDS generic module in a Portuguese sample. Vulnerable Children and Youth Studies. 2013; 8(3):243-57.
14. Coelho FU, Reigota SM, Cavalcanti FM, Regagnin DA, Murakami BM, Santos VB. Bladder ultrasound: evidence of content validity of a checklist for training nurses. Revista Brasileira de Enfermagem. 2024; 77(6):e20230183.
15. Wilson FR, Pan W, Schumsky DA. Recalculation of the Critical Values for Lawshe's Content Validity Ratio. Measurement and Evaluation in Counseling and Development. 2012; 45(3):197-210.
16. Scaratti M, Johann GR, Argenta C, Zanatta EA. Content and semantics validation of an application for adolescents with diabetes mellitus. Acta Paulista de Enfermagem. 2023; 36:eAPE021031.
17. Giacomini I, Martins MR, Matijasevich A, Cardoso MA. Internal consistency of the Strengths and Difficulties Questionnaire in Amazonian children. Revista de Saúde Publica. 2023; 57(Supl.2):4s.
18. Chaves TD, Guedes TG, Perrelli JG, Albuquerque NL, Mangueira SD, Linhares FM. COVID-19 in prisons: validity of a knowledge, attitude and practice survey. Acta Paulista de Enfermagem. 2024; 37:eAPE002811.
19. Melo ESJ, Silva MJN, Silva APN, Braga HFGM, Oliveira BSB, Monteiro FPM, Barbosa LP. Criteria for selecting experts in the evaluation of educational technologies in Nursing: an integrative review. Revista Rene. 2024; 25:e92942.
20. Gomes DS, Souza PA, Assis GM, Paula DG. Validation of a mobile application for adults with neurological lower urinary tract dysfunction. Revista Latino Americana de Enfermagem. 2024; 32:e4323.
21. Arroio LF, Lopes JD, Barros AL, Lima EA, Lopes CT, Santos VB. Desenvolvimento e validação de conteúdo de um website para pacientes com doença arterial coronariana. Revista Brasileira de Enfermagem. 2023; 76(1): 76(1):e20220302.
22. Mattos LM, Barlem ELD, Barlem JGT. Propriedades psicométricas da escala de fatores de evasão nos cursos de graduação em Enfermagem. Educação por escrito. 2024;15(1):e44445.
23. Alvarenga JD, Sousa MF. Processo de trabalho de enfermagem na Atenção Primária à Saúde no estado da Paraíba – Brasil: perfil profissional e práticas de cuidados na dimensão assistencial. Saúde em Debate. 2023; 46(135):1077-92.
24. Duarte BAR, Leite TCP, Felix TR, Santana MAO, Giuliani CD. Home visits in rural areas: demands in primary care. Rural Remote Health. 2023; 23:8118.
25. Girardi KH, Zanatta L, Zocche DAA, Vendruscolo C, Hirdes A. Production and validity of a podcast to promote mental health among primary care users. Revista de Enfermagem da UFSM. 2024; 14:e40.

Original Article

Effect of the fluid management nursing intervention on improving biochemical test results and dialysis therapy in chronic kidney disease patients: a randomized controlled trial

José Erivelton de Souza Maciel Ferreira[1,7]
https://orcid.org/0000-0003-2668-7587
Daniel Freire de Sousa[2,7]
https://orcid.org/0000-0002-2333-5343
Rafaella Pessoa Moreira[3,7]
https://orcid.org/0000-0003-2341-7936
Huana Carolina Cândido Morais[4,7]
https://orcid.org/0000-0001-6435-1457
Lívia Moreira Barros[5,7]
https://orcid.org/0000-0002-9763-280X
Tahissa Frota Cavalcante[6,7]
https://orcid.org/0000-0002-7758-4273

How to cite this article: Ferreira JESM, Sousa DF, Moreira RP, Morais HCC, Barros LM, Cavalcante TF. Effect of the fluid management nursing intervention on improving biochemical test results and dialysis therapy in chronic kidney disease patients: a randomized controlled trial. Investigación y Educación en Enfermería. 2025; 43(3):e12.

DOI: https://doi.org/10.17533/udea.iee.v43n3e12

1 Research Nurse, Ph.D. student. Email: eriveltonsmf@gmail.com. Corresponding author.
2 Research Pharmacist, Ph.D. Professor. Email: daniel@unilab.edu.br
3 Research Nurse, Ph.D. Professor. Email: rafaellapessoa@unilab.edu.br
4 Research Nurse, Ph.D. Professor. Email: huanacarolina@unilab.edu.br
5 Research Nurse, Ph.D. Professor. Email: livia@unilab.edu.br
6 Research Nurse, Ph.D. Professor. Email: tahissa@unilab.edu.br
7 University of International Integration of Afro-Brazilian Lusofonia, Redenção (Ceará), Brazil.

Conflicts of interest: None
Received: March 27, 2025.
Approved: September 10, 2025.

Effect of the fluid management nursing intervention on improving biochemical test results and dialysis therapy in chronic kidney disease patients: a randomized controlled trial

Abstract

Objetive. To test the effectiveness of nursing intervention to control fluid volume on improving laboratory test results and dialysis adequacy in patients with Excess fluid volume. **Methods.** This is a randomized, double-blind, parallel-group controlled trial involving 34 patients with chronic kidney disease and a nursing diagnosis of Excess Fluid Volume undergoing chronic hemodialysis equally randomized into two groups (control $n=17$ and intervention $n=17$). Data were collected on sociodemographic and clinical factors, the presence of Excess Fluid Volume, and water balance. Laboratory parameters, including serum electrolytes, urea, creatinine, and dialysis adequacy markers, were assessed before and after the intervention. The intervention consisted of 13 nursing activities, including educational, follow-up, and reminder components, such as fluid balance monitoring, daily weight control, edema assessment, laboratory follow-up, and health education on diet and self-care. The control group received only the usual care provided at the dialysis clinic. **Results.** There were significant improvements in laboratory test results and dialysis adequacy. The statistical difference between the groups was significant in the mean values of calcium ($p<0.001$), post-hemodialysis urea ($p=0.002$), and creatinine ($p=0.006$), demonstrating the direct effect of the intervention. In addition, there were improvements in overall dialysis quality and adequacy measures. **Conclusion.** The nursing intervention significantly improved laboratory test results and dialysis adequacy in patients with chronic renal failure and Excess Fluid Volume, highlighting its potential for enhancing patient management and nursing care.

Descriptors: renal insufficiency chronic; renal dialysis; water-electrolyte balance; nursing care.

Efecto de la intervención de enfermería en el manejo de fluidos para mejorar los resultados de las pruebas bioquímicas y el tratamiento de diálisis en pacientes con enfermedad renal crónica: un ensayo controlado aleatorizado

Resumen

Objetivo. Evaluar la eficacia de la intervención de enfermería para controlar el volumen de líquidos en la mejoría de los resultados de las pruebas de laboratorio y en la adecuación de la diálisis en pacientes con exceso de volumen de líquidos**.** **Métodos.** Se trata de un ensayo aleatorio, doble ciego, controlado, de grupos paralelos, en el que participaron 34 pacientes con enfermedad renal crónica y un diagnóstico de enfermería de exceso de volumen de líquidos sometidos a hemodiálisis crónica, aleatorizados por igual en dos grupos (control $n=17$ e intervención $n=17$). Se recopilaron datos sobre factores sociodemográficos y clínicos, la presencia de exceso de volumen de líquidos y del equilibrio hídrico. Se evaluaron los parámetros de laboratorio, incluidos los electrolitos séricos, la urea, la creatinina y los marcadores de adecuación de la diálisis, antes y después de la intervención. La intervención

consistió en 13 actividades de enfermería, que incluían componentes educativos, de seguimiento y de recordatorio, como la monitorización del equilibrio hídrico, el control diario del peso, la evaluación del edema, el seguimiento de laboratorio y la educación sanitaria sobre la dieta y el autocuidado. El grupo control solo recibió la atención habitual que se proporciona en la clínica de diálisis. **Resultados.** Se observaron mejorías significativas en los resultados de las pruebas de laboratorio y en la adecuación de la diálisis. La diferencia estadística entre los grupos fue significativa en los valores medios de calcio ($p<0.001$), urea post-hemodiálisis ($p=0.002$) y creatinina ($p=0.006$), lo que demuestra el efecto directo de la intervención. Además, se observaron mejorías en la calidad general de la diálisis y en las medidas de adecuación. **Conclusión.** La intervención de enfermería mejoró significativamente los resultados de las pruebas de laboratorio y la adecuación de la diálisis en pacientes con insuficiencia renal crónica y exceso de volumen de líquido, lo que pone de relieve su potencial para mejorar el manejo de los pacientes y la atención de enfermería.

Descriptores: insuficiencia renal crónica; diálisis renal; equilibrio hidroelectrolítico; atención de enfermería.

Efeito da intervenção de enfermagem na gestão de fluidos na melhoria dos resultados dos exames bioquímicos e da terapia de diálise em pacientes com doença renal crónica: um ensaio clínico randomizado controlado

Resumo

Objetivo. Testar a eficácia de uma intervenção de enfermagem para o controle do volume de líquidos na melhora dos exames laboratoriais e da adequação da diálise em pacientes com diagnóstico de Enfermagem de Excesso de volume de líquidos. **Métodos.** Trata-se de um ensaio clínico randomizado, duplo-cego, controlado, em grupos paralelos, envolvendo 34 pacientes com doença renal crônica e com a presença do diagnóstico de Enfermagem Excesso de volume de líquidos, em hemodiálise crônica, igualmente randomizados em dois grupos (controle $n=17$ e intervenção $n=17$). Foram coletados dados sociodemográficos e clínicos, a presença de Excesso de volume de líquidos e equilíbrio hídrico. Os parâmetros laboratoriais avaliados antes e após a intervenção incluíram eletrólitos séricos, ureia, creatinina e marcadores de adequação da diálise. A intervenção consistiu em 13 atividades de enfermagem, incluindo componentes educativos, de acompanhamento e de lembrete, tais como monitoramento do balanço hídrico, controle diário de peso, avaliação de edema, acompanhamento laboratorial e educação em saúde sobre dieta e autocuidado. O grupo controle recebeu apenas o cuidado usual prestado na clínica de diálise. **Resultados.** Houve melhora significativa nos exames laboratoriais e na adequação da diálise. A diferença estatística entre os grupos foi significativa nos valores médios de cálcio ($p<0.001$), ureia pós-hemodiálise ($p=0.002$) e creatinina ($p=0.006$), demonstrando o efeito direto da intervenção. Além disso, observaram-se melhorias na qualidade global e nas medidas de adequação da diálise. **Conclusão.** A intervenção de enfermagem melhorou significativamente os exames laboratoriais e a adequação da diálise em pacientes com insuficiência renal crônica e Excesso de volume de líquidos, destacando seu potencial para aprimorar o manejo clínico e o cuidado de enfermagem.

Descritores: insuficiência renal crônica; diálise renal; equilíbrio hidroeletrolítico; cuidados de enfermagem.

Introduction

The progressive decline in glomerular filtration rate (GFR) is a hallmark of chronic kidney disease (CKD), initially evidenced by the persistent rise in plasma levels of substances normally excreted by the kidneys, such as urea and creatinine.[1] This progressive decline compromises the body's ability to eliminate toxic substances, resulting in a variety of biochemical disorders and potential complications arising from their accumulation in the body, such as imbalances in calcium, phosphorus, potassium, sodium, and magnesium, among others.[2] Electrolyte imbalance in this population can lead to water overload, serious cardiac complications, muscle weakness, neurological and renal problems, worsening their prognosis.[3] The risk factors for mortality in chronic hemodialysis patients are not well understood, but there is a positive association between hypokalemia, hyponatremia, and hyperphosphatemia and a significant risk of mortality.[4] Therefore, electrolyte shifts are among the most important factors in hemodialysis patients.[5]

Hemodialysis therapy plays a critical role in the regulation of these electrolytes but is directly related to the challenge of controlling Excess fluid volume (EFV) in these patients, which can lead to greater hemodynamic instability.[6] In this context, nurses play an essential role in maintaining adequate electrolyte and laboratory balance, assuming responsibilities that range from direct assistance during hemodialysis therapy to educating and guiding patients on various aspects of self-care and management of the individual's renal and general condition.[7] The interventions envisaged by nurses in this context, especially those supported by the Nursing Interventions Classification (NIC), not only have the potential to improve the results of biochemical and laboratory tests in patients with end-stage CKD, but also aim to significantly improve the patient's quality of life and safety.[8] This goal will be achieved through precise control of fluid and electrolyte balance, careful evaluation of clinical observation and analysis of laboratory and biochemical test results, and measurement of dialysis adequacy for these patients.[9]

There is a clear and urgent need for effective management of laboratory abnormalities in patients with CKD and EFV because of their significant impact on the quality of life and prognosis of these patients. The current literature presents research on the importance of volume control and dialysis adequacy, as well as studies demonstrating the relationship between electrolyte imbalances and complications in patients with CKD.[3,8,9] However, there is a gap in specific nursing interventions focused on optimizing care and reducing the risk of complications associated with biochemical changes and inadequate dialysis. Most research focuses on medical or technological interventions, leaving the critical role of nursing in the management of these patients in the background.

Although fluid intake is not a primary factor in altering laboratory values, its analysis remains relevant for monitoring physiological status, identifying potential variations in plasma osmolality, electrolytes, and renal function. Additionally, it helps detect unexpected side effects, such as fluid overload or dehydration, and allows for correlations with other clinical indicators that may influence the body's response. Furthermore, it ensures the safety of the intervention by preventing physiological imbalances and providing complementary data for a comprehensive understanding of its effects. Therefore, the aim of this study was to test the effect of the nursing intervention Fluid Volume Control on the improvement of laboratory tests and dialysis adequacy in patients with excess fluid volume. This research fills the identified gap and contributes to the literature with evidence on the effectiveness of nursing interventions in this context.

Methods

Design. This is a randomized controlled trial (RCT), with two parallel groups, conducted in a dialysis center in Brazil from August 2022 to May 2023. The study followed the Consolidated Standards of Reporting Trials (CONSORT) guidelines. The study was also registered in the Brazilian Clinical Trials Registry (REBEC) - RBR-2DD6X6R.

Sample and recruitment. The population of this study was made up of patients with chronic renal failure undergoing hemodialysis in a dialysis center that serves approximately 140 patients from 13 cities, with 3 shifts, every day of the week. The population was defined as finite and relatively small. All patients were screened, and those meeting the inclusion criteria were invited to participate. No formal sample size calculation was conducted; instead, a convenience sample comprising all eligible patients from this finite population was adopted. A total of 34 patients were included in the final sample and randomized into two groups: Intervention Group (IG, $n = 17$) and Control Group (CG, $n = 17$). The inclusion criteria for the study were: a medical diagnosis of chronic kidney disease, undergoing hemodialysis treatment for a minimum of 8 months, enrollment and follow-up at the designated dialysis clinic, and being of legal age (>18 years). For participants in the RCT, the inclusion criteria were further specified as follows: a medical diagnosis of chronic kidney disease, undergoing hemodialysis for at least 8 months, age >18 years, a nursing diagnosis of excess fluid volume[10] at baseline, and scoring less than 4 points on the average indicators of the Nursing Outcomes Classification (NOC) scale for water balance[11] at baseline. Exclusion criteria included any condition impairing mental capacity to understand and cooperate with the study, assessed using the Mini-Mental State Examination.[12] Withdrawal criteria encompassed patient death, transfer to another dialysis clinic, hospitalization during the study period, missing a hemodialysis session on the day of intervention or outcome assessment, kidney transplantation, discharge due to improved renal function, or voluntary withdrawal at any point during the study.

Randomization. Randomization was conducted by an independent staff member, not otherwise involved in the study, using the Research Randomizer application. The allocation sequence was generated with simple 1:1 randomization, without blocks or restrictions. Although participants were aware of their group allocation due to the nature of the intervention, the trial adopted a double-blind design since both outcome assessors (laboratory staff) and the statistician were blinded to group assignment. Clinical staff at the dialysis center were also not informed of which patients belonged to each group. Both groups received the same routine dialysis care, with the structured nursing protocol being the only additional component for the intervention group.

Variables. The main explanatory variables assessed in the study included the sociodemographic and clinical characteristics of the participants, serving as both predictors and prognostic variables. It is important to emphasize that in RCTs, the

intervention under investigation should be the sole variable differing between groups. Biochemical test values for each participant were obtained directly from the dialysis center's laboratory and biochemical test software. These values were collected both before and after the intervention in both groups to ensure accurate and consistent measurement of biochemical outcomes. The outcome variables were: 1) the change in results of biochemical tests related to fluid volume and hemodialysis (pre-hemodialysis urea, post-hemodialysis urea, creatinine, potassium, phosphorus, calcium, hemoglobin and hematocrit) between patients in the intervention group and those in the control group; 2) the change in dialysis adequacy measures (URR - Urea Reduction Rate; and Kt/V - used to assess the adequacy of hemodialysis treatment, where it reads: Dialyzer urea clearance multiplied by dialysis time divided by the volume of urea distribution, which is approximately equal to the patient's total body water). Both results were observed in both groups. These biochemical tests were selected because they have been reported to be relevant for analyzing the quality of hemodialysis in patients with CKD and because they are widely prescribed for analysis in this population.[13] Therefore, these electrolytes were used to evaluate the effect of the proposed intervention on improving their results and dialysis adequacy. The use of furosemide was considered as a possible confounding variable. The data analyzed showed that this medication was present in 23.5% of the control group and 35.3% of the intervention group, but this difference was not statistically significant (p=0.708). Nevertheless, we decided to use linear regression to adjust the risk estimates to account for this confounding variable and its possible relationship with the outcome variables.

Instrument and outcome measures. Four instruments were used to collect data. The first allowed the researcher to monitor and control the process of selecting participants, as well as obtaining their sociodemographic and clinical data. The second aimed to identify the presence of excess fluid volume. The third allowed the measurement of water balance. Finally, the fourth instrument refers to the 13 groups of activities that make up the intervention carried out for the intervention group. The full version of the instrument can be found in the study by Azevedo *et al.*[6]

Data collection and research protocol. The research team consisted of members of a research group on chronic non-communicable diseases, including senior nursing students, clinical nurses, and nursing researchers with master's and doctoral degrees. The lead researcher coordinated the process and developed the clinical cases used in the simulations. The intervention group received the structured nursing protocol in addition to routine dialysis care, whereas the control group received only the routine care usually provided at the clinic. This was a IV phases study:

Phase I - Baseline, the research was presented, and participants were recruited. The 139 patients (total population) were screened to select a significant target population that met the defined inclusion criteria. Three months were dedicated to this phase, with recruitment taking place in the clinic itself. Patients who agreed to participate were taken individually to a private room where they underwent a nursing consultation to verify the inclusion and exclusion criteria.

Phase II - Reassessment, there was a one-month reassessment of the subjects potentially selected to make up the research sample. This phase was considered necessary because of the mutability of human responses, which can worsen, become chronic, or even disappear. After the reassessment of the patients, the clinical indicators to be compared with the outcome were evaluated.

Phase III - the intervention is applied to the IG. This phase lasted one month and took place in the health center itself, before the hemodialysis session. The intervention was carried out through a nursing consultation, following the protocol of Azevedo *et al.*[6] with the aim of achieving and

maintaining good biochemical results, as well as an excellent measure of dialysis adequacy, through an adequate water balance in people undergoing hemodialysis. The intervention comprised 13 distinct activities aimed at managing fluid volume: (1) Daily weighing and trend monitoring, (2) Keeping accurate records of intake and output, (3) Monitoring laboratory results for fluid retention, (4) Monitoring hemodynamic status, including mean arterial pressure, (5) Monitoring vital signs, as appropriate, (6) Monitoring indicators of fluid excess/retention, as appropriate, (7) Monitoring the patient's weight change before and after dialysis, as appropriate, (8) Assessing the location and extent of edema, if present, (9) Monitoring food/fluid intake and calculating daily caloric intake, if appropriate, (10) Advising the patient on fasting for laboratory and biochemical tests, if appropriate, (11) Distributing fluid intake over 24 hours, if appropriate, (12) Advising family members and/or caregivers on assisting the patient with eating, if appropriate, and (13) Alerting the medical team to cases of worsening signs and symptoms of fluid overload. The implementation of the different groups of activities in the intervention required the adoption or development of different tools. For the activities in groups 1 and 7, a diary was developed to allow participants to record their daily weigh-ins. For groups 2, 6 and 11, a diary was developed to record daily intake and excretion. In addition, an illustrated e-book developed by a team of nephrologist nutritionists was used to provide nutritional guidance.[14] For the activities in groups 3, 10 and 13, the monthly laboratory tests collected and provided by the dialysis clinic were used. For the activity "Conduct health education activities on nutrition during the hemodialysis session", an educational intervention was conducted using a quiz format. This interactive educational action took place during the hemodialysis sessions with participants in the intervention group. The quiz questions and the topics discussed were based on the literature consulted in narrative form.[14,15] All the activities described in this intervention, both those that contribute directly and those that contribute indirectly to the achievement of the proposed objective, were fully implemented. The last-mentioned tools did not require validation or analysis, as they were simple daily records of weight and intake/excretion. However, all supplementary materials were discussed by members of a research group specializing in chronic non-communicable diseases, composed of postdoctoral fellows, physicians, masters, master's students, and undergraduate nursing students. Routine interventions in the dialysis clinic included various activities, such as daily bedside visits by the physician and nurse, weekly multidisciplinary visits involving the physician, nurse, dietician, psychologist, and social worker, and office consultations in case of significant changes in laboratory and/or imaging tests. All professionals on the unit provided regular instruction on fluid and electrolyte control, arteriovenous fistula maintenance, and general catheter care as part of their work routines.

Phase IV - outcomes evaluation: semiological evaluation was conducted at the health facility prior to the hemodialysis session, and laboratory tests were performed both before and after the session. Participants in the intervention group were informed that their involvement in the research would occur at two additional points after the baseline and reassessment: the first point focused on the application of the proposed intervention, and the second point involved verifying the study's outcomes. Participants in the control group were informed that their contribution to the study would only occur at two points: at the baseline and at the final review of the study outcomes.

Data analysis. The analyses encompassed comparisons both within each group (intra-group) and between groups (inter-group). Between-group comparisons utilized Fisher's exact test for qualitative variables and the Mann-Whitney test for quantitative variables due to the nonparametric nature of the data and the small sample size. Within-group comparisons employed McNemar's test for qualitative variables

and Wilcoxon's test for quantitative variables. Furthermore, linear regression was employed to assess group effects on numerical variables, with consideration given to furosemide usage as a potential confounder. All statistical analyses were conducted at a significance level of $\alpha=5\%$, with associations deemed significant at $p<0.05$. Stata software version 13 facilitated these analytical procedures, enabling a thorough evaluation of the intervention's impact on study outcomes.

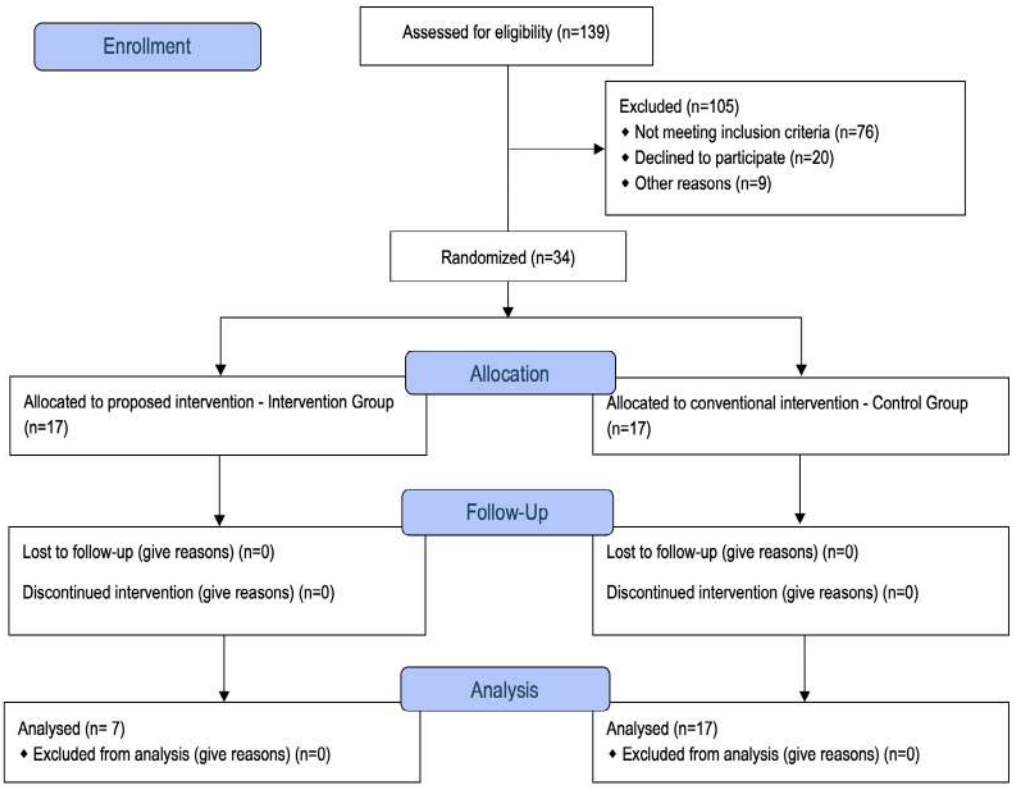
Ethical considerations. The research strictly complied with ethical and legal principles, was approved by the Institutional Research Ethics Committee for studies involving human subjects under registration number CAAE 56761422.6.0000.5576, and all participants signed a written informed consent form.

Results

Recruitment and retention

All subjects in the study population (n=139) were examined as shown in Figure 1. From the initial baseline of 92 subjects, 22 were excluded for lack of EFV[10], 20 for water balance >4 points on the NOC scale[11], 9 for both lack of EFV and water balance >4 points on the NOC scale, 2 died before the intervention, and 2 were discharged due to successful transplantation and improved renal function, leaving 37 subjects. After reassessment, 1 was transferred and 2 withdrew, resulting in their exclusion from the study. After applying the inclusion, exclusion, discontinuation, and dropout criteria, 34 individuals were included in the study.

Figure 1. Flowchart for a detailed understanding of the procedures adopted for the execution of the randomized clinical trial.



Sociodemographic and clinical characterization of the sample

The sociodemographic and clinical characteristics of the study population are summarized in Table 1. In this study, women predominated (61.8%), and the mean age of participants was 61.7 years. Most were married (55.9%; n = 19), and 97.1% (n = 33) underwent three hemodialysis sessions per week, with 52.9% (n = 18) having sessions of four hours or more. Control of underlying medical conditions was considered adequate in 61.8% (n = 21), and adherence to treatment was reported by 82.4% (n = 28). In all cases, there was similarity between the control and intervention groups, as $p>0.05$.

Regarding comorbidities, 41.2% (n = 14) had diabetes mellitus, 76.5% (n = 26) had systemic arterial hypertension, and 58.8% (n = 20) had heart failure. In terms of pharmacological treatment, 85.3% (n = 29) used erythropoietin, 73.5% (n = 25) received intravenous iron, 67.6% (n = 23) used folic acid, 64.7% (n = 22) used vitamin B-complex, and 50% (n = 17) used sevelamer hydrochloride. Furosemide was used by 29.4% (n = 10) of participants, with no significant difference between groups (p = 0.708). In general, there was no significant difference in the distribution of medications (p > 0.05), except for carvedilol 25 mg: 26.5% (n = 9) of participants used this drug, with one in the control group and eight in the intervention group, showing a statistically significant difference (p = 0.017). Despite this, carvedilol use did not influence the outcomes of this study.

Table 1. Distribution of participants in the intervention group and control group by sociodemographic and clinical variables.

Variables	Total (*n*=34)	CG (*n*=17)	IG (*n*=17)	*p*-value
Sex; n (%)				0.500[a]
Male	21 (61.8)	11 (64.7)	10 (58.8)	
Female	13 (38.2)	6 (35.3)	7 (41.2)	
Age; Mean ± SD	61.7±12.2	64.4±9.8	59.1±14.0	0.228[b]
Marital status; n (%)				0.657[a]
Single	9 (26.5)	3 (17.6)	6 (35.3)	
Married	19 (55.9)	10 (58.8)	9 (52.9)	
Widower	3 (8.8)	2 (11.8)	1 (5.9)	
Divorced	3 (8.8)	2 (11.8)	1 (5.9)	
Ethnicity; n (%)				0.349[a]
White	6 (17.6)	2 (11.8)	4 (23.5)	
Black	5 (14.7)	4 (23.5)	1 (5.9)	
Mixed	23 (67.7)	11 (64.7)	12 (70.1)	
Education; n (%)				0.135[a]
No formal education	9 (26.5)	7 (41.2)	2 (11.8)	
Incomplete primary school	16 (47.1)	8 (47.0)	8 (47.0)	
Complete primary school	4 (11.8)	1 (5.9)	3 (17.7)	
Complete high school	5 (14.7)	1 (5.9)	4 (23.5)	
Religion; n (%)				1.000[a]
Affiliated	32 (94.1)	16 (94.1)	16 (94.1)	
Unaffiliated	2 (5.9)	1 (5.9)	1 (5.9)	

Table 1. Distribution of participants in the intervention group and control group by sociodemographic and clinical variables. (Cont.)

Variables	Total (*n*=34)	CG (*n*=17)	IG (*n*=17)	*p*-value
Living arrangement; n (%)				0.539[a]
Alone	2 (5.9)	1 (5.9)	1 (5.9)	
With a partner	9 (26.5)	3 (17.7)	6 (35.9)	
With family	22 (64.7)	13 (76.5)	9 (52.9)	
Friends and/or acquaintances	1 (2.9)	0 (0.0)	1 (5.9)	
Employment status; n (%)				0.227
Employed	2 (5.9)	1 (5.9)	1 (5.9)	
Unemployed	3 (8.8)	0 (0.0)	3 (17.6)	
Retired	29 (85.3)	16 (94.1)	13 (76.5)	
Monthly income				0.773[b]
Mean	1513.9±773	1464.9±533.4	1562.8±972.2	
Number of hemodialysis sessions; n (%)				1.000[a]
Three	33 (97.1)	17 (100.0)	16 (94.1)	
Four	1 (2.9)	0 (0.0)	1 (5.9)	
Duration of sessions; n (%)				0.732[a]
2 to 4 hours	16 (47.1)	7 (41.2)	9 (52.9)	
>4 hours	18 (52.9)	10 (58.8)	8 (47.1)	
Control of underlying diseases; n (%)				0.481[a]
Adequate	21 (61.8)	12 (70.6)	9 (52.9)	
Slightly adequate	12 (35.3)	5 (29.4)	7 (41.2)	
Not adequate	1 (2.9)	0 (0.0)	1 (5.9)	
Knowledge about chronic kidney disease (CKD); n (%)				0.169[a]
Adequate	16 (47.1)	7 (41.2)	9 (52.9)	
Slightly adequate	14 (41.2)	6 (35.3)	8 (47.1)	
Not adequate	4 (11.8)	4 (23.5)	0 (0.0)	
Treatment adherence; n (%)				0.794[a]
Adequate	28 (82.4)	15 (88.2)	13 (76.5)	
Slightly adequate	4 (11.8)	1 (5.9)	3 (17.7)	
Not adequate	2 (5.9)	1 (5.9)	1 (5.9)	
Percentage of post-hemodialysis weight loss; n (%)				0.141[a]
8–14% loss	1 (2.9)	1 (5.9)	0 (0.0)	
5–8% loss	11 (32.4)	3 (17.7)	8 (47.1)	
1–4% loss	21 (61.8)	12 (70.6)	9 (52.9)	
No change	1 (2.9)	1 (5.9)	0 (0.0)	
Depression; n (%)				0.656[a]
Present	6 (17.7)	4 (23.5)	2 (11.8)	
Absent	28 (82.3)	13 (76.5)	15 (88.2)	
Transplanted; n (%)				0.259[a]
Yes	1 (2.9)	1 (5.9)	0 (0.0)	
No	33 (97.1)	16 (94.1)	17 (100.0)	

Table 1. Distribution of participants in the intervention group and control group by sociodemographic and clinical variables. (Cont.)

Variables	Total (n=34)	CG (n=17)	IG (n=17)	p-value
Hemodialysis time (months); Mean ± SD	56.6±29.7	54.6±28.5	58.5±31.4	
Patient's initial weight; Mean ± SD	66.2±16.1	68.4±14.8	64.1±17.5	0.352[b]
Height; Mean ± SD	1.59±0.1	1.57±0.1	1.60±0.1	0.730[b]
BMI; Mean ± SD	26.3±6.4	27.6±6.2	25.0±6.5	0.101[b]
Blood type and Rh factor; n (%)				0.653[a]
A+	9 (26.5)	3 (17.6)	6 (35.3)	
B+	5 (14.2)	3 (17.6)	2 (11.8)	
AB+	1 (2.9)	1 (5.9)	0 (0.0)	
O+	18 (52.9)	9 (53.0)	9 (52.9)	
O-	1 (2.9)	1 (5.9)	0 (0.0)	

a: Fisher's exact test; b: Mann-Whitney test; Minimum Wage: approximately 250 US dollars (August 2022 – May 2023).

Effect of the Intervention

The distribution of subjects in terms of laboratory and biochemical tests at baseline was comparable between CG and IG. Among the ten parameters evaluated, there were no statistically significant differences (p>0.005) in eight of them (Phosphorus, Potassium, Calcium, Pre-Hemodialysis Urea, Post-Hemodialysis Urea, URR, Creatinine, Kt/V) (Table 2). However, baseline comparison between CG and IG revealed significant differences in hematocrit (p<0.001) and hemoglobin (p=0.002).

At baseline, the mean hematocrit was 43.3±4.1 in CG and 37.1±5.0 in IG, indicating a significant group difference (p<0.001). Post-intervention, these values were 40.1±4.3 in CG and 37.6±4.4 in IG, with no significant difference observed (p=0.104). The prevalence of individuals developing anemia increased more in CG (from 17.6% to 29.4%) compared to IG (from 47% to 52.9%), a statistically significant difference (p=0.006). Similarly, baseline mean hemoglobin differed significantly between CG (13.2±1.3) and IG (11.6±1.6) (p=0.002).

Post-intervention, values were comparable: CG (12.4±1.4) and IG (12.0±1.6), with no significant difference detected (p=0.373). However, there was a notable increase in the prevalence of altered hemoglobin in CG (23%) compared to a decrease in IG (11.8%), a statistically significant finding (p=0.017). Regarding calcium, 11.8% (n=4) of participants showed negative changes at baseline, while 100% (n=34) had no change post-intervention, indicating a significant difference (p=0.031). Mean calcium levels increased from 9.1±0.5 to 9.4±0.2 (p<0.001), remaining within the normal range. The post-intervention increase was statistically significant in both CG (p=0.015) and IG (p=0.013). Mean post-hemodialysis urea increased significantly from 32.4±14.1 to 39.0±19.9 (p<0.001), with 100% (n=34) of the sample experiencing a change. Between-group differences were significant for CG (p=0.002) and marginally non-significant for IG (p=0.057). Regarding URR, 29.4% (n=5) of CG participants showed a decrease, contrasting with 100% (n=17) of IG participants showing no change (p=0.04). URR decreased significantly from 73.3±7.4 to 69.7±12.9 (p=0.001), with the most pronounced reduction observed in CG compared to IG (p=0.003). Mean creatinine increased from 8.9±3.1 to 9.7±3.0 (p=0.002), with no significant between-group differences observed (p=0.006 for CG and p=0.09 for

IG). Finally, there was a statistically significant decrease in mean Kt/V from 1.6±0.3 to 1.5±0.4 (p=0.001). This decline was driven by CG (from 1.6±0.4 to 1.4±0.5), while IG maintained Kt/V (1.6±0.3). The difference between CG and IG Kt/V post-intervention approached significance (p=0.056). The deterioration in dialysis quality in CG was significant (p<0.001), while the intervention effectively maintained dialysis quality without significantly altering this measure (p=0.521).

Table 2. Intergroup and intragroup comparison of laboratory and biochemical test results related to fluid volume and hemodialysis, before and after the intervention

Variables	Baseline			Outcome			Intragroup comparison		
	CG (n=17)	IG (n=17)	Intergroup *p*-value	CG (n=17)	IG (n=17)	Intergroup *p*-value	*p*-value	*p*-value	*p*-value
Hematocrit			0.141[a]			0.296[a]	0.687[b]	1.000[e]	1.000[f]
Decreased	3 (17.6)	8 (47.1)		5 (29.4)	9 (52.9)				
Increased	1 (5.9)	0 (0.0)		0 (0.0)	0 (0.0)				
No change	13 (76.5)	9 (52.9)		12 (70.6)	8 (47.1)				
Mean	43.3±4.1	37.1±5.0	**<0.001[c]**	40.1±4.3	37.6±4.4	0.104[c]	0.106[d]	**0.006[g]**	0.523[h]
Hemoglobin			0.166[a]				0.508[b]	**0.063[e]**	0.625[f]
Decreased	7 (41.2)	12 (70.6)		12 (70.6)	10 (58.8)				
Increased	1 (55.9)	0 (0.0)		0 (0.0)	0 (0.0)				
No change	9 (52.9)	5 (29.4)		5 (29.4)	7 (41.2)				
Mean	13.2±1.3	11.6±1.6	**0.002[c]**	12.4±1.4	12.0±1.6	0.373[c]	0.338[d]	**0.017[g]**	0.320[h]
Phosphorus			1.000[a]			0.634[a]	1.000[b]	0.688[e]	1.000[f]
Decreased	1 (5.9)	1 (5.9)		0 (0.0)	2 (11.7)				
Increased	9 (52.9)	8 (47.1)		8 (47.1)	8 (47.1)				
No change	7 (41.2)	8 (47.0)		9 (52.9)	7 (41.2)				
Mean	4.8±1.2	4.4±1.4	0.409[c]	4.5±1.2	4.5±1.8	0.915[c]	0.918[d]	0.492[g]	0.619[h]
Potassium			1.000[a]			0.169[a]	0.774[b]	0.453[e]	1.000[f]
Decreased	1 (5.9)	1 (5.9)		1 (5.9)	0 (0.0)				
Increased	6 (35.3)	5 (29.4)		10 (58.8)	6 (35.3)				
No change	10 (58.8)	11 (64.7)		6 (35.3)	11 (64.7)				
Mean	5.0±0.4	4.9±0.8	0.500[c]	5.3±0.9	4.9±0.8	0.303[c]	0.113[d]	0.128[g]	0.380[h]
Calcium			0.537[a]			*	**0.031**	0.500[e]	0.125[f]
Decreased	2 (11.8)	2 (11.8)		0 (0.0)	0 (0.0)				
Increased	0 (0.0)	2 (11.8)		0 (0.0)	0 (0.0)				
No change	15 (88.2)	13 (76.4)		17 (100.0)	17 (100.0)				
Mean	9.0±0.4	9.1±0.6	0.352[c]	9.3±0.2	9.4±0.3	0.693[c]	**<0.001[d]**	**0.015[g]**	**0.013[h]**
Pre-HD Urea			1.000[a]			*	1.000[b]	1.000[e]	1.000[f]
Decreased	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)				
Increased	17 (100.0)	16 (94.1)		17 (100.0)	17 (100.0)				
No change	0 (0.0)	1 (5.9)		0 (0.0)	0 (0.0)				
Mean	121.5±35.7	118.8±23.0	0.828[c]	128.9±33.5	128.4±28.5	0.923[c]	0.102[d]	0.344[g]	0.185[h]

Table 2. Intergroup and intragroup comparison of laboratory and biochemical test results related to fluid volume and hemodialysis, before and after the intervention (Cont.)

Variables	Baseline			Outcome			Intragroup comparison		
	CG (n=17)	IG (n=17)	Intergroup *p*-value	CG (n=17)	IG (n=17)	Intergroup *p*-value	*p*-value	*p*-value	*p*-value
Post-HD Urea			1.000[a]			0.398[a]	0.753[b]	0.375[e]	1.000[f]
Decreased	1 (2.9)	2 (11.8)		0 (0.0)	0 (0.0)				
Increased	1 (2.9)	1 (2.9)		5 (29.4)	2 (11.8)				
No change	15 (88.2)	14 (82.3)		12 (70.6)	15 (88.2)				
Mean	34.1±17.8	30.6±9.3	0.374[c]	43.1±26.1	34.8±10.1	0.191[c]	**<0.001[d]**	**0.002[g]**	0.057[h]
URR*			0.601[a]			**0.044[a]**	1.000[b]	0.500[e]	1.000[f]
Decreased	3 (17.7)	1 (5.9)		5 (29.4)	0 (0.0)				
Increased	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)				
No change	14 (82.3)	16 (94.1)		12 (70.6)	17 (100.0)				
Mean	72.2±8.7	74.4±5.9	0.272[c]	66.6±16.9	72.8±5.8	0.102[c]	**0.001[d]**	**0.003[g]**	0.130[h]
Creatinine			*			*	1.000[b]	1.000[e]	1.000[f]
Decreased	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)				
Increased	17 (100.0)	17 (100.0)		17 (100.0)	17 (100.0)				
No change	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)				
Mean	9.5±3.1	8.3±3.0	0.324[c]	10.4±3.3	9.1±2.6	0.340[c]	**0.002[d]**	**0.006[g]**	0.093[h]
Kt/V***			0.227[a]			0.085[a]	0.125[b]	0.250[e]	1.000[f]
Unbalanced	2 (12.5)	0 (0.0)		5 (29.4)	1 (5.9)				
Balanced	14 (87.5)	17 (100.0)		11 (68.7)	16 (94.1)				
Mean	1.6±0.4	1.6±0.3	0.565[c]	1.4±0.5	1.6±0.3	**0.056[c]**	**0.001[d]**	**<0.001[g]**	0.521[h]

(a) Fisher's exact test for intergroup comparison; (b) McNemar's test for intragroup comparison; (c) Linear regression models were performed to adjust for group and furosemide use, given its potential role as a confounding variable; (d) Wilcoxon test for intragroup comparison; (e) McNemar's test for intragroup comparison in CG; (f) McNemar's test for intragroup comparison in the IG; (g) Wilcoxon test for intragroup comparison in the CG; (h) Wilcoxon test for intragroup comparison in the IG; *Calculation not possible; **URR: Urea Reduction Ratio; ***Dialysis adequacy measure.

Discussion

Several blood components and clinical/laboratory markers are altered in CKD patients on hemodialysis.[16] The major components that were altered in our study included the electrolytes calcium, phosphorus, potassium, creatinine, urea, and sodium, as well as red blood cells. Proper hemodialysis management and implementation of the intervention corrected or helped maintain these components within recommended serum concentrations, preventing hemodynamic instability and adverse human reactions. Regarding hematocrit and hemoglobin tests, both are interrelated and potentially impaired in the patients studied due to the organ's inability to produce erythropoietin.[17] EFV in these patients decreases the concentration of these blood components, just as the loss of iron during dialysis impairs the synthesis of new red blood cells, leading to a decrease in these components.[18]

The intervention helped maintain hematocrit and hemoglobin levels in the IG, while there

was a significant deterioration in the CG. This maintenance can be attributed to: 1) the nurse's signal to review the prescription of medications that stimulate the direct production of these blood components, which were prescribed for 85.3% of the sample; 2) the nutritional counseling; and 3) the understanding of the importance of maintaining self-care. This highlights the importance of the nurse's role in the management of these conditions. Implementation of the activities in this intervention also enabled early identification and targeted appropriate care in cases of anemia. By controlling intravascular fluid, the intervention helped prevent changes in hematocrit and serum hemoglobin parameters and associated complications, thereby improving patients' quality of life. Significant changes in electrolytes in general, and those altered by EFV in particular, can lead to adverse reactions in humans, depending on the ion. Regarding calcium, the intervention was effective in improving calcium levels in chronic kidney disease patients on hemodialysis in the IG tract. However, it should be considered that the routine intervention may have contributed to the serum improvement of this element in both groups, given the improvement in CG.

A correlation study found that the longer the time on hemodialysis, the lower the calcium concentration and the higher the final creatinine and potassium levels.[19] Only 11.8% had lower calcium levels before the procedure, and none of the patients had hypocalcemia after the procedure, even those who had been on dialysis for 56.6±29.7 months. The correlation between hemodialysis time and calcium, creatinine and potassium levels, although weak, provides important insights into long-term management. This knowledge can help to personalize long-term treatment plans for hemodialysis patients. Educational efforts and medication adherence can be critical for electrolyte balance, which is essential for the prevention of bone and cardiovascular complications. It should be noted that altered and elevated creatinine levels were present in the entire sample before and after the intervention, as expected due to the physiological aspects of the disease, as well as a high prevalence of hyperphosphatemia. Hyperphosphatemia inhibits the enzyme renal 1-α-hydroxylase, which is responsible for converting vitamin D into its active form and impairs calcium absorption in the intestine.[20] The joint analysis of electrolytes, such as calcium and phosphorus, highlights the importance of integrated thinking that takes into account the mutual influence of these elements. This approach can lead to a better understanding and management of electrolyte complications and prevent adverse reactions.

Urea, a waste product produced by the breakdown of proteins and eliminated from the blood by the kidneys,[21] was altered in nearly 100% of the pre- and post-hemodialysis samples. On the other hand, post-hemodialysis urea improved in IG and worsened in CG after the intervention, with significant results. The improvement in IG is related to the increase in the prevalence of patients who started to urinate after the intervention, with a statistical difference, and to the nutritional advice given for a balanced protein intake. The deterioration observed in the IG may be attributed to inadequate reinforcement of nutritional care and failure to improve uremia. Effective management of uremic control in EFV patients is complex and necessitates adherence to dietary guidelines akin to those for CKD, which advocate for a low-protein diet, restriction of processed foods, and increased fiber intake.[22] Research indicates that these dietary interventions effectively mitigate the accumulation of uremic toxins.[23]

Creatinine, by the same principle as urea, also accumulates in the body of this population.[24] In the present study, it remained altered in all participants, even after the intervention. This result was expected, as persistently elevated serum creatinine is a diagnostic and prognostic feature of CKD itself.[25] Dehydration can elevate the body's creatinine concentration.[26] However, this possibility was excluded since there was no deterioration in assessments of "skin turgor",

"mucosal moisture", or "eye appearance", indicating that these patients maintained adequate hydration. Considering the worsening of urea, URR, and creatinine values, along with the increase in average calcium and phosphorus levels within recommended ranges, it is hypothesized that the elevated organic compound levels in the IG reflect the impact of nutritional counseling, a key component of the intervention. This likely contributed to improved nutritional status and consequent increases in nitrogen compounds within this group. In contrast, these changes were not observed in the CG, where phosphorus levels decreased within the recommended range, and nutritional counseling was not provided as part of the intervention. These findings underscore the importance of nurses acquiring specialized nutrition knowledge for effective patient monitoring.

The mean values of URR and Kt/V in hemodialysis patients serve as critical indicators of dialysis adequacy in chronic kidney disease, guiding multidisciplinary care tailored to patient needs.[9] Normal thresholds for Kt/V are typically above 1.20, and for URR, above 65%.[27] In a recent cross-sectional study of 100 hemodialysis patients, the average URR was 25.24±15.59, and Kt/V was 0.73±0.162.[9] Similarly, our study found a baseline URR of 73.3±7.4, which decreased to 69.7±12.9 post-intervention, primarily due to deterioration observed in the CG. In contrast, the IG maintained adequate URR within the 70% range (from 74.4±5.9 to 72.8±5.8 post-intervention).

As for Kt/V, this study showed a significant deterioration in CG, from 1.6±0.4 to 1.4±0.5, while in IG the average remained at 1.6±0.3, although one patient in this group had an unbalanced Kt/V. For URR, the patients in IG had the same average dialysis quality, while those in CG were close to the 65% cut-off, indicating a deterioration in hemodialysis adequacy. Similarly, CG had the worst performance in dialysis quality during the 12 hemodialysis sessions after the intervention date. The literature does not indicate whether there is a difference in dialysis adequacy between patients using an arteriovenous fistula and those using a hemodialysis catheter. The statistically significant differences for both measures of dialysis adequacy may be related to the performance of the intervention, which eliminated the presence of EFV in 35.3% of the IG sample. The persistence of hypervolemia in 94.1% of the CG may justify the marked deterioration in the quality of hemodialysis in these patients, since EFV directly affects the quality of dialysis in patients with chronic kidney disease.[28] Hypervolemia directly affects the quality of dialysis, and its elimination contributed to more effective dialysis.

The difference between the mean results for URR, urea reduction rate considering its pre-HD and post-HD values, and Kt/V, validate the intervention and show that its implementation had an influence on improving the quality of dialysis in the IG. It should be noted that all patients in the dialysis clinic used the same brand of dialyzer, prescribed appropriately according to the client's weight and clinical conditions.[29] The maintenance and improvement of dialysis adequacy measures in the IG after the intervention highlights the effectiveness of the practices implemented and reinforces the need for nursing strategies focused on resolving hypervolemia and nutritional education to optimize hemodialysis outcomes. It is suggested that a multiprofessional approach with the active participation of nurses, nutritionists and physicians is fundamental to improve the quality of dialysis and, consequently, the clinical outcomes of patients.

Nursing interventions targeting these patients have the potential to improve their quality of life and health.[30] Combining interventions targeting electrolyte imbalance with this tested intervention could potentially be beneficial in resolving the EFV and electrolyte imbalance common in these patients.[31-33] It highlights the potential of nursing practices to improve the health and quality of life of CKD patients on hemodialysis, supporting the adoption of similar interventions in other

clinics. This study provides new evidence on the effectiveness of nursing interventions in the management of CKD patients on hemodialysis. By focusing on an integrated approach that includes medication review, nutritional counseling and fluid control, the study demonstrates that structured interventions can significantly improve laboratory parameters and dialysis adequacy. This not only improves patients' quality of life, but also reduces the risk of complications related to electrolyte imbalances and dialysis inadequacy.

With the positive impact of the intervention evident in stable hemodialysis patients, as indicated by stable or improved post-intervention test results without significant fluctuations, it is clear that this intervention could effectively address electrolyte and blood component disorders. However, caution is advised regarding the risk of electrolyte imbalances, given their high prevalence in this patient population. Experts emphasize the importance of publishing research on laboratory parameters and associated risk factors in hemodialysis patients to ensure dialysis adequacy and early detection of CKD-related complications.[13] Furthermore, future studies should explore implementing this intervention to evaluate its impact on the quality of life among CKD patients undergoing hemodialysis, considering the notable improvements observed in biochemical profiles, laboratory measures, and dialysis adequacy in patients who received the intervention.

Strength and limitations. One of the limitations of the study was the inability to calculate patients' GFR for comparison within and between groups. Other tests, such as serum glucose, were not analyzed because not all patients underwent the same tests in addition to the routine tests, which are prescribed only when necessary, making further comparisons impossible. It should be emphasized that the laboratory test results were provided by the dialysis center itself and it was not possible to include other blood components. The exclusion of additional non-standard tests reflects a realistic and practical approach and is taken into account in randomized clinical trials to ensure that the results analyzed are clinically relevant.

Implications for clinical practice. The results of this research provide a significant contribution to nursing practice in the care of patients with end-stage CKD in a real-world healthcare setting. By analyzing biochemical test results and dialysis adequacy measures, nurses can identify early clinical changes and variations in electrolyte levels and other laboratory tests, allowing timely implementation of the evaluated intervention to mitigate complications and improve dialysis adequacy measures. Applying this intervention not only improves test results, but also improves patient quality of life while reducing the risk of adverse events related to fluid and electrolyte imbalances in this population. This proactive, evidence-based approach by nurses plays a key role in promoting effective care for CKD patients with excess fluid volume, inadequate fluid control and electrolyte disturbances, as well as improving dialysis adequacy. This underscores the critical importance of the nurse's role in identifying, preventing and managing these complex conditions.

Conclusion. The intervention studied was effective in improving therapy outcomes, particularly in terms of fluid volume and hemodialysis, in patients with end-stage CKD who initially had excess fluid volume. The statistically significant results indicated significant improvements in laboratory tests, dialysis adequacy and patient care process. The statistical difference between the groups was remarkable for the mean values of calcium, post-hemodialysis urea and creatinine, demonstrating the direct impact of the intervention. In addition, there were statistically significant improvements in overall dialysis quality, as evidenced by the between-group mean URR and Kt/V. This highlights the importance of taxonomies and targeted care plans for patients with kidney disease and chronic hemodialysis.

References

1. Oni OO, Akinwusi PO, Owolabi JI, Odeyemi AO, Israel GM, Ala O, et al. Chronic Kidney Disease and Its Clinical Correlates in a Rural Community in Southwestern Nigeria. Saudi Journal of Kidney Diseases and Transplantation. 2022; 33:774-83.
2. Oliveira REF, Moreno AH. Verification of biochemical, lipid and glycemic parameters in patients undergoing hemodialysis in a teaching hospital in the noroeste paulista. Revista Cuidarte Enfermagem. 2022; 78-85.
3. Sampani E, Theodorakopoulou M, Iatridi F, Sarafidis P. Hyperkalemia in chronic kidney disease: a focus on potassium lowering pharmacotherapy. Expert Opinion on Pharmacotherapy. 2023; 24:1775-89.
4. Moromizato T, Kohagura K, Tokuyama K, Shiohira Y, Toma S, Uehara H, et al. Predictors of Survival in Chronic Hemodialysis Patients: A 10-Year Longitudinal Follow-Up Analysis. American Journal of Nephrology. 2021; 52:108-18.
5. Hu EA, Coresh J, Anderson CAM, Appel LJ, Grams ME, Crews DC, et al. Adherence to Healthy Dietary Patterns and Risk of CKD Progression and All-Cause Mortality: Findings from the CRIC (Chronic Renal Insufficiency Cohort) Study. American Journal of Kidney Diseases. 2021; 77:235-44.
6. Azevedo VNG, Cavalcante TH, Jansen RC, Moreira RP, Lira ALB, Oliveira-Kumakura ARZ. Validation of an instrument to assess fluid control in outpatient hemodialysis patients. Journal of Nursing Education and Practice. 2022; 12:30-7.
7. Beetham KS, Krishnasamy R, Stanton T, Sacre JW, Douglas B, Isbel NM, et al. Effect of a 3-year lifestyle intervention in patients with chronic kidney disease: A randomized clinical trial. Journal of the American Society of Nephrology. 2022; 33:431-41.
8. Voltarelli BC, Ruzzi-Pereira A. Occupational performance of chronic kidney patients undergoing hemodialysis. Revista Família, Ciclos de Vida e Saúde no Contexto Social (REFACS). 2021; 9:631-41.
9. Agrawaal KK, Kandel S, Devkota S. Mean Urea Reduction Ratio among Patients Undergoing Hemodialysis at a Tertiary Care Centre: A Descriptive Cross-sectional Study. Journal of the Nepal Medical Association. 2023; 61:446-50.
10. Herdman TH, Kamitsuru S, Lopes CT. NANDA-I Nursing Diagnoses: Definitions and Classifications (2021-2023). 12th ed. Porto Alegre: Artmed; 2021.
11. Moorhead S, Johnson M, Maas ML, Swanson E. Nursing Outcomes Classification (NOC): Measurement of Health Outcomes. 6th ed. Rio de Janeiro: Elsevier; 2018.
12. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician. Journal of Psychiatric Research. 1975; 12:189-98.
13. Chidiac C, Chelala D, Nassar D, Beaini C, Azar H, Finianos S, et al. Routine laboratory testing in hemodialysis: how frequently is it needed? BMC Nephrology. 2022; 23:1-9.
14. Felipe C, Natália T, Sheila B. Orientações nutricionais para pacientes com doença renal crônica em hemodiálise. Brasília: Federal District. Multiprofessional Residency in Nephrology - SES DF; 2019.
15. Silva TT, Dantas JKS, Araújo SCM, Silva SO, Dantas DV, Dantas RAN. Strategies for thirst management in postoperative adult patients: a scoping review. Revista Brasileira de Enfermagem. 2022; 75:e20220154.
16. Portales-Castillo I, Rieg T, Khalid SB, Nigwekar SU, Neyra JA. Physiopathology of phosphate disorders. Advances in Kidney Disease and Health. 2023; 30(2):177-88.
17. Yanagawa T, Hirayama A, Osada K, Kuno A, Takahashi S. Sufficient liver erythropoietin synthesis is induced in hemodialysis patients not requiring erythropoiesis-stimulating agents. Clinical Nephrology. 2022; 98:167-70.
18. Koury MJ, Agarwal R, Chertow GM, Eckardt KU, Fishbane S, Ganz T, et al. Erythropoietic effects of vadadustat in patients with anemia associated with chronic kidney disease. American Journal of Hematology. 2022; 97:1178-88.
19. Bialeski AB, Lopes CM, Iser BPM. Factors related to clinical outcomes and survival time in chronic kidney disease patients on hemodialysis. Cadernos de Saúde Coletiva. 2022; 30:115-26.
20. Rehma S, Sharif N, Rahman S. Frequency of vitamin D deficiency and hypocalcemia in patients presented with low back pain in tertiary care hospital Khyber Pakhtunkhwa. Journal of Medical Sciences. 2020; 28:42-5.
21. Zemaitis MR, Foris LA, Katta S, Bashir K. Uremia. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2022.

22. Kalim S, Zhao S, Tang M, Rhee EP, Allegretti AS, Nigwekar S, et al. Protein carbamylation and the risk of ESKD in patients with CKD. Journal of the American Society of Nephrology. 2023; 34:876-85.
23. Ko G-J, Rhee CM, Kalantar-Zadeh K, Joshi S. The effects of high-protein diets on kidney health and longevity. Journal of the American Society of Nephrology. 2020; 31:1667-79.
24. Swierczynska-Mróz K, Nowicka-Suszko D, Fleszar MG, Fortuna P, Krajewski PK, Krajewska M, et al. Serum Level of Protein-Bound Uraemic Toxins in Haemodialysis Patients with Chronic Kidney Disease-Associated Pruritus: Myths and Facts. Journal of Clinical Medicine. 2023; 12:2310.
25. Gaitonde DY, Cook DL, Rivera IM. Chronic kidney disease: detection and evaluation. American Family Physician. 2017; 96:776-83.
26. Brazilian Society of Nephrology. Biomarkers in Nephrology. Accessed 5 June 2023. Available from: https://arquivos.sbn.org.br/pdf/biomarcadores.pdf
27. Raimann JG, Ye X, Kotanko P, Daugirdas JT. Routine Kt/V and normalized protein nitrogen appearance rate determined from conductivity access clearance with infrequent postdialysis serum urea nitrogen measurements. American Journal of Kidney Diseases. 2020; 76:22-31.
28. Masakane I, Ito M, Tanida H, Nawano T. Patient-Centered Care Could Improve Quality of Life and Survival of Dialysis Patients: Dialysis Prescription and Daily Practice. Blood Purification. 2023; 52:44-55.
29. Maduell F, Broseta JJ, Rodríguez-Espinosa D, Del Risco-Zevallos J, Gómez M, Rodas LM, et al. Efficacy and Safety of the Medium Cut-Off Elisio HX Dialyzer. Blood Purification. 2023; 52:68-74.
30. Stumm EMF, Benetti ERR, Pretto CR, Barbosa DA. Effect of educational intervention on the quality of life of hyperphosphathemic chronic renal patients on hemodialysis. Texto & Contexto Enfermagem. 2019; 28:e20180267.
31. Frazão CML, Medeiros ABA, Silva FBBL, Sá JD, Lira ALBC. Nursing diagnoses in chronic renal failure patients on hemodialysis. Acta Paulista de Enfermagem. 2014; 27:40-3.
32. Debone MC, Pedruncci EDSN, Candido MDC, Marques S, Kusumota L. Nursing diagnosis in older adults with chronic kidney disease on hemodialysis. Revista Brasileira de Enfermagem. 2017; 70:800-5.
33. Fernandes MICD, Cavalcanti PKAS, Dantas ALM. Patients receiving hemodialysis with the nursing diagnosis of fluid volume excess: socioeconomic and clinical aspects. Cogitare Enfermagem. 2015; 20:160-8.

Original Article

Effectiveness of Nursing Interventions in Reducing Maternal Mortality in Resource-Limited Settings: A Systematic Review and Meta-Analysis

Dr Jasneet Kaur[1,3]
https://orcid.org/0000-0001-6897-9137

Dr Sheela Upendra[2,3]
https://orcid.org/0000-0003-2413-1219

1 Professor, Ph.D. Email: jasneetkaur@scon.edu.in. Corresponding author.

2 Professor, Ph.D. Email: sheelaupendra@scon.edu.in.

3 Symbiosis College of Nursing, Symbiosis International (Deemed University), Pune, India.

Conflicts of interest: None

Received: Junio 27, 2025.

Approved: September 11, 2025.

How to cite this article: Kaur J, Upendra S. Effectiveness of Nursing Interventions in Reducing Maternal Mortality in Resource-Limited Settings: A Systematic Review and Meta-Analysis. Investigación y Educación en Enfermería. 2025; 43(3):e13.

DOI: https://doi.org/10.17533/udea.iee.v43n3e13

Effectiveness of Nursing Interventions in Reducing Maternal Mortality in Resource-Limited Settings: A Systematic Review and Meta-Analysis

Objective. To assess the effectiveness of nurse-led or nurse-integrated interventions in improving maternal health outcomes, particularly antenatal care (ANC) attendance, in resource-constrained settings. **Methods.** A systematic review and meta-analysis were conducted following PRISMA guidelines. Databases including PubMed, Scopus, CINAHL and Web of Science were searched for studies evaluating the impact of nursing interventions on maternal health outcomes. Risk of bias was assessed using the Cochrane RoB 2 tool and Newcastle-Ottawa Scale. A random-effects meta-analysis was performed for studies reporting ANC attendance (4 and more visits). (PROSPERO CRD420251067253). **Results.** Of the 1038 records identified, 11 studies met the inclusion criteria, and 3 were eligible for meta-analysis. The pooled Odds Ratio for ANC attendance was 1.48 (95% CI = 1.06–2.08), indicating a statistically significant improvement. For facility use at birth, results also showed positive effects (OR=1.49, 95% CI = 1.21–1.77). Mortality-related outcomes showed a midwife-delivered postpartum hemorrhage bundle reduced a composite

outcome including severe hemorrhage and death (RR = 0.40, 95% CI = 0.32–0.50) Narrative synthesis of other outcomes such as skilled birth attendance and maternal mortality also suggested a positive impact of nurse-led interventions. **Conclusion.** Nurse-led and nurse-integrated maternal health interventions significantly improve ANC utilization in low-resource settings. Policymakers should consider scaling these models as part of broader maternal health strategies. Further research is needed to assess long-term outcomes, including facility-based delivery and mortality.

Descriptors: maternal health; prenatal care; maternal health services; maternal mortality; nursing care.

Descriptores: salud materna; atención prenatal; servicios de salud materna; mortalidad materna; atención de enfermería.

Descritores: saúde materna; cuidados pré-natais; serviços de saúde materna; mortalidade materna; cuidados de enfermagem.

Introduction

Maternal mortality continues to be a significant public health issue, especially in low- and middle-income countries (LMICs), which account for approximately 295 000 of the nearly 300 000 annual global maternal deaths.[1] Despite a global drop in maternal mortality ratio (MMR) from roughly 385 per 100,000 live births in 1990 to around 216 per 100 000 by 2015, disparities remain stark; more than 60% of maternal deaths are concentrated in Sub-Saharan Africa and South Asia.[2] Direct obstetric complications namely hemorrhage, hypertensive disorders like pre-eclampsia and eclampsia , unsafe abortions, sepsis, and obstructed labor contribute to over two-thirds of these deaths.[3] Indirect contributors such as HIV, malaria, and cardiovascular diseases further elevate risk, particularly in settings with weakened health infrastructure.[4] Sepsis alone exerts a disproportionate toll: a retrospective study in Mbarara, Uganda reported that puerperal sepsis was responsible for 31% of maternal deaths in the cohort.[5] Additional research has shown that postpartum infections such as surgical site infections, endometritis and urinary tract infections are primary drivers of maternal morbidity and mortality in many LMIC hospitals.[6] Improving maternal survival in these environments requires a sustained increase in skilled birth attendance and quality obstetric care. Nurse- and midwife-led interventions have emerged as pivotal strategies in this context.[7] Indeed, community health worker and nurse-midwife programs have demonstrated effectiveness in reducing maternal and neonatal deaths by enhancing access to care, health education, and timely referrals.[8]

An exploration of nurse-led wound sepsis prevention in Uganda showed that trained nursing interventions significantly reduced wound infection rates and increased maternal satisfaction post-delivery.[9] Similarly, a targeted nurse education program implementing sepsis-screening tools in southwestern Uganda led to improved documentation of vital signs and early detection of puerperal sepsis a crucial step toward lowering maternal mortality.[10] Beyond infection control, nurse- and midwife-delivered interventions have been effective in enhancing antenatal care uptake and facility-based deliveries.[11] A review of interventions aimed at increasing maternal health service utilization in LMICs highlighted that most successful strategies were delivered by nurses, midwives, and community health workers. These treatments generally focus on the “three delays” in maternal care: the delay in getting care, the delay in getting to care, and the delay in getting good care.[12]

Mobile health (mHealth) strategies—frequently facilitated by nurses—have also shown promise. A recent systematic review involving 131 trials reported that SMS reminders and digital planning tools significantly improved antenatal attendance and timely immunizations for mothers and newborns across LMICs.[13] However, the impact on facility-based birth rates and maternal health

outcomes showed mixed results, highlighting the need for context-specific implementation studies.[14] The integration of nurse-led models at national scale has also yielded success. In Nigeria, the Midwives Service Scheme (MSS) which deployed qualified midwives to rural primary healthcare centres helped boost facility delivery rates and improved maternal health services in underserved areas.[15] Similarly, The Abiye Safe Motherhood Program cut the number of mothers who died after childbirth by an amazing 84.9% (from 745 to 112 per 100,000 live births) by providing free treatment for mothers and integrating community health workers.[16]

Despite this encouraging evidence, there remains a lack of comprehensive synthesis focused explicitly on nurse-led interventions' impact on maternal mortality and morbidity.[17] A recent blend of maternal health interventions in LMICs noted variable effectiveness tied to contextual and systemic factors, yet stopped short of isolating nursing-specific modalities.[18] Another review highlighted gaps in our understanding of implementation barriers and facilitators in contexts such as infrastructure, staff training, and health system leadership.[19] Emerging literature supports nurse-led models in high-income settings for example, the Nurse-Family Partnership in the U.S. demonstrated significant reductions in preterm birth, child maltreatment, and inter-pregnancy intervals, although the model's adaptation to LMIC contexts remains underexplored.[20] This suggests that similarly structured interventions, tailored for LMIC health systems and resources, could yield substantial maternal health gains.

Taken together, this body of evidence underscores both the promise and complexity of nurse-led interventions in improving maternal outcomes. What remains elusive is a focused meta-analysis examining their specific contribution to reducing maternal mortality across LMICs. A systematic review with meta-analytic methods could clarify effectiveness, identify implementation barriers, and inform scalable, evidence-based policy frameworks. Until such synthesis exists, policymakers and program implementers lack fully informed guidance for deploying nursing-led initiatives that most effectively save maternal lives.

The objective of this review was to comprehensively evaluate the efficacy of nursing interventions in decreasing maternal mortality in resource-constrained or low-income healthcare environments. The Secondary objectives include evaluating their impact on antenatal care attendance, facility-based delivery rates, and maternal morbidity.

Methods

This research is a systematic review and meta-analysis aimed at assessing the efficacy of nurse-led interventions in decreasing maternal mortality and enhancing maternal health outcomes in resource-constrained environments. The PRISMA criteria are adhered to in this technique. The review protocol was registered in International Prospective Register of Systematic Reviews (PROSPERO CRD420251067253).

Eligibility Criteria. This review will include studies from January 2015 to June 2025 involving pregnant, labouring, or postpartum women who are receiving care in low-resource or low- and middle-income country (LMIC) healthcare settings. The interventions of interest are nurse-led or nurse-midwife-led maternal health services. These may include antenatal care (ANC), maternal health education, community outreach or home visit programs, emergency obstetric care, and birth preparedness initiatives. The comparator groups will consist of women receiving standard care that is not led by nurses, physician-led care, or no intervention at all. The exclusion criteria involve studies if they focus on non-pregnant individuals, male subjects, healthcare providers as participants, or if the outcomes pertain solely to neonatal health

without maternal health components. Studies that do not report on maternal mortality or any of the predefined secondary outcomes (antenatal care attendance, facility-based delivery, maternal morbidity, or postpartum complications) and those not published in English. The primary outcome for this review is maternal mortality, defined as death occurring during pregnancy, childbirth, or the postpartum period. Secondary outcomes include antenatal care attendance, rates of facility-based deliveries, maternal morbidity, and postpartum complications.

Search Strategy. An inclusive literature search was conducted to identify studies evaluating the effectiveness of nursing interventions in reducing maternal mortality in resource-limited settings. PubMed, Scopus, CINAHL, Web of Science were searched. Keywords were searched using logical operators using MeSH terms (((((((("maternal mortality") OR "pregnancy related death") OR "maternal death") AND "nursing interventions") OR "nurse led") OR "maternal care") OR "antenatal care") AND "low income countries") OR "developing countries") OR "resource limited settings. Furthermore, the lists of all identified articles were examined for further suitable publications. The requirements of the PRISMA were adhered to. To ensure research-supported updates, we only included papers from the last decade. 8 articles found eligible for systematic review and 3 for meta-analysis.

Study Selection. All recognized studies will be loaded into reference management software. The selection method started with an independent screening of titles and abstracts by two reviewers, followed by a comprehensive full-text evaluation of possibly suitable papers. Disputes between the two authors over the inclusion of papers were settled by dialogue and consensus.

Data Extraction. Using a standardized data extraction form, two researchers independently extracted data and subsequently cross-checked all entries for accuracy. Any discrepancies were resolved through consensus. The following information was collected for the included studies: first author's name, year, design, area, sample size, characteristics, intervention details, outcomes, and statistical data. All reviewer verified the entries. (Table 1)

Assessment of quality of papers. The risk of bias in randomized controlled trials (RCTs) was assessed using the Cochrane Risk of Bias tool (RoB 2), while observational studies were evaluated using the Newcastle-Ottawa Scale. Two independent reviewers conducted the assessments, and any disagreements were resolved through discussion. Based on the Risk of Bias table (Figure 1) and the study names extracted from the PDFs, the studies were classified as follows: Three Studies were with low risk of bias studies.[21–23]Three Studies with moderate risk of bias[24–26] and two studies with high risk of bias.[27,28] Publication bias was not officially evaluated by funnel plots or Egger's test owing to the limited number of papers included in the meta-analysis ($n=3$). Given the restricted data, these statistical instruments lack the capability to consistently identify asymmetry. Therefore, while no formal evidence of publication bias was identified, the possibility cannot be ruled out and results should be interpreted with caution. Two studies[24,28] did not report effect sizes or confidence intervals, and therefore were excluded from the meta-analysis. However, their findings were discussed. (Figure 1)

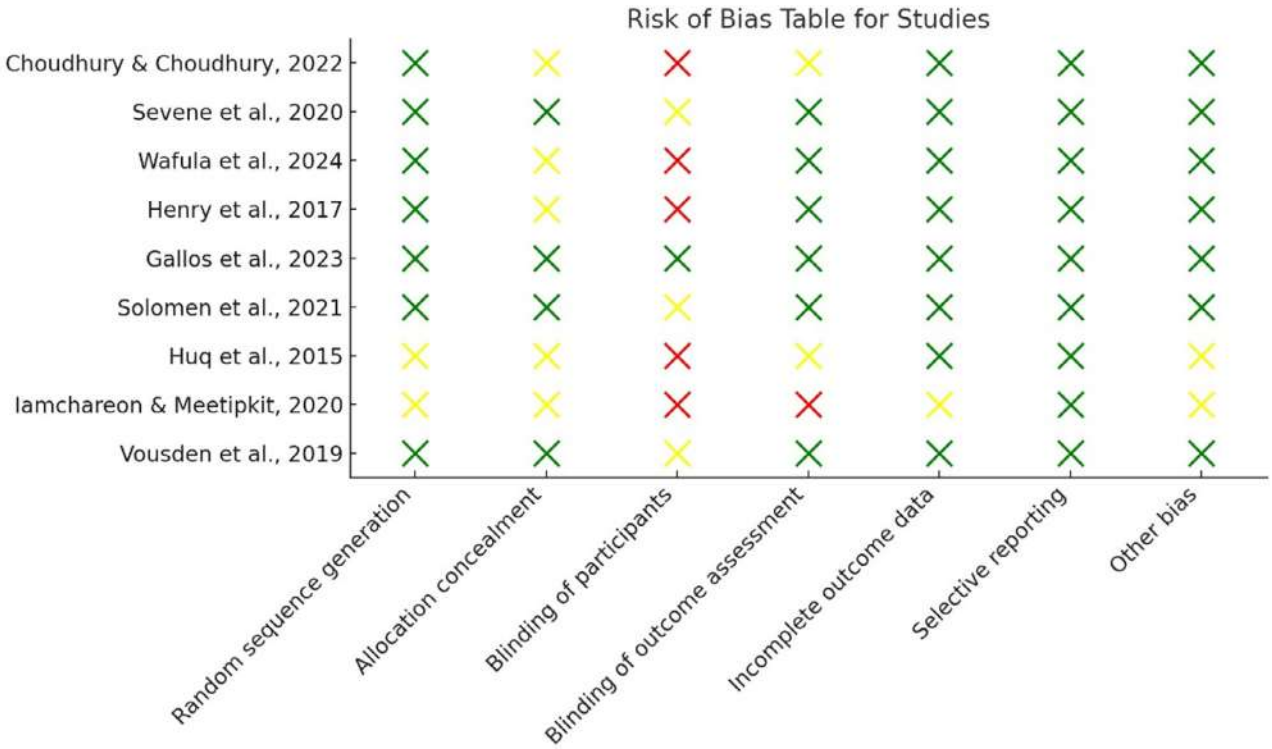


Figure 1. Risk of Bias

Data Synthesis and Statistical Analysis. As prespecified in the protocol, a meta-analysis was planned if at least three studies reported on the same outcome using comparable definitions and reported or allowed calculation of effect sizes like odds ratio and relative risk. After full-text screening and data extraction, only antenatal care coverage (ANC ≥4 visits) met these criteria. Studies[25–27] reported this outcome with compatible definitions and sufficient statistical detail. These were therefore included in a random-effects meta-analysis. Other outcomes (e.g., maternal mortality, facility-based delivery, postpartum hemorrhage) lacked sufficient comparable data across studies and were synthesized narratively. Although maternal mortality was the primary outcome outlined in the registered protocol, insufficient and inconsistent reporting of effect sizes prevented meta-analysis of this outcome. Therefore, quantitative synthesis was limited to antenatal care attendance, which met criteria for meta-analysis with at least three comparable studies. This deviation from the original protocol was necessary due to data limitations and is transparently reported in accordance with PRISMA guidelines. (Figure 2)

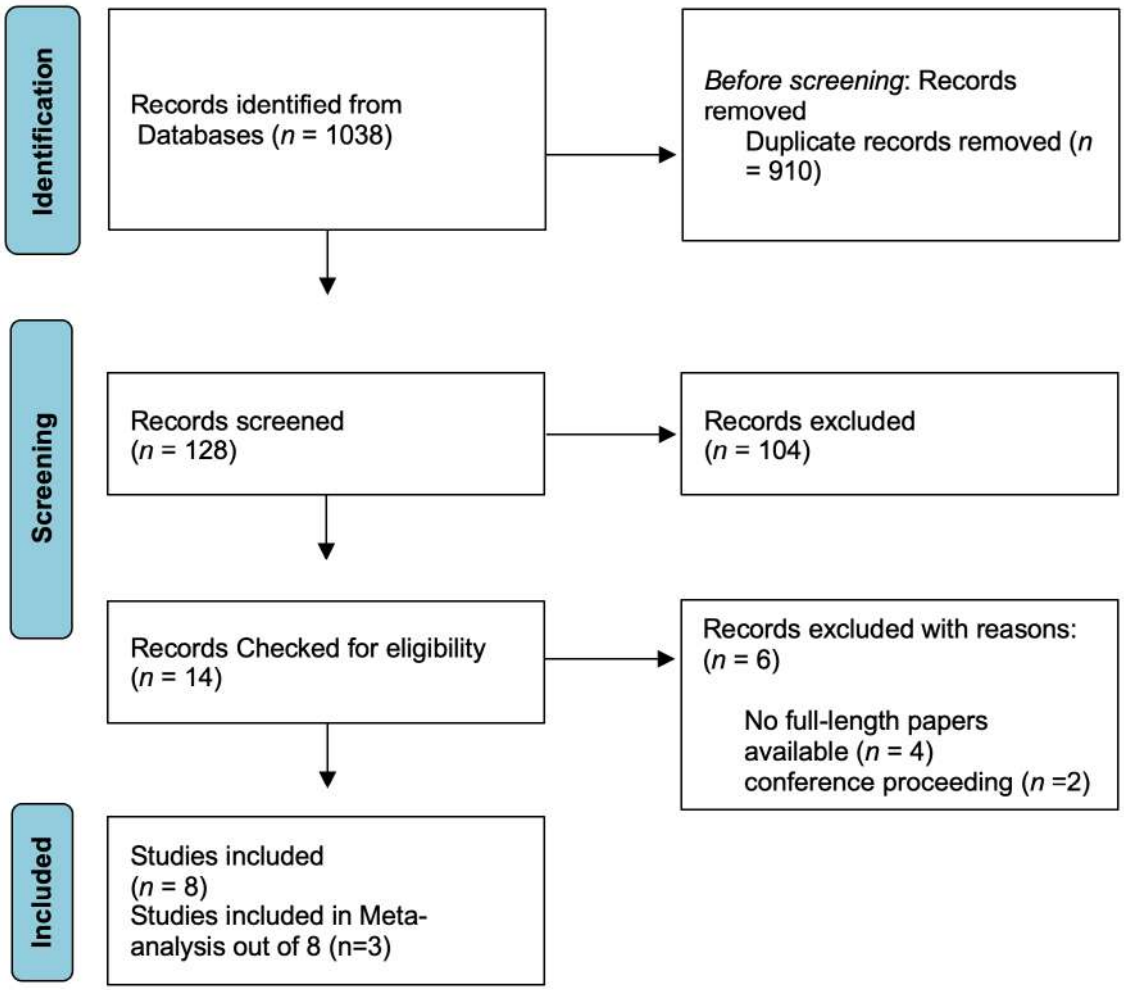


Figure 2. Prisma Flowchart

Heterogeneity Assessment. Statistical heterogeneity was assessed using the I^2 statistic, which quantifies the percentage of total variability attributable to between-study differences rather than chance. For the outcome of antenatal care coverage (ANC ≥4 visits), a random-effects model was applied to account for expected heterogeneity in populations, intervention types, and study designs. Due to the limited number of studies (n = 3) included in the meta-analysis, funnel plots and Egger's test were not used, as their reliability is limited in small samples. For outcomes that could not be meta-analyzed due to non-comparable definitions or missing effect size data, a narrative synthesis was conducted, and key results were summarized descriptively.

Table 1. Characteristics of included studies

Study	Year	Study Design	Setting	Sample Size	Population	Intervention Type	Primary Outcome	Effect Size (RR/OR)	95% CI	*p*-value
Choudhary and Asan. [24]	2020	RCT	India	1480	Pregnant women	mHealth (Mobile for Mothers app) intervention delivered by ASHAs	Significant increases in awareness about the "five cleans," tetanus vaccination, reproductive tract infections, HIV testing, and adherence to iron tablet consumption	-	-	<0.001
Sevene L. *et al*.[22]	2020	Cluster Randomized Controlled Trial	Mozambique	15,013	Pregnant women	Mobile health application-directed community health worker-administered community-level intervention (CLIP)	Aggregation of maternal, fetal, and neonatal mortality with significant morbidity.	aOR 1.31 (no significant difference between groups)	0.70–2.48	0.40
Henry *C. et al*.[25]	2017	Retrospective pre–post non-equivalent comparison group design	Zambia	21,680	Pregnant women	Multi-level health systems initiative (SMGL)	Facility-based birth (FBB) and skilled birth attendance. The intervention notably increased facility-based births (FBB), but did not significantly improve the presence of skilled birth providers.	OR 1.49 (Facility-based births)	1.21–1.77	0.005
Gallos I., *et al*.[21]	2023	Cluster Randomized Controlled Trial	Kenya, Nigeria, South Africa, Tanzania	210,132	Women undergoing vaginal delivery	Calibrated blood-collection drape and WHO first-response treatment bundle (uterine massage, oxytocics, tranexamic acid, IV fluids, examination, escalation)	Composite of significant postpartum hemorrhage (≥1000 ml blood loss), laparotomy due to hemorrhage, or maternal mortality resulting from hemorrhage. The intervention significantly decreased the composite main result in comparison to standard treatment.	RR 0.40	0.32–0.50	<0.001

Table 1. Characteristics of included studies (Cont.)

Study	Year	Study Design	Setting	Sample Size	Population	Intervention Type	Primary Outcome	Effect Size (RR/OR)	95% CI	*p*-value
Wafula *et al.*[26]	2024	Pre-post comparison with propensity score matching	Uganda	1202	Pregnant/ postpartum women aged 15–49 years with children ≤1 year	Community-facility linked intervention (COMONETH), involving CHW home visits, community video education, PRONTO health-worker training, and improved facility care	Antenatal care (ANC), facility delivery, postnatal care (PNC), and improved newborn care practices. Significant increase in ANC (4+ and 8+ visits) and PNC visits. Facility delivery did not significantly improve (likely due to high baseline levels)	ANC 4+: OR 1.26	ANC 4+: (1.07–1.49) ANC 8+: (1.06–4.82) PNC: (1.20–1.63)	0.006
Huq *et al.*[27]	2015	Pre-post study (with cluster sampling)	Bangladesh	Baseline: 3,158; Endline: 3,431	Women who delivered within the previous 6 months in rural areas	Integrated maternal health intervention involving CSBA training, deployment, community mobilization, and linkage to referral facilities	Skilled provider attendance for ANC (≥4 visits), delivery, and PNC. Integrated community-level intervention significantly improved utilization of skilled maternal healthcare in remote, rural areas, particularly benefiting disadvantaged populations.	ANC 4+: OR 3.8, SBA: 2.8	ANC: [1.9–7.6] Skilled attendance: [2.1–3.8]	<0.0001
Vousden N., Lawley E., *et al.*[23]	2019	Stepped-wedge Cluster Randomized Trial	Nigeria , Uganda	81,502	Women admitted for childbirth in secondary/ tertiary hospitals	Data-driven, quality improvement intervention using CRADLE VSA device, clinical protocols, and dashboard feedback	Composite of maternal mortality and morbidity (eclampsia, sepsis, hemorrhage, ICU admission). No statistically significant reduction in the composite outcome. Improved early detection of risk (e.g., BP and shock index) but this did not translate into reduced adverse outcomes.	OR 1.31 (NS)	0.70–2.48	0.40

Table 1. Characteristics of included studies (Cont.)

Study	Year	Study Design	Setting	Sample Size	Population	Intervention Type	Primary Outcome	Effect Size (RR/OR)	95% CI	*p*-value
Iamchareon & Meetipkit[28]	2020	Prospective, controlled experimental study	Thailand	126 mothers (60 control, 66 intervention)	Women undergoing cesarean section	Nurse-led guideline intervention including risk assessment, postpartum hemorrhage (PPH) kit, and cold compress belly band	Blood loss volume and rate of postpartum hemorrhage post-cesarean section	Significantly reduced mean blood loss post-cesarean section; no significant difference in postpartum hemorrhage rate	Not reported	0.001 / 0.476

Results

This systematic review included eight studies conducted across seven countries India, Mozambique, Zambia, Kenya, Nigeria, South Africa, Tanzania, Uganda, Bangladesh, and Thailand representing a cumulative sample of over 350 000 women. The studies employed a variety of designs: three were RCTs[21–23] one used a prospective controlled design,[28] and four were quasi-experimental or pre–post evaluations.[24–27] Although the registered protocol planned a purely quantitative synthesis, several outcomes lacked sufficient comparable data for meta-analysis. Therefore, a narrative synthesis was conducted for outcomes such as facility-based delivery and maternal mortality, in accordance with PRISMA guidelines.

Various Nursing Interventions

Across the eight studies included in this review, a range of nursing-led or nurse-integrated interventions were implemented to improve maternal health outcomes in resource-limited settings. These interventions varied in complexity and setting, but shared a common reliance on nurses and community-based workers as central delivery agents. In India, Choudhury and Asan introduced a mobile health (mHealth) intervention where Accredited Social Health Activist (ASHA) used a maternal health app to deliver structured education to pregnant women. This intervention significantly increased maternal awareness regarding hygiene, tetanus vaccination, reproductive tract infections, HIV testing, and adherence to iron-folic acid supplementation, although effect sizes were not reported.[24] In Bangladesh, Huq *et al*. mplemented a broad community-based maternal health program, training and deploying Community Skilled Birth Attendants (CSBAs), strengthening referral linkages, and conducting outreach services.[27] Similarly, in Uganda, Wafula *et al.* evaluated the COMONETH initiative—a multi-component model that integrated CHW home visits, community video education, PRONTO nurse training, and facility quality improvement mechanisms.[26] All three of these interventions were designed to expand access and bridge community facility gaps.

At the health systems level, Henry *et al.* assessed the impact of SMGL- Saving Mothers, Giving Life initiative in Zambia, which involved a system-wide response including improved facility readiness, emergency response planning, and enhanced nurse deployment and referral systems.[25] In contrast, Gallos *et al.* focused on

clinical intervention at delivery using a WHO-recommended treatment bundle for postpartum hemorrhage (PPH), administered by trained midwives in four sub-Saharan African countries.[21] Vousden *et al.* also evaluated facility-based strategies by introducing the CRADLE Vital Signs Alert (VSA) device a nurse-managed risk detection tool—alongside protocol training and real-time feedback dashboards for maternal early warning.[23]

Technology and standardized clinical protocols were central to interventions in Thailand and Mozambique. Iamchareon and Meetipkit evaluated a controlled trial of a nurse-led PPH management guideline for cesarean section patients. This included the use of a PPH risk assessment tool, a PPH response kit, and a cold compress belly band.[28] In Mozambique, Sevene *et al.*[22] assessed a mobile app–guided intervention through the CLIP trial, enabling community health workers and nurses to conduct maternal assessments and risk triage during pregnancy. Taken together, these interventions reflect the diverse roles nurses played as educators, system navigators, emergency responders, and clinical managers across both community and facility settings in low-resource environments.

Effectiveness of nursing interventions in reducing maternal mortality

Only a few of the included studies reported maternal mortality directly, and among those, mortality was often part of a broader composite outcome. Gallos *et al.* reported on a composite endpoint comprising severe PPH (≥1000 mL blood loss), laparotomy, or maternal death.[21] The intervention, which consisted of a calibrated drape for blood-collection and a structured six-step response protocol administered by midwives, led to a significant reduction in this composite outcome (RR: 0.40; 95% CI: 0.32–0.50; $p < 0.001$). While it is unclear how much of this reduction was attributable to changes in maternal mortality alone, the study nonetheless indicates that nurse-led emergency response interventions can have life-saving impacts when systematically implemented. In contrast, Sevene *et al.* and Vousden *et al.* both evaluated data-driven interventions aimed at maternal mortality reduction but did not observe statistically significant improvements. Sevene's CLIP trial used community-level risk screening via mobile decision support, while Vousden's study used the CRADLE VSA device combined with clinical escalation protocols. Both studies reported adjusted odds ratios of 1.31 (95% CI: 0.70–2.48), indicating no substantial reduction in composite mortality and morbidity outcomes.[22] Iamchareon and Meetipkit observed a statistically significant reduction in mean blood loss after cesarean section with the use of a nurse-led intervention, but no statistically significant difference in the rate of postpartum hemorrhage or maternal death (PPH rate $p = 0.476$).[28] Overall, while one study showed measurable improvements in outcomes linked to mortality, most studies lacked sufficient statistical power or used composite definitions that diluted the ability to draw strong conclusions about the effect of nursing interventions on maternal mortality.

Impact of nursing-led maternal health interventions on secondary outcomes such as antenatal care coverage and maternal morbidity

Three studies[25–27] reported on the part of women who received antenatal care (ANC) for 4 or more visits. These studies were the only ones to report this outcome using comparable definitions and with effect sizes amenable to statistical synthesis. The implementation of community-based CSBAs led to substantial increases in ANC attendance (OR: 3.8; 95% CI: 1.9–7.6).[27] COMONETH intervention also demonstrated increased ANC 4+ visit coverage (OR: 1.26; 95% CI: 1.07–1.49) (26), as did the SMGL initiative evaluated by Henry (OR: 1.43; 95% CI: 1.29–1.58).[25] A random-effects meta-analysis of these three studies yielded a pooled odds ratio of 1.48 (95%

CI: 1.06–2.08), indicating, indicating a significant increase in ANC uptake associated with nursing-led or nurse-integrated interventions. Egger's test ($p = 0.978$) and funnel plot inspection did not reveal any indication of publication bias. This finding aligns with previous studies that underscore the importance of nurse-led education, counseling, and follow-up care in maternal health. It is worth noting, however, that the meta-analysis was limited to ANC attendance due to inconsistent reporting of effect sizes and outcome definitions for other variables, such as facility-based delivery and maternal mortality. Despite this, the narrative synthesis of excluded studies also suggested a consistent positive trend, reinforcing the potential impact of nurse-led models.

Additional secondary outcomes reported across studies included skilled birth attendance, facility-based deliveries, postnatal care, postpartum hemorrhage, and maternal knowledge. Two studies reported increases in facility-based deliveries (OR: 2.8 and 1.49, respectively),[25,27] while one. also reported increased postnatal care visits (OR: 1.40; 95% CI: 1.20–1.63).[26] Gallos *et al.* demonstrated that structured PPH management significantly reduced hemorrhage-related morbidity.[21] Iamchareon and Meetipkit, although lacking effect size data, observed significantly reduced mean blood loss ($p < 0.001$) post-cesarean section.[28] Choudhury and Asan found significant improvements in maternal knowledge on hygiene, tetanus immunization, and HIV awareness ($p < 0.001$), highlighting the behavioral impact of structured maternal education.[24] However, outcomes such as maternal morbidity, hemorrhage, and postnatal care were too heterogeneously defined or lacked consistent effect sizes across studies, precluding meta-analytic synthesis. Nonetheless, the descriptive findings suggest that nursing-led maternal health programs improve a range of important intermediate outcomes that are predictive of maternal survival and long-term health.

Discussion

This quantitative review synthesizes evidence from eight studies evaluating the effectiveness of nursing-led or nurse-integrated maternal health interventions in resource-limited settings. The interventions varied from community-based strategies involving trained nurses and community health workers (CHWs) to facility-based clinical protocols and digital decision-support tools. The analysis provides compelling evidence that such interventions can significantly improve service utilization especially antenatal care (ANC) and contribute to maternal morbidity reduction, although direct effects on maternal mortality remain inconclusive.

Interpretation of Meta-analysis Findings

The most robust and statistically consistent outcome across the included studies was antenatal care coverage, specifically the part of women receiving 4 or more ANC visits. A meta-analysis of three studies[25–27]demonstrated a pooled odds ratio of 1.48 (95% CI: 1.06–2.08) indicating a statistically significant and clinically meaningful increase in ANC utilization. These interventions included the training and deployment of community-based skilled birth attendants (CSBAs), improvements in facility infrastructure and referral systems, and home visits combined with health worker coaching and feedback mechanisms. These findings reinforce the pivotal role that nurses and CHWs play in maternal care delivery as supported in literature.[29] Prior literature has shown that community-based maternal care models particularly those involving midwives and nurses can lead to increased service access and

patient trust.[30,31] The SMGL initiative not only increased ANC and facility delivery rates but also showed gains in emergency response systems, largely led by nurses and midwives. Similarly, deploying CSBAs in rural Bangladesh significantly increased the odds of both ANC attendance and skilled birth attendance, with particularly strong gains among disadvantaged populations. The I^2 statistic for the ANC meta-analysis was moderate (47%), suggesting some variability across studies, likely due to differences in intervention design and populations. A random-effects model was used to accommodate this heterogeneity. Visual inspection of the funnel plot and Egger's test ($p = 0.483$) showed no evidence of publication bias, although power was limited due to the small number of studies.

Maternal Mortality and Morbidity Outcomes

While improvements in service utilization were well-documented,[32] the effect of nursing-led interventions on maternal mortality was less consistent. WHO-recommended PPH treatment bundle delivered by midwives significantly reduced a composite outcome that included severe hemorrhage (≥1000 ml), laparotomy, or maternal death (RR: 0.40, 95% CI: 0.32–0.50). Although maternal mortality alone was not disaggregated in their analysis, the reduction in severe hemorrhage and the structured response protocol suggest a plausible mortality benefit.[21] In contrast, interventions targeting early risk detection and triage but did not observe significant reductions in composite maternal morbidity and mortality outcomes.[22,23] CLIP trial used an mHealth-supported triage model, enabling CHWs and facility nurses to identify hypertensive and at-risk women in the community.[22] Despite high fidelity to the intervention, no significant change in maternal outcomes was detected. CRADLE VSA early warning device reported improved detection of high-risk patients but no statistically significant improvement in maternal death or morbidity rates.[23] These findings reflect a common challenge in maternal health evaluations: mortality outcomes are rare and often require large sample sizes and long follow-up periods to detect statistically meaningful effects.[33] Moreover, many interventions were implemented in health systems already under strain, where nursing-led improvements alone may not be sufficient to shift mortality trends without broader systemic changes.[34]

Secondary Outcomes: PPH, Facility Delivery, Knowledge Gains

Several studies reported improvements in secondary maternal health indicators. Few studies demonstrated increased facility delivery rates following their respective interventions.[25,27] However, postnatal care visits significantly improved after implementation of COMONETH, an integrated model involving CHW outreach, nurse-facility coordination, and clinical mentoring.[26] These service uptake improvements suggest that when nurses are engaged not only in care delivery but also in system organization and outreach, maternal health access expands substantially.[35] Regarding postpartum hemorrhage, two studies provided insight into nursing-led responses. which use of calibrated blood drapes, early escalation protocols, and uterotonic bundles led to a clinically significant reduction in hemorrhage-related outcomes[21] and standardized nurse-led hemorrhage prevention bundle during cesarean sections in Thailand, observed reduced blood loss, although the rate of postpartum hemorrhage[28] did not differ significantly between groups. In terms of health education and behavior significant improvements found in women's knowledge of maternal health practices, including tetanus vaccination and iron supplement adherence, after a mobile app intervention delivered by ASHAs.[24] While no effect size was reported, the improvements underscore the role of trained nursing or CHW educators in promoting preventive behaviors.

Limitations of Included Evidence

This review has several limitations. First, although the initial search yielded a large number of studies, only three met the criteria for inclusion in the meta-analysis due to consistent outcome reporting. As a result, the pooled analysis was limited to ANC attendance, while other outcomes such as facility-based delivery and maternal mortality could only be synthesized narratively. Second, there was variation in the design, delivery, and intensity of nurse-led interventions across the included studies, which may have influenced the effect sizes. Additionally, heterogeneity in the definitions and measurement of outcomes limited direct comparability. Third, while risk of bias was assessed systematically, some included studies had methodological concerns, such as lack of blinding or unclear allocation methods, which may affect the internal validity of findings. Finally, although publication bias was assessed visually, the small number of studies limits the ability to detect asymmetry reliably using funnel plots or statistical tests.

Global Significance and Policy Implications

Despite these limitations, the findings have significant implications for global maternal health strategies. The evidence clearly supports the effectiveness of nurse-led and nurse-integrated interventions in improving antenatal care coverage and select maternal health outcomes in low-resource settings. This aligns with global recommendations emphasizing task-sharing, decentralization, and empowerment of mid-level health workers as key strategies to reduce maternal mortality and improve care access. These findings are particularly relevant in light of ongoing workforce shortages in maternal care across sub-Saharan Africa and South Asia. Nurses and midwives often serve as the primary caregivers in both community and facility settings. Strengthening their roles through training, technology, and structured intervention models could drive meaningful improvements in maternal health outcomes and support progress toward Sustainable Development Goal.

Conclusion

This systematic review and meta-analysis found that nurse-led interventions are associated with a significant increase in ANC attendance. The pooled OR of 1.48 (95% CI: 1.06–2.08) supports the integration of nurses into maternal health delivery models, particularly in settings with limited access to physicians. Future research should aim for standardized outcome reporting and include more robust designs to allow for broader meta-analytic comparison. Policymakers should consider expanding and investing in nurse-led initiatives as part of national strategies to reduce maternal mortality. These findings support the strategic integration of nurses into maternal health delivery systems in LMICs, with implications for policy, training, and health system design.

References

1. Ekwuazi EK, Chigbu CO, Ngene NC. Reducing maternal mortality in low- and middle-income countries. Case Reports in Women's Health. 2023; 39:e00542.
2. Alkema L, Chou D, Hogan D, Zhang S, Moller AB, Gemmill A, et al. National, regional, and global levels and trends in maternal mortality between 1990 and 2015 with scenario-based projections to 2030: a systematic analysis by the United Nations Maternal Mortality Estimation Inter-Agency Group. Lancet. 2016; 387(10017):462–74.

3. Ayele AD, Tilahun ZA. Magnitude of Preeclampsia and Associated Factors Among Women Attending Delivery Service in Debre Tabor Specialized Hospital. Ethiopian Journal of Health Sciences. 2022; 32(2):279–88.
4. White NJ. Anaemia and malaria. Malaria Journal. 2018; 17(1):371.
5. Ngonzi J, Tornes YF, Mukasa PK, Salongo W, Kabakyenga J, Sezalio M, et al. Puerperal sepsis, the leading cause of maternal deaths at a Tertiary University Teaching Hospital in Uganda. BMC Pregnancy Childbirth. 2016; 16(1):207.
6. Feruza N, Wang Z. Evaluation of Puerperal and Postpartum Infections after Cesarean Section and Their Clinical Outcomes. Open Journal of Internal Medicine. 2023; 13(4):330–50.
7. Wainaina GM, Kaura D, Jordan P. A systematic review on continuity of care for effective coordination in maternal and neonatal health continuum: Experiences of skilled birth attendants. International Journal of Africa Nursing Sciences. 2024; 21:100776.
8. Hosler JJF, Abrams JA, Godsay S. Combining task shifting and community-based care to improve maternal health: Practical approaches and patient perceptions. Social Science & Medicine. 2018; 216:26–32.
9. Humphrey E, Burston A, McInnes E, Cheng H, Musgrave-Takeda M, Wan CS. Clinicians' and Patients' Experiences and Perceptions on the Prevention and Management of Surgical Site Infections: A Mixed-Methods Systematic Review. Journal of Clinical Nursing. 2025; 34(1):24–48.
10. Luwaga R, Beebwa E, Ngonzi J, Nduhukire T, Brennaman L. Providing education and tools increases nurses' and midwives' assessment for puerperal sepsis in a regional referral hospital in South Western Uganda. International Journal of Africa Nursing Sciences. 2022; 17:100487.
11. Amoah B, Anto EA, Osei PK, Pieterson K, Crimi A. Boosting antenatal care attendance and number of hospital deliveries among pregnant women in rural communities: a community initiative in Ghana based on mobile phones applications and portable ultrasound scans. BMC Pregnancy and Childbirth. 2016; 16(1):141.
12. Actis Danna V, Bedwell C, Wakasiaka S, Lavender T. Utility of the three-delays model and its potential for supporting a solution-based approach to accessing intrapartum care in low- and middle-income countries. A qualitative evidence synthesis. Global Health Action. 2020; 13(1):1819052.
13. Kante M, Målqvist M. Effectiveness of SMS-based interventions in enhancing antenatal care in developing countries: a systematic review. BMJ Open. 202; 15(2):e089671.
14. Souza JP, Day LT, Rezende-Gomes AC, Zhang J, Mori R, Baguiya A, et al. A global analysis of the determinants of maternal health and transitions in maternal mortality. The Lancet Global Health. 2024; 12(2):e306–16.
15. Okpani AI, Abimbola S. The midwives service scheme: a qualitative comparison of contextual determinants of the performance of two states in central Nigeria. Global Health Research and Policy. 2016; 1(1):16.
16. Oladimeji OJ, Fatusi AO. Realist Evaluation of the "Abiye" Safe Motherhood Initiative in Nigeria: Unveiling the Black-Box of Program Implementation and Health System Strengthening. Frontiers Health Service. 2022; 2:779130.
17. Guilamo-Ramos V, Johnson C, Thimm-Kaiser M, Benzekri A. Nurse-led approaches to address social determinants of health and advance health equity: A new framework and its implications. Nursing Outlook. 2023 Nov 1;71(6):101996.
18. Abraham JM, Melendez-Torres G. A realist review of interventions targeting maternal health in low- and middle-income countries. Womens Health (London). 2023; 19:17455057231205687.
19. Ahumada-Canale A, Jeet V, Bilgrami A, Seil E, Gu Y, Cutler H. Barriers and facilitators to implementing priority setting and resource allocation tools in hospital decisions: A systematic review. Social Science & Medicine. 2023; 322:115790.
20. Miller TR. Projected Outcomes of Nurse-Family Partnership Home Visitation During 1996-2013, United States. Prevention science. 2015; 16(6):765–77.
21. Gallos I, Devall A, Martin J, Middleton L, Beeson L, Galadanci H, et al. Randomized Trial of Early Detection and Treatment of Postpartum Hemorrhage. The New England Journal of Medicine. 2023; 389(1):11–21.
22. Sevene E, Sharma S, Munguambe K, Sacoor C, Vala A, Macuacua S, et al. Community-level interventions for pre-eclampsia (CLIP) in Mozambique: A cluster randomised controlled trial. Pregnancy Hypertension. 2020; 21:96–105.

23. Vousden N, Lawley E, Nathan HL, Seed PT, Gidiri MF, Goudar S, et al. Effect of a novel vital sign device on maternal mortality and morbidity in low-resource settings: a pragmatic, stepped-wedge, cluster-randomised controlled trial. The Lancet Global Health. 2019; 7(3):e347–56.
24. Choudhury A, Asan O. Role of Artificial Intelligence in Patient Safety Outcomes: Systematic Literature Review. JMIR Medical Informatics. 2020; 8(7):e18599.
25. Henry EG, Thea DM, Hamer DH, DeJong W, Musokotwane K, Chibwe K, et al. The impact of a multi-level maternal health programme on facility delivery and capacity for emergency obstetric care in Zambia. Global Public Health. 2017; 13(10):1481–94.
26. Wafula ST, Kananura RM, Pande G, Kizito F, Namutamba S, Kyobe B, et al. Effect of community – facility linked interventions on maternal health service utilization and newborn care in rural low-resource settings in Eastern Uganda. BMC Pregnancy and Childbirth. 2024 Oct 22;24(1):692.
27. Huq NL, Ahmed A, Haque N al, Hossaine M, Uddin J, Ahmed F, et al. Effect of an integrated maternal health intervention on skilled provider's care for maternal health in remote rural areas of Bangladesh: a pre and post study. BMC Pregnancy and Childbirth. 2015;15(1):104.
28. Iamchareon T, Meetipkit J. Effectiveness of Nursing Guideline to Prevent Postpartum Hemorrhage on Blood Loss and Rate of Postpartum Hemorrhage after Cesarean Section. Thai Pharmaceutical and Health Science Journal. 2020; 15(2):81-9.
29. Olaniran A, Madaj B, Bar-Zev S, van den Broek N. The roles of community health workers who provide maternal and newborn health services: case studies from Africa and Asia. BMJ Global Health. 2019; 4(4):e001388.
30. Sandall J, Fernandez Turienzo C, Devane D, Soltani H, Gillespie P, Gates S, et al. Midwife continuity of care models versus other models of care for childbearing women. Cochrane Database Systematic Review. 2024; 2024(4):CD004667.
31. Vowles Z, Lovell H, Black M, Sandall J, Easter A. Models of care for pregnant women with multiple long-term conditions and the role of the midwife: A scoping review. Women and Birth. 2024; 37(5):101645.
32. Singh P, Singh KK, Singh P. Maternal health care service utilization among young married women in India, 1992–2016: trends and determinants. BMC Pregnancy and Childbirth. 2021; 21(1):122.
33. Tolani H, Neogi SB, Pandey AK, Khan PK, Mishra SS. Contributing factors for reduction in maternal mortality ratio in India. Scientific reports. 2024; 14(1):14883.
34. Yihune Teshale M, Bante A, Gedefaw Belete A, Crutzen R, Spigt M, Stutterheim SE. Barriers and facilitators to maternal healthcare in East Africa: a systematic review and qualitative synthesis of perspectives from women, their families, healthcare providers, and key stakeholders. BMC Pregnancy and Childbirth. 2025; 25(1):111.
35. Jacobsson B, Requejo JH, Dey T, Lavin T, Mannah MT, Menon R, et al. Women's health and maternal care services: seizing missed opportunities to prevent and manage preterm birth. Reproductive Health. 2025; 22(2):109.

Ethics and Technology in Nursing Education: Rethinking Artificial Intelligence

Palmira Canales-Morales[1]
https://orcid.org/0000-0002-4649-6780

Essay

UNIVERSIDAD DE ANTIOQUIA
1803

Ethics and Technology in Nursing Education: Rethinking Artificial Intelligence.

Abstract

This essay aims to critically reflect on the ethical challenges posed by the incorporation of artificial intelligence (AI) in the education of nursing professionals. Based on an argumentative review of recent scientific literature, three key dimensions are analyzed: personalized learning as an opportunity to promote inclusion and academic autonomy; the potential of AI to reduce educational gaps through public policies that guarantee digital equity; and the strengthening of clinical and ethical judgment through AI-assisted simulations in educational environments. Likewise, the risks associated with its implementation are addressed, such as algorithmic surveillance, the mechanization of moral reasoning, and technological exclusion in contexts with low digital literacy. It is concluded that the real challenge does not lie in the technology itself, but in how it is designed, regulated,

1 Nurse, Ph.D Candidate. Professor, Universidad Santo Tomás, Sede Santiago, Chile. Email: palmiracanalesmo@santotomas.cl. Corresponding author

Conflicts of interest: None
Received: August 4, 2025.
Approved: October 1, 2025.

How to cite this article: Canales-Morales P. Ethics and Technology in Nursing Education: Rethinking Artificial Intelligence. Investigación y Educación en Enfermería. 2025; 43(3):14.

DOI: https://doi.org/10.17533/udea.iee.v43n3e14

and pedagogically integrated in terms of care, dignity, and critical thinking. Finally, the need to advance research that guides regulatory frameworks and educational proposals to ensure an ethical, inclusive, and contextualized integration of AI in nursing education is suggested.

Descriptors: artificial intelligence; ethics, nursing; education, nursing; health equity.

Ética y tecnología en la formación de enfermería: repensando la inteligencia artificial

Resumen

Este ensayo tiene como objetivo reflexionar críticamente sobre los desafíos éticos que plantea la incorporación de la inteligencia artificial (IA) en la formación de profesionales de enfermería. A partir de una revisión argumentativa de literatura científica reciente, se analizan tres dimensiones clave: la personalización del aprendizaje como oportunidad para favorecer la inclusión y la autonomía académica; el potencial de la IA para reducir brechas educativas mediante políticas públicas que garanticen equidad digital; y el fortalecimiento del juicio clínico y ético a través de simulaciones asistidas por IA en entornos formativos. Asimismo, se abordan los riesgos asociados a su implementación, como la vigilancia algorítmica, la mecanización del razonamiento moral y la exclusión tecnológica en contextos con baja alfabetización digital. Se concluye que el verdadero desafío no radica en la tecnología en sí, sino en cómo se diseña, regula e integra pedagógicamente en función del cuidado, la dignidad y el pensamiento crítico. Finalmente, se sugiere la necesidad de avanzar en investigaciones que orienten marcos normativos y propuestas educativas que aseguren una integración ética, inclusiva y contextualizada de la IA en la formación en enfermería.

Descriptores: inteligencia artificial; ética en enfermería; educación en enfermería; equidad en salud.

Ética e Tecnologia na Educação em Enfermagem: Repensando a Inteligência Artificial

Resumo

Este ensaio tem como objetivo refletir criticamente sobre os desafios éticos impostos pela incorporação da inteligência artificial (IA) na formação de profissionais de enfermagem. A partir de uma revisão argumentativa da literatura científica recente, são analisados três aspectos-chave: a personalização da aprendizagem como oportunidade para promover a inclusão e a autonomia acadêmica; o potencial da IA para reduzir lacunas educacionais por meio de políticas públicas que garantam a equidade digital; e o fortalecimento do julgamento clínico e ético por meio de simulações assistidas por IA em ambientes de formação. Também são abordados os riscos associados à sua implementação, como a vigilância algorítmica, a mecanização do raciocínio moral e a exclusão tecnológica em contextos de baixa alfabetização digital. Conclui-se que o verdadeiro desafio não está na tecnologia em si, mas em como ela é projetada, regulada e integrada pedagogicamente com base no cuidado, na dignidade e no pensamento crítico. Por fim, sugere-se a necessidade de avançar em pesquisas que orientem marcos regulatórios e propostas educacionais que garantam a integração ética, inclusiva e contextualizada da IA na educação em enfermagem.

Descritores: inteligência artificial; ética em enfermagem; educação em enfermagem; equidade em saúde.

Introduction

Artificial intelligence (AI), since it was coined in 1956 at the Dartmouth Conference by John McCarthy, has gone through a long path of technological evolution. In 2022, this trajectory took a transcendental turn with the emergence of generative artificial intelligence (GenAI), marking a before and after in multiple fields, including higher education.[1] This advance, although fascinating, has exceeded the capacity of societies to regulate its impacts. While legitimate ethical concerns persist, the potential of GenAI to transform educational practices and strengthen the preparation of future health professionals is undeniable.[2] In the health field, AI promises to optimize processes, improve diagnoses, and personalize learning experiences. However, its adoption faces important ethical and practical barriers, such as trust in systems, algorithmic transparency, and effective integration into complex clinical workflows.[3] In the specific field of nursing, technologies such as chatbots or AI-enhanced simulators have positioned themselves as promising tools to enrich training: they allow for more adaptive, accessible, and motivating learning. Even so, their incorporation is not free of ethical tensions, especially in a discipline where care, empathy, and social responsibility constitute fundamental pillars of the educational act.[4]

As these technologies are integrated into the classroom, it becomes essential that teachers and students develop the competencies to use them with critical and ethical sense. Issues such as privacy, algorithmic biases, student autonomy, and the use of sensitive data require not only deep digital literacy, but also regulatory and pedagogical frameworks that guide their implementation. In this sense, it has been proposed to advance in three strategic areas: the construction of solid ethical frameworks, the promotion of interdisciplinary collaboration, and investment in continuous training for all the actors involved.[5] These strategies seek to ensure that AI does not deepen existing inequalities, but rather becomes a tool at the service of the common good, sustained in values such as equity, inclusion, and safety. In this context, GenAI cannot be understood solely as a technical leap, but as a transformation that directly questions the ethical and pedagogical foundations of teaching, especially in a discipline such as nursing, where technical, humanistic, and ethical knowledge converge. As various authors warn, the ethical dilemmas that emerge with AI range from privacy and individual autonomy to broader issues of social justice, environmental sustainability, and civil rights.[6] When these dilemmas are transferred to the educational field, they directly affect the way future generations of health professionals are trained.

The expansion of automated systems, personalization algorithms, and adaptive platforms poses concrete risks: the dehumanization of pedagogical relationships, the standardization of learning, and the reproduction of social and digital inequalities. Added to this is the concern about a possible loss of autonomy

both for students and teachers, when educational decisions begin to be delegated to systems that are opaque and difficult to audit.[6] In view of this panorama, the present essay adopts a critical, reflective, and purposeful stance regarding the role of artificial intelligence in the training of nurses. Based on the analysis of recent scientific evidence, it examines the risks and opportunities that this technology represents for health education, with the aim of proposing guidelines that allow for its ethical, contextualized, and humanized integration. The thesis that guides this work is that AI can become a valuable ally in educational processes, as long as its implementation is guided by ethical, pedagogical, and social principles oriented towards the care of human dignity, educational justice, and critical thinking.

From this perspective, the essay is structured around three central arguments. First, the potential of AI to personalize learning is addressed, adapting to the pace and needs of each student, which could help reduce academic dropout and strengthen autonomy. Second, its capacity to promote greater educational equity is explored, provided that its implementation is accompanied by inclusive public policies and strategies to reduce the digital divide. Finally, the role of AI in strengthening clinical and ethical judgment through formative simulations is analyzed, without losing sight of the risks of mechanization of moral reasoning. In short, this essay seeks to open an academic and ethical debate on how to critically inhabit technology in the formative processes of nursing. It is not about rejecting AI nor assuming it with naïve enthusiasm, but about collectively thinking about how to integrate it without giving up what is essential: the sensitivity, the ethics, and the human encounter that give meaning to care.

Personalization of Learning: A Pedagogical Opportunity with Ethical Risks

The integration of artificial intelligence (AI) into nursing education presents itself as a profoundly transformative pedagogical strategy. Its ability to personalize learning, adapt content to individual needs, and provide immediate feedback offers unique opportunities to optimize the educational process.[7,8] Through real-time data analysis, AI-based systems can adjust the pace, formats, and teaching strategies, responding to students' diverse skill levels and learning styles.[8] In contexts where student groups are large and heterogeneous, this technology acts as a strategic ally of faculty, allowing them to address differences that would otherwise go unattended. The aim is not to replace teachers but to expand and strengthen their capacity for accompaniment, especially when faced with limitations of time or resources. This type of support can have a direct impact on students' self-esteem, motivation, and autonomy, by offering a fairer and more inclusive learning experience.[9] Furthermore, the personalization that AI offers helps address one of the major challenges of higher education in Latin America: student attrition. Several studies have shown that low academic performance, curricular misalignment, lack of effective feedback, and limited faculty support are determining factors in university dropout.[10,11] In health-related programs, these risks are accentuated during the first semesters, when adapting to the pace of university life is crucial.[12]

In this scenario, AI can provide concrete solutions: by offering adaptive practices, simulating clinical scenarios, identifying learning gaps in a timely manner, and providing personalized support, academic trajectories are strengthened, and student retention is improved. For example, intelligent tools can identify students with difficulties in pharmacology and generate additional exercises to reinforce their learning something difficult to achieve with traditional methods in overcrowded classrooms. In nursing, where the acquisition of clinical, cognitive, and ethical competencies requires constant practice, al-powered simulated environment offer a safe and flexible alternative. These platforms allow students to repeat procedures, make mistakes without real-world consequences, and receive

immediate feedback.[13] This democratizes access to learning opportunities that, in real clinical settings, are often distributed unequally. From an ethical perspective, this personalization represents a concrete way of applying the principle of justice in education, by providing equal training opportunities, reducing access gaps, and enabling each student to develop their potential. Likewise, the principle of beneficence is reflected in the commitment to use technologies that favor students' academic and integral well-being.

Towards Ethical Surveillance and Strengthened Autonomyz

Concerns about algorithmic surveillance and the loss of autonomy are legitimate and must be taken seriously. However, it is important to recognize that the risks associated with the use of artificial intelligence (AI) in education do not derive from the technology itself, but from the way it is designed, managed, and implemented. Therefore, the challenge is not merely technical, but also ethical and political: the focus should be on promoting critical governance of AI, articulating clear regulatory frameworks, processes of informed consent, algorithmic transparency, and the active participation of students in the decisions that affect them. In this regard, it has been pointed out that AI-supported educational systems should empower students, allowing them to understand, audit, and even intervene in automated recommendations.[18] This transparency not only protects fundamental rights but also strengthens their autonomy, positioning them as active subjects in their learning process. To achieve this, it is essential to incorporate ethical training and digital literacy from the early stages of the educational system, as recommended by the United Nations Educational, Scientific and Cultural Organization.[7]

Beyond understanding autonomy as a merely individualistic ideal, it can also be conceived from a relational perspective: if implemented critically and reflectively, AI can act as an extension of the self-learning process, enabling each student to make more informed decisions about their personal and professional development.[9] In this context, the role of teachers does not disappear but is transformed. By being freed from repetitive or administrative tasks, new spaces open up to strengthen critical mentoring, emotional support, and the teaching of ethical and professional values.[2] It is also imperative that states assume an active and regulatory role regarding these technologies. The misuse of educational data undermines fundamental rights such as privacy, informational self-determination, and equity. Regulatory models such as the General Data Protection Regulation (GDPR) in Europe, the Family Educational Rights and Privacy Act (FERPA) in the United States, or emerging policies in Asian countries can serve as references to guarantee the protection of students' data and establish minimum standards of digital ethics in the educational field.[19] In sum, AI can and must contribute to more inclusive, personalized, and effective education, provided that its integration is guided by solid ethical principles, robust regulatory frameworks, and critical human oversight. The point is not to renounce technology, but to inhabit it consciously, safeguarding the dignity, privacy, and autonomy of learners

Artificial Intelligence as a Promoter of Educational Equity

Educational equity is an ethical principle that seeks to ensure that all students—regardless of their social, economic, or cultural background—have access to quality education. Unlike equality, which implies offering the same to everyone, equity acknowledges structural inequalities and proposes differentiated support to provide each person with real opportunities for learning and development.[19] Among its key dimensions are the fair distribution of resources, the strengthening of teaching capacities, the design of inclusive pedagogical practices, and the constant monitoring of gaps with the aim of proactively reducing them. AI, when implemented through a critical and pedagogically oriented lens, can

significantly contribute to these purposes. AI-based tools allow for the adaptation of content, the delivery of personalized feedback, the generation of accessible materials, and the early detection of academic difficulties, thereby facilitating more effective support that is sensitive to diversity.[20,21] From this perspective, AI positions itself as a tool with great potential to foster inclusive educational environments. Technologies such as voice recognition, screen readers, automatic transcription, and subtitles help eliminate historical barriers faced by students with disabilities. Likewise, early warning systems that analyze academic data can identify risks of dropout or academic delay, allowing for timely interventions, especially during the first semesters of university studies.[21] AI also promotes methodological diversification by tailoring teaching to different cognitive styles, learning paces, and educational trajectories. This personalization is particularly valuable for vulnerable populations, such as students who work, who perform caregiving duties, or who belong to cultural or linguistic minorities. In this sense, educational equity is not limited only to access, but also to the relevance, depth, and quality of learning.

Nevertheless, for this personalization to be ethical, it is essential to consider the risks associated with algorithmic bias. Several studies have demonstrated that AI systems can reproduce and even amplify preexisting prejudices, depending on how they were trained. These biases may arise from incomplete data, erroneous assumptions by developers, or non-representative datasets.[22,23] In education, this could translate into unfair decisions that negatively affect academic trajectories, reinforcing stereotypes of gender, race, or social class. As an illustrative example, a generative AI system was asked how it perceives university students, particularly those studying nursing.[24] The responses revealed troubling stereotypes: the idealization of young students, the invisibilization of non-linear educational paths, the assumption of homogeneous access to technology, the undervaluing of the emotional dimensions of learning, and even gender and professional subordination biases. Although generated by an automated system, these responses reflect social imaginaries still in force, which risk being reinforced if not critically addressed. All of this shows that AI is not a neutral technology. When integrated into teaching processes—especially in contexts such as nursing, where technical, ethical, and humanistic knowledge converge—it becomes imperative to question what discourses it reinforces, what experiences it excludes, and what criteria it reproduces in decision-making. If these logics are not critically reviewed, we could end up perpetuating the very prejudices we seek to transform.

Deepening of Structural Digital Divides

Despite its inclusive potential, the implementation of artificial intelligence (AI) can also exacerbate existing inequalities if structural gaps are not critically addressed. It has been noted that access to these technologies varies enormously across countries, regions, and educational communities.[7] While institutions in high-income contexts often have stable connectivity, technological resources, and political support, many areas of the Global South still face basic deficiencies such as access to devices, continuous electricity, or even elementary digital literacy. These digital divides are not limited solely to material access to the internet or technological tools; they also include the ability to use them critically, to adapt them to local realities, and to integrate them pedagogically into learning processes.[20] In this scenario, a rapid deployment of AI without accompanying public policies—such as infrastructure development, teacher training, technical support, and sustained funding—could generate new forms of exclusion. Some students may not understand how these tools work, may lack adequate guidance, or may only have access to outdated versions of platforms, thereby deepening educational inequality.

Another significant risk is the imposition of pedagogical and epistemological models disconnected from local contexts. Many AI systems are developed in urban, technologically advanced, and culturally homogeneous environments, where English predominates and knowledge is shaped by standardized logics. By failing to incorporate the cultural, linguistic, and community richness of rural areas or Indigenous peoples, such tools risk reinforcing technological dependence, invisibilizing local knowledge, and reproducing colonial hierarchies of knowledge.[21] In short, digital equity is not achieved solely by providing more technology, but through intersectoral policies that recognize the multiple dimensions of inequality and ensure fair conditions for access, appropriation, and participation. Otherwise, AI could become not a bridge, but a new boundary that deepens the very inequalities it aims to overcome.

Digital Equity Requires Political Will, Not Technological Abandonment

The risk of deepening inequalities should not lead to abandoning the use of artificial intelligence (AI) in education. On the contrary, it constitutes an ethical call to transform it into an ally for educational justice. The dilemma does not lie in whether to use technology, but in how, for what, and for whom it is implemented.[7,25] Achieving true digital equity requires more than access to infrastructure: it demands sustained investment in connectivity, continuous teacher training, the production of culturally relevant content, the development of ethical frameworks, and the active participation of educational communities. Equity is not achieved merely by providing more devices, but by fostering inclusive pedagogies, empowering teachers, and preparing students capable of critically understanding the digital world they inhabit.[19] Some countries have shown that an ethical and equitable integration of AI is possible.

Experiences developed in contexts such as Finland, Singapore, or Estonia demonstrate that, with coordinated public policies, teacher training programs, and continuous evaluation mechanisms, it is possible to align technological innovation with the principles of equity, inclusion, and democratic participation.[19] These examples show that AI is not exclusionary by nature; it becomes exclusionary when it is deployed without context, without participation, and without clear ethical criteria. Ultimately, the issue is not to idealize technology nor to assume it as a panacea. It is about committing pedagogically and politically to a more just education, in which AI is not a privilege reserved for a few, but a right built collectively. Digital equity is possible, but it requires courageous decisions, institutional will, and an ethics radically committed to the dignity of all students.

Strengthening Clinical and Ethical Judgment through Simulated Environments

Clinical judgment constitutes an essential competency in the training of nursing professionals, as it enables prudent and well-founded decisions in complex care scenarios. This judgment is not limited to technical mastery: it involves ethical reasoning, moral sensitivity, and the ability to act with discernment in the face of human suffering.[2,17] However, several studies have indicated that this competency is not always adequately developed during professional training, revealing the need for a profound renewal of the pedagogical strategies employed in educational processes.[5,18] In this context, clinical simulation—especially high-fidelity simulation—has become a key strategy for strengthening clinical and ethical judgment in nursing.[9] With the incorporation of artificial intelligence (AI), these educational experiences acquire a new dimension. Advanced platforms make it possible to recreate complex clinical scenarios, with adaptive and immediate feedback that guides students in their decision-making. These simulations can include ethical dilemmas such as care prioritization, informed consent, or patient confidentiality, integrating technical and moral components in a single educational experience.

Moreover, these tools allow the representation of emotions, uncertainties, and tensions characteristic of real clinical settings. It has been documented that AI-assisted simulation environments not only strengthen clinical reasoning but also promote skills such as emotional self-regulation, empathy, and interprofessional communication.[4,5,9] These abilities are fundamental in nursing practice, where the human dimension of care cannot be replaced by any algorithm. From a phenomenological perspective, it has been proposed that clinical judgment is constructed in contexts of uncertainty, where the professional must respond to the suffering of others with practical wisdom based on experience and situated reflection.[17] In this sense, AI-enhanced simulations can place students in ethically challenging scenarios, where they must confront decisions without unique answers, deliberate responsibly, and reflect on the deeper meaning of their actions. Thus, technology does not replace moral sensitivity but cultivates it through meaningful educational experiences.

Nevertheless, critical voices also warn about the risks of an education excessively mediated by intelligent technologies. It has been argued that the automation of simulations could create the false impression that there is only one correct answer, thereby inhibiting ethical judgment and limiting divergent thinking.[4] Likewise, excessive dependence on digital platforms could weaken clinical intuition and the ability to interpret context—elements that are indispensable in nursing practice.[18] These warnings call for deep reflection: How can we integrate technology without impoverishing the ethical dimension of care? How can we train professionals who are technically competent but also ethically sensitive and empathetic? The key does not lie in choosing between technology or humanism, but in articulating both with pedagogical intent, critical openness, and commitment to the dignity of others.

Clinical Judgment Is Strengthened in Ethically Designed Environments

Clinical judgment cannot be reduced to a technical skill, nor does it develop spontaneously. It is a competency cultivated in carefully designed pedagogical environments that promote critical reflection, ethical deliberation, and meaningful learning. Far from replacing these processes, artificial intelligence (AI) can enhance them, provided its integration is guided by a humanized educational intent and accompanied by teachers committed to care.[2] Evidence has shown that when AI is incorporated into clinical simulation environments in a critical and deliberative manner, it can strengthen students' ability to reflect on ethical dilemmas and make complex decisions in simulated contexts.[4,9] In these scenarios, AI does not provide automatic answers or impose closed criteria; instead, it poses challenges that invite students to think, argue, and assume responsibility for their own judgment.

International recommendations on the ethical use of AI in education emphasize the need for these technologies to promote human dignity, inclusion, and critical thinking.[7] Simulating ethical dilemmas with AI does not mean automating moral responses, but recreating experiences that challenge students, confront them with possible alternatives, and invite them to assume responsibility for their decisions. When these tools are combined with faculty guidance and spaces for collective reflection, they become allies of clinical judgment, not threats to it. The key lies in pedagogical design. It is not about technology deciding for students, but about creating experiences that stimulate their ethical discernment. It is not about replacing deliberation, but provoking it. Because in nursing, deciding is also an act of care, and caring always requires an ethical, situated, and profoundly human perspective.[17,18]

Conclusions

This essay has maintained the thesis that artificial intelligence (AI), when incorporated into nursing education from an ethical, inclusive, and pedagogically intentional perspective, can become a powerful tool to enrich learning without compromising the humanized dimension that characterizes care. Far from a technophobic or technocratic stance, a critical and situated perspective has been proposed, one that makes it possible to engage with technology without abandoning the principles that give meaning to health education. Throughout the text, three main arguments were developed, each accompanied by its respective counterargument and refutation, in order to explore both the possibilities and the tensions that arise when introducing intelligent technologies into educational spaces in health.

First, it was argued that AI has enormous potential to personalize learning, adapting to the individual needs of students in contexts marked by heterogeneity and structural limitations. This adaptive capacity fosters autonomy, motivation, and academic performance. However, warnings were raised about the risks of algorithmic surveillance and loss of privacy, with transparent regulatory frameworks and student participation mechanisms proposed as urgent responses to ensure ethical and informed accompaniment.[9,14]

Second, it was maintained that AI could become an ally in reducing historical educational gaps, provided it is embedded in inclusive public policies, continuous teacher training, and strategies for critical digital literacy. Its potential to generate accessibility, identify specific needs, and diversify educational resources is especially relevant in highly vulnerable contexts. Nevertheless, it was also recognized that, without state investment and contextualized design, technology risks deepening structural and epistemic inequalities. Therefore, the ethical requirement of conceptualizing AI from its origin with criteria of justice, equity, and cultural relevance was reaffirmed.[9,19,20]

The third argument addressed the contribution of AI to strengthening students' clinical and ethical judgment, particularly through pedagogically designed clinical simulations. These tools make it possible to recreate complex care scenarios, provide immediate feedback, and promote prudent, empathetic, and safe decision-making. Faced with fears that such technologies could mechanize moral reasoning, an alternative perspective was proposed: AI does not replace ethical deliberation, but can enhance it when integrated into pedagogical environments guided by teachers trained in the ethics of care. From a phenomenological approach, it was argued that these formative experiences can consolidate the professional identity of caregivers, by placing them in contexts of uncertainty, responsibility, and compassion.[2,5,17]

Taken together, these three arguments allow us to affirm that AI does not constitute an intrinsic threat to nursing education. Its impact will depend on the ethical and political sense that guides its incorporation. The counterarguments raised—algorithmic surveillance, digital exclusion, and mechanization of judgment—should not be interpreted as reasons to reject technology, but as necessary warnings that reinforce the urgency of designing critical governance, developing inclusive policies, and promoting context-sensitive pedagogies. As various studies warn, the ethics of AI in education is today an emerging field that must be addressed with urgency. It is not enough to teach how to use these tools; it is imperative to train professionals capable of questioning them, transforming them, and orienting them toward the common good.[6] Artificial intelligence should not be imposed as a neutral promise, but as a tool that must be at the service of life, justice, and care.

Finally, this essay invites us to rethink the meaning of the educational act in times of automation.

Training in nursing is not simply about transmitting techniques or integrating devices, but about cultivating critical thinking, empathetic sensitivity, and an ethic of care capable of resisting the logic of efficiency and keeping the human dimension at the center of learning. On this path, artificial intelligence should not displace care, but rather reinforce its depth, its complexity, and its dignity.

References

1. Mondal H. Ethical engagement with artificial intelligence in medical education. Advances in Physiology Education. 2025; 49(1):163-5.
2. Lane SH, Haley T, Brackney DE. Tool or Tyrant: Guiding and Guarding Generative Artificial Intelligence Use in Nursing Education. Creative Nursing. 2024; 30(2):125-32.
3. Esmaeilzadeh P. Challenges and strategies for wide-scale artificial intelligence (AI) deployment in healthcare practices: A perspective for healthcare organizations. Artificial Intelligence in Medicine. 2024; 151:102861.
4. Tam W, Huynh T, Tang A, Luong S, Khatri Y, Zhou W. Nursing education in the age of artificial intelligence powered Chatbots (AI-Chatbots): Are we ready yet? Nurse Education Today. 2023; 129:105917.
5. Srinivasan M, Venugopal A, Venkatesan L, Kumar R. Navigating the Pedagogical Landscape: Exploring the Implications of AI and Chatbots in Nursing Education. JMIR Nursing. 2024; 7:e52105.
6. Huang C, Zhang Z, Mao B, Yao X. An overview of artificial intelligence ethics. IEEE Transactions on Artificial Intelligence. 2023; 4(4):799-819.
7. UNESCO. Recomendación sobre la ética de la inteligencia artificial [Internet]. París: UNESCO; 2021 [cited 2025 Aug 1]. Available from: https://unesdoc.unesco.org/ark:/48223/pf0000381137
8. Yurt E. AI-Powered Personalized Education: Impacts on Student Achievement and Future Perspectives. In: Proceedings of the International Conference on Education. Chicago; 2024. p. 64-72.
9. Sidiropoulos D, Anagnostopoulos CN. Applications, challenges and ethical issues of AI and ChatGPT in education. Ciencias de la Computación. 2024; 1-6.
10. Ramírez Heredia RC, Carcausto-Calla W. Factors associated with student dropout in Latin American universities: Scoping review. Journal of Educational and Social Research. 2024; 14(2):62-72.
11. Pérez-Jaimes AK, Estrada-Reyes CU, Hurtado-Velmar KP. Factores causales de la deserción escolar en alumnos de nivel superior. Revista de Investigación Latinoamericana en Competitividad Organizacional. 2025; 7(25):93-100.
12. Martínez Reinoso AR, Laínez Tomalá AD, Bravo López JA, Cevallos Mendoza LA, Vera Delgado FV. Factores asociados a la deserción estudiantil en los primeros años de carreras de salud: una revisión sistemática de intervenciones y estrategias de retención. Revista Social Fronteriza. 2024; 4(5):e45461.
13. American Nurses Association. The ethical use of artificial intelligence in nursing practice [Internet]. Silver Spring (MD): ANA; 2022 [cited 2025 Aug 1]. Available from: https://www.nursingworld.org/globalassets/practiceandpolicy/nursing-excellence/ana-position-statements/the-ethical-use-of-artificial-intelligence-in-nursing-practice_bod-approved-12_20_22.pdf
14. Oye E, Edwin F, Owen J. Ethical considerations in AI-driven education. ResearchGate Preprint. 2024; 1-23.
15. Williamson B. Policy networks, performance metrics and platform markets: Charting the expanding data infrastructure of higher education. British Journal of Educational Technology. 2019; 50(6):2794-809.
16. Chinta SV, Wang Z, Yin Z, Hoang N, Gonzalez M, Le QT, et al. FairAIED: Navigating fairness, bias, and ethics in educational AI applications. AI and Ethics. 2024. Available in: https://arxiv.org/pdf/2407.18745
17. Escobar-Castellanos B, Jara Concha P. Filosofía de Patricia Benner, aplicación en la formación de enfermería: propuestas de estrategias de aprendizaje. Educación. 2019; 28(54):182-202.

18. Knopp MI, Warm EJ, Weber D, Kelleher M, Kinnear B, Schumacher DJ, et al. AI-Enabled Medical Education: Threads of change, promising futures, and risky realities across four potential future worlds. JMIR Medical Education. 2023; 9:e50373.
19. Vincent-Lancrin S, Van der Vlies R. Trustworthy artificial intelligence (AI) in education. París: OECD; 2020 Apr.
20. OECD. Equity and inclusion in education [Internet]. Paris: Organisation for Economic Co-operation and Development; 2023 [cited 2025 Aug 1]. Available from: https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/01/equity-and-inclusion-in-education_e8cfc768/e9072e21-en.pdf
21. Melo-López VA, Basantes-Andrade A, Gudiño-Mejía CB, Hernández-Martínez E. The impact of artificial intelligence on inclusive education: a systematic review. Education Sciences. 2025; 15(5):539.
22. Comas-Forjas R. Sesgos algorítmicos en educación: Casos y soluciones. In: Proceedings of the 8th Virtual International Conference on Education, Innovation and ICT. Universitat de les Illes Balears; 2023. p. 329-30.
23. Akgun S, Greenhow C. Artificial intelligence in education: Addressing ethical challenges in K-12 settings. AI and Ethics. 2022; 2(3):431-40.
24. Sabzalieva E, Valentini A. ChatGPT and artificial intelligence in higher education: quick start guide. Caracas: UNESCO; 2023.
25. Martínez V. De qué hablamos cuando hablamos de inteligencia artificial [Internet]. Montevideo: UNESCO; 2024 [cited 2025 Jun 9]. Available from: https://unesdoc.unesco.org/ark:/48223/pf0000391087

Review

Challenges and implications of the use of artificial intelligence in health care, with an emphasis on nursing. Scoping review

Neelam Shah[1,6]
https://orcid.org/0009-0001-8785-1785

Jyoti Bala[2,6]
https://orcid.org/0000-0003-1732-0636

Ashutosh Sharma[3,6]
https://orcid.org/0009-0000-8543-4921

Jitendra Singh Parmar[4,6]
https://orcid.org/0009-0002-4868-6438

Dharmendra Singh[5,6]
https://orcid.org/0009-0003-2652-5358

Challenges and implications of the use of artificial intelligence in health care, with an emphasis on nursing. Scoping review

Abstract

Objective. To review the literature related to ethics of artificial intelligence (AI) in healthcare, with a particular emphasis on its challenges and implications in nursing. **Methods.** Data bases including PubMed, Scopus, Web of Science, and CINAHL are reviewed. Inclusion criteria focused on English-language articles addressing AI ethics in healthcare, with priority given to empirical studies, World Health Organization (WHO) reports, and nursing-specific scholarship. General Search Items included artificial intelligence ethics, AI in healthcare challenges, nursing AI implications, algorithmic bias healthcare, informed consent AI, privacy data protection AI, and WHO AI guidelines,

1 Faculty of Nursing, Email: shahneelam196@gmail.com
2 Faculty of Nursing, Email: jb1849@gmail.com
3 Faculty of Nursing, Email: ashutosh_sharma2008@rediffmail.com
4 Faculty of Nursing, Email: singhjitu222@gmail.com
5 Faculty of Nursing, Email: dharmendrasingh8023@gmail.com
6 Uttar Pradesh University of Medical Sciences, Saifai, Uttar Pradesh, India.

Conflicts of interest: None

Received: July 12, 2025.

Approved: September 16, 2025.

How to cite this article: Shah N, Bala J, Sharma A, Parmar JS, Singh D. Challenges and implications of the use of artificial intelligence in health care, with an emphasis on nursing. Scoping review. Investigación y Educación en Enfermería. 2025; 43(3):e15.

DOI: https://doi.org/10.17533/udea.iee.v43n3e15

combined with Boolean operators (e.g., "AI AND nursing autonomy") and filters for publication date (post-2018) and article type (reviews, originals). **Results.** Most of the studies emphasizes that integration of Artificial intelligence provides substantial benefits for patients, medical professionals, and the overall healthcare framework. Like the improving the primary healthcare, cost reduction, and enhanced efficiency of medical and clinical processes and it also helps where human intelligence is needed i.e. analytical reasoning, acquiring knowledge, and decision-making. While it offers immense possibilities, this technology demands vast amounts of patient information, leading to concerns about confidentiality, protection, and other moral dilemmas. It also highlights the need for nurses to develop AI literacy and bias recognition to balance technological efficiency with humanistic care and ethical evaluation; enabling nurses to monitor unethical AI applications and ensure fairness in patient care. **Conclusion.** AI is revolutionizing the healthcare sector but demands robust ethical governance to mitigate harms like discrimination and privacy erosion. For nursing, proactive integration—via updated curricula and interdisciplinary policies—can foster safe, equitable AI adoption, ultimately advancing human dignity and health outcomes.

Descriptors: maternal health; prenatal care; maternal health services; maternal mortality; nursing care.

Retos e implicaciones del empleo de la inteligencia artificial en la atención sanitaria, con énfasis en la enfermería. Revisión de alcance

Resumen

Objetivo. Revisar la literatura relacionada con la ética de la inteligencia artificial (IA) en la atención sanitaria, con especial énfasis en sus retos e implicaciones en la enfermería. **Métodos.** Se revisaron las bases de datos como PubMed, Scopus, Web of Science y CINAHL. Los criterios de inclusión se centraron en artículos en inglés que abordaban como tema la ética de la IA en la atención sanitaria, dando prioridad a los estudios empíricos, los informes de la Organización Mundial de la Salud (OMS) y los trabajos académicos específicos sobre enfermería. Los términos de búsqueda generales incluyeron ética de la inteligencia artificial, retos de la IA en la atención sanitaria, implicaciones de la IA en la enfermería, sesgo algorítmico en la atención sanitaria, consentimiento informado en la IA, protección de datos y privacidad en la IA y directrices de la OMS sobre la IA, combinados con operadores booleanos (por ejemplo, «IA Y autonomía de la enfermería»), filtros por fecha de publicación (posterior a 2018) y por tipo de artículo (revisiones, originales). **Resultados.** La mayoría de los estudios señalan que la integración de la IA proporciona beneficios sustanciales para los pacientes, los profesionales de la salud y el marco sanitario en general. Por ejemplo, mejora la atención primaria, reduce los costos y aumenta la eficiencia de los procesos clínicos, y también ayuda en aquellos ámbitos en los que se necesita la inteligencia humana, como el razonamiento analítico, la adquisición de conocimientos y la toma de decisiones. Aunque ofrece inmensas posibilidades, esta tecnología exige grandes cantidades de información sobre los pacientes, lo que suscita preocupaciones sobre la confidencialidad, la protección y otros dilemas morales. También se destaca la necesidad de que las enfermeras desarrollen la

alfabetización en IA y el reconocimiento de sesgos con el fin de equilibrar la eficiencia tecnológica con el cuidado humanizado. La evaluación ética permitirá a las enfermeras monitorizar las aplicaciones poco éticas de la IA y garantizar la equidad en la atención al paciente. **Conclusión.** El uso de la IA está revolucionando el sector sanitario, y exige una sólida gobernanza ética para mitigar los posibles daños de su empleo. En el caso de la enfermería, la integración proactiva, mediante la actualización de los planes de estudio, puede fomentar la adopción segura y equitativa de la IA, lo que en última instancia promoverá la dignidad humana y los resultados en materia de salud.

Descriptores: salud materna; atención prenatal; servicios de salud materna; mortalidad materna; atención de enfermería.

Desafios e Implicações do Uso de Inteligência Artificial na Saúde, com Ênfase em Enfermagem. Revisão de Escopo

Resumo

Objetivo. Revisar a literatura relacionada à ética da inteligência artificial (IA) na saúde, com ênfase particular em seus desafios e implicações para a enfermagem. **Métodos.** Foram revisadas bases de dados como PubMed, Scopus, Web of Science e CINAHL. Os critérios de inclusão se concentraram em artigos em inglês que abordassem a ética da IA na saúde, priorizando estudos empíricos, relatórios da Organização Mundial da Saúde (OMS) e trabalhos acadêmicos específicos da enfermagem. Os termos gerais de busca incluíram ética da inteligência artificial, desafios da IA na saúde, implicações da IA para a enfermagem, viés algorítmico na saúde, consentimento informado em IA, proteção de dados e privacidade em IA e diretrizes da OMS sobre IA, combinados com operadores booleanos (por exemplo, "IA E autonomia da enfermagem"), filtros por data de publicação (após 2018) e tipo de artigo (revisões, originais). **Resultados.** A maioria dos estudos indica que a integração da IA oferece benefícios substanciais para pacientes, profissionais de saúde e para o sistema geral de saúde. Por exemplo, melhora a atenção primária, reduz custos e aumenta a eficiência dos processos clínicos, além de auxiliar em áreas onde a inteligência humana é necessária, como raciocínio analítico, aquisição de conhecimento e tomada de decisão. Embora ofereça imensas possibilidades, essa tecnologia requer grandes quantidades de informações do paciente, levantando preocupações sobre confidencialidade, proteção e outros dilemas morais. A necessidade de enfermeiros desenvolverem alfabetização em IA e reconhecimento de vieses também é destacada para equilibrar a eficiência tecnológica com o cuidado humanizado. A avaliação ética permitirá que enfermeiros monitorem aplicações antiéticas de IA e garantam a equidade no atendimento ao paciente. **Conclusão.** O uso de IA está revolucionando o setor de saúde e requer forte governança ética para mitigar os danos potenciais de seu uso. Na enfermagem, a integração proativa por meio de atualizações curriculares pode promover a adoção segura e equitativa da IA promovendo, em última análise, a dignidade humana e os resultados de saúde.

Descritores: saúde materna; cuidados pré-natais; serviços de saúde materna; mortalidade materna; cuidados de enfermagem.

Introduction

Artificial intelligence (AI) is the replication of simulation of human intelligence, behavior, instant computations, troubleshooting in machines based on available data.[1] Artificial intelligence in healthcare have primarily transmuted the medical domain, encompassing the diagnostics, Maintenance of digital records, treatment, enhancing health professionals' intelligence, novel drug discovery, comprehensive biological data analysis, accelerating the workflow, facilitating data storage and retrieval for healthcare institutions. AI driven innovation possesses the potential to shape the future of industries and humanity, but it is a double-edged blade.[2] AI is quickly being adopted in the healthcare, bringing forth a revolutionary phase of innovation that is set to transform how we diagnose, cure, and manage ailments.[3] AI-driven technology provides substantial benefits for patients, medical professionals, and the overall healthcare framework. Like the improving the primary healthcare, cost reduction, and enhanced efficiency of medical and clinical processes and it also helps where human intelligence is needed i.e. analytical reasoning, acquiring knowledge, and decision-making.[4] Besides this, artificial intelligence encounters numerous ethical and legal problems, also it is inaccessible to all populations specially the low-income and developing nations still.[5,6] It is essential to acknowl edge that ethical conflicts, privacy concerns, data security, informed consent, societal disparities, medical counseling, compassion, and empathy are some of the challenges associated with adoption of artificial intelligence.[7,8] Thus, before incorporating artificial intelligence into the healthcare , health professionals and experts need to adhere to the four fundamental principles of ethics i.e. autonomy, beneficence, nonmaleficence, and justice—across all planes of healthcare.[9]

The World Health Organization (WHO) has released two reports, in 2021 and 2023, on AI applications in healthcare. These reports outline key principles and considerations for the responsible and ethical use of AI. It is essential th at AI in healthcare is designed and utilized in a manner that upholds human dignity, core rights, and values. AI systems should promote fairness, inclusivity, transparency, and accountability. Additionally, the WHO's findings highlight existing legal and ethical gaps in AI regulation within the healthcare sector. The use of AI in medicine presents issues of trust, accountability, discrimination risks, privacy concerns, and patient autonomy, alongside its many potential advantages and disadvantages.[3] AI is an innovative technology with the potential to transform healthcare services. However, its benefits will only be fully realized if ethical oversight is incorporated into its design, development, and application in clinical settings.[4]

Methods

Data bases including PubMed, Scopus, Web of Science, and CINAHL are reviewed. Inclusion criteria focused on English-language articles addressing AI ethics in healthcare, with priority given to empirical studies, World Health Organization (WHO) reports, and nursing-specific scholarship. General Search Items included artificial intelligence ethics, AI in healthcare challenges, nursing AI implications, algorithmic bias healthcare, informed consent AI, privacy data protection AI, and WHO AI guidelines, combined with Boolean operators (e.g., "AI AND nursing autonomy") and filters for publication date (post-2018) and article type (reviews, originals).

Results

Prerequisite of artificial intelligence in healthcare

Artificial intelligence has the capability to analyze huge amounts of digital data at a speed and efficiency beyond human capacity, Hence Artificial intelligence has the potential to transform the healthcare sector by uncovering valuable and essential insights and help health professionals to concentrate on actual patient concerns while delegating tasks that can be automated to computer systems. There are some examples of uses of Artificial intelligence (AI) in various areas of healthcare are:[5] **(i) Diagnosis:** With the help of Imaging technology, AI can help to detect lung cancer, pneumonia, and diabetic retinopathy in CT scans, chest X-rays, and retinal scans, AI can help in diagnosing cancer from tissue samples Surgery; **(ii) Robot-assisted surgery:** AI-controlled robots can perform complex operations with greater precision and dexterity; **(iii) Documentation:** AI can quickly analyze patient information and suggest required improvements to be done in documentation, saving time and reducing errors; **(iv) Drug discovery:** AI can speed up drug discovery and diagnoses personalized medicine; and **(v) Virtual nursing assistants:** AI can also interact with patients, answer their queries, and help health professionals to understand the patient conditions

Ethical Principles related to use of Artificial Intelligence

To establish trust with end users, following principles are essential to follow: These principles include:[6] **(i) Transparency**: AI systems and their decision-making processes should be clear and comprehensible to patients, healthcare professionals, and regulatory bodies; **(ii) Beneficence and Non-malfeasance**: AI should be employed to enhance patient well-being while preventing any harm; **(iii) Justice and Fairness**: AI systems should be developed and implemented in a way that ensures impartiality and prevents discrimination; **(iv) Patient Autonomy and Consent**: Patients should have control over their healthcare choices, and their data should only be utilized with informed consent; an: **(v) Privacy and Confidentiality**: Patient information must be handled with complete security, ensuring strict privacy protection.

Ethical challenges associated with artificial intelligence in healthcare

The ethical challenges linked to artificial intelligence (AI) in healthcare encompasses the apprehensions such as privacy, bias, discrimination, and the extent of human judgment involved. The implementation of AI technologies introduces potential risks, including inaccuracies and data breaches, which can have severe consequences for patients. Notably, lack of comprehensive regulations addressing the legal and ethical dimensions of AI's role in healthcare, underscoring the necessity for thorough examination of this critical issue.[7]

Ethical issues in AI data handling. Use of Electronic health records (EHRs) can enhance scientific research, healthcare quality, and clinical

efficiency, they also pose risks such as potential hacking and misuse of data. Additional ethical concerns involve determining ownership of personal health records, deciding with whom and when this information is shared, and establishing the necessity for obtaining patient consent.[6]

Privacy and Data Protection. In November 2022, one of India's leading hospitals, All-India Institute of Medical Sciences, New Delhi, had its computer servers knocked out by a ransomware attack that targeted its services like patient registration, online appointments, diagnostic report generation, billing, and administrative systems, such as salary disbursal and drug procurement etc. For approximately 2 weeks, these services managed manually. Even though online services have been resumed, with data restored from a backup server but the personal data of more than 30 million patients and healthcare workers may have been compromised. Globally numerous act and regulations are available to guide and protect the data. It includes the following: (i) General Data Protection Regulation: Applicable only in the European Union but can be used as a guide by other nations; (ii) Global Initiative on Ethics of Autonomous and Intelligent Systems: Aimed at formulation of a set of standards and principles for Autonomous and Intelligent Systems, to make them secure, ethical, and advantageous to society at large; (iii) Health Insurance Portability and Accountability Act: This act was passed as a federal law for formulating national standards for dealing with sensitive patients' health information and prohibiting its disclosure without the patient's consent or knowledge.

Informed Consent and Autonomy must be given voluntarily, for a specific purpose, and without ambiguity. The growing use of AI in healthcare has further intensified concerns regarding this issue. In alignment with the principle of autonomy, patients must be fully informed to make independent and well-informed healthcare decisions.[13]

Social Gaps and Justice. The advancement of AI has imposed another challenge to societies, as difference of advancement in developing and developed countries, loss of jobs of individuals in various areas due to growing robots and automated machines like surgical robots etc.

Issues related to Consultation and understanding of health problems. Integration of artificial intelligence in healthcare appears challenging and impractical. The presence of uniquely human emotions makes it unlikely that humans and medical robots will develop together rapidly. Many a times, Health professionals do consultation in collaboration with their seniors and juniors to guide, learn or sometime for the benefit of the patients. This is difficult to think that the traditional human relations will be replaced by machine human interaction. Although the machine (Robot) will not have the feeling, kindness, compassion which are the quality of human being and help in healing process of the patient. Hence it is one of the major issue related to Artificial intelligence in health profession.[12]

Use of Artificial intelligence in drug development: Artificial intelligence has gained success in the drug discovery but this is required large amount of information which may not be possible in some cases where the limited information or low quality of data is available as it may affect the reliability and validity of the results. It also raises the issue related to fairness and biases.[8]

Human values and AI in healthcare. Software engineering, which underpins most AI applications, often overlooks human values.[18] Neglecting human values can lead to numerous ethical concerns. According to Schwartz's Theory of Basic Human Values, ten core values have been identified and validated globally.[20] Research has pinpointed security, benevolence, universalism, and self-direction as the four most commonly cited values in recent software engineering publications.[17]

Human values and corresponding ethical principles

Security. Security encompasses the sense of safety and stability for individuals, their relationships, and the broader community, embodying the principle of doing no harm. **(i) Non-maleficence.** The principle of non-maleficence focuses on minimizing potential harm, including discrimination, privacy breaches, and physical harm.[16] Current AI guidelines prioritize avoiding harm over doing good, highlighting the importance of preventing negative outcomes.[21] However, the rapidly evolving nature of AI in healthcare raises concerns that potential harms may only be addressed after they occur. Safety is a top priority in healthcare AI, particularly given the limited empirical evidence supporting many initiatives.[22] Technical issues, such as AI malfunctions or network failures, can lead to unintended harm. Moreover, AI's lack of cultural or interpersonal sensitivity may compromise the relationship and can cause emotional sufferings to individuals.[23]

Self-direction. Self-direction represents the idea of self-independence, encircling the ethical principles of freedom, dignity, and confidentiality, which enable individuals to make his / her independent choices. **(i) Freedom and autonomy.** Preserving autonomy and freedom means upholding individuals' rights to make informed decisions and revoke consent as needed,[24] this includes transparently sharing relevant information and ensuring participants understand and agree to the terms.[25] However, complex AI systems and vast datasets can make informed consent difficult to achieve.[26] Furthermore, users of mobile health apps often assume their data is protected with the same rigor as traditional healthcare, but the fine print is often overlooked or not fully grasped;[27] **(ii) Dignity.** Dignity involves upholding human rights and decency. This includes considering the well-being of developers who may be exposed to traumatic content without proper training.[28] Additionally, dignity is relevant when individuals form bonds with AI, raising concerns such as patients mistakenly attributing human-like qualities to AI, experiencing unease due to robots' unsettling appearance, or struggling to terminate the therapeutic relationship safely;[23] **(iii) Privacy.** Privacy is the right of every individual which requires careful protection and secure management of personal information. Sensitive health data demands confidentiality, a responsibility traditionally held by healthcare professionals.[28] The advancement of AI in healthcare frequently clashes with the right to privacy, particularly regarding data collection, management, and utilization of social media information.[29] Data acquisition can pose several ethical dilemmas. Data can be acquired from various sources (e.g., mobile device location services and online discussion board engagement),[24] by machine learning algorithms,[22] or via implicit methods (e.g., monitoring screen interactions or vocal pitch). A crucial issue revolves around individual comfort levels regarding data collection in these contexts, particularly when it occurs without their knowledge.[28] Data management raises further concerns related to privacy which may be compromised due to careless security measures like unattended sensitive information in health setting, cyber-attacks, leaking of information through social media etc.[23]

Benevolence embodies the idea of promoting and preserving the well-being of oneself and others, rooted in core values such as doing good, accountability, reliability, openness, and unity; **(i) Beneficence.** The principle of beneficence is about advancing the welfare of individuals and society. While AI holds great promise for positive impact, concerns arise from its current limitations and potential influence on clinical judgment.[16] AI's limitations need to be acknowledged. Clinicians, guided by their professional standards, can identify broader societal risks like domestic violence, child abuse etc. However, AI systems designed for specific tasks might overlook these critical indicators.[30] AI-informed decisions may also have unintended effects on clinicians' judgments. For example, when radiologists are

aware of a patient's high-risk genetic mutation, they tend to detect significantly more breast lesions on MRI scans.[31] consequently; AI-driven predictions may influence clinicians' own risk assessments. If further screening or treatment is only offered to patients labeled high-risk by AI, without clinician oversight, it could create a self-perpetuating cycle;[32] **(ii) Responsibility and trust.** Responsibility represents the accountability and liability, being transparent and acting with honesty to earn trust.[16] when developing predictive models, it's crucial for creators to transparently outline their limitations.[30] Notably, most suicide risk assessments can't accurately forecast when someone might attempt suicide, making it challenging to determine if intervention is required like involuntary restraint.[33] The boundaries of accountability for AI systems are unclear, especially with complex "black box" algorithms that are difficult to interpret.[27] This ambiguity raises questions about liability in cases where AI fails to detect a critical issue, such as a potential suicide – who bears the responsibility i.e. developer or the implementors? This issue remains unresolved.[33] Other gray areas like discrepancies between AI-driven decisions and clinician judgments, such as when AI flags a patient as high-risk but the clinician disagrees.[33] Unlike health professionals, AI systems lack inherent accountability and aren't capable of experiencing moral consequences, like emotional distress, resulting from poor decisions.[23,28] and Trust can be compromised when AI produces numerous false positives or negatives; **(iii) Transparency** encompasses two key aspects: interpretability, which means to understand the decision-making process (the "how"), and explain ability, which refers to understanding the underlying reasons for the decision (the "why").[34] The challenge lies in AI systems having limited interpretability and/or explains ability, as well as hidden shortcomings. While some AI algorithms, like regression models, offer more transparency whereas others, such as deep learning models built on vast datasets, often sacrifice interpretability for better performance.[24] The problem with these "black box" algorithms is that they obscure the connection between inputs and outputs, making it difficult for humans to comprehend the decision-making process.[27] The lack of transparency can have problems, such as patients being informed of a high risk of illness without understanding the underlying reasons. Some individuals are hesitant to receive such unexplainable high-risk assessments, as they can be distressing.[24] Furthermore, if implementers cannot grasp the models, they may struggle to identify biases or challenge AI-driven decisions;[24] **(iv) Solidarity** involves prioritizing the needs of people with low socioeconomic status and are in inaccessible community area which may require redistributing AI benefits to them.[16] For example, NLP algorithms developed solely in English may exclude cultural groups that speak other languages, limiting their applicability.[25] The use of AI in healthcare can have negative consequences for vulnerable populations. Some individuals, such as those with schizophrenia, may find AI-driven tracking and surveillance distressing.[27]

Universalism reflects a commitment to promoting human dignity and protecting the planet, guided by ethical principles that prioritize fairness, justice, and long-term sustainability. **(i) Justice and fairness** in AI development involve ensuring diverse representation in research, design, and development to prevent discrimination against vulnerable groups and protect the right of individual.[16] If AI systems aren't developed with diverse populations in mind, they may overlook the requirements of diminished groups.[2] Gaps in training data can arise from limited representation of non-binary individuals in electronic health records or from marginalized communities with restricted access to healthcare.[33] Moreover, training data may reflect systemic biases related to human characteristics which can exacerbate existing disparities if used for predictions.[26,33,34] Economic factors, such as varying billing rates, can also impact data collection and perpetuate biases.[34] Additionally, social media data may skew towards younger, Caucasian populations, potentially neglecting the health needs of other

groups.[35,36] A critical concern is whether implementers can challenge AI-driven decisions, particularly in high-risk situations like suicide prediction. Given these risks, relying solely on AI for decision-making has been criticized for lacking human oversight and accountability.[37]

Sustainability in AI development means taking into account the environmental impact and striving to minimize the environmental foot print of AI projects. Although AI is beneficial in predicting the disease outbreaks, investigations, patient health care etc but still its implementation requires careful consideration of privacy of data, unintended consequences and data biases etc. Also, without concrete examples of AI in healthcare, it's challenging to define what sustainable AI in this field would look like. [16]

Implications of Artificial Intelligence in Health Care:

The World Health Organization (WHO) is urging careful consideration when utilizing large language models (LLMs) powered by artificial intelligence (AI) to safeguard human well-being, safety, autonomy, and public health. It's crucial to assess the risks associated with relying on LLMs to expand access to health information, support decision-making, or boost diagnostic capabilities in resource-limited areas, ultimately protecting people's health and reducing disparities. Rushing to adopt unproven systems can result in mistakes by healthcare professionals, harm to patients, and erosion of trust in AI, which could undermine the long-term benefits of these technologies.[16] To ensure safe, effective, and ethical use, rigorous oversight is necessary to address concerns surrounding these technologies: [38]

- The training data for AI systems can contain inherent prejudices, leading to flawed or deceptive outputs that might compromise health, fairness, and social inclusivity.
- LLMs produce answers that seem convincing and trustworthy, but they can be entirely wrong or contain significant mistakes, particularly when it comes to health information.
- LLMs might rely on training data that wasn't authorized for this purpose, and they may not safeguard sensitive information, including personal health details, shared by users when interacting with an application.
- LLMs can be exploited to create and spread highly believable false information in various formats, including text, audio, and video, making it challenging for people to distinguish it from trustworthy health information.
- As WHO embraces innovative technologies like AI and digital health to advance human well-being, they stress that policymakers must prioritize patient safety and security as tech companies develop and market large language models.

WHO suggests that these issues need to be resolved and concrete benefits demonstrated before large language models are widely adopted in everyday healthcare and medicine, whether by individuals, healthcare professionals, or those managing health systems and policies.[16] AI's influence on healthcare is distinctive, but the question remains whether its use will be morally sound. While AI has the potential to reform disease diagnosis, risk prediction, personalized treatment, remote monitoring, and automated triage, it also poses substantial risks to patient safety and the healthcare sector's trustworthiness. These ethical concerns stem from three main areas: (a) the limitations and biases in healthcare AI's underlying evidence (knowledge gaps); (b) AI's potential to redefine health, healthcare, and medical practice (value-based concerns); and (c) the opaque nature of AI development, which hinders accountability and transparency (accountability concerns).[17]

Some areas of implication of Artificial Intelligence in Nursing are as follows:

- **Clinical Nursing-** AI application in nursing is an opportunity as well as a challenge in the health care system. It helps in decision making, critical analysis, assessment, monitoring but it cannot replace a nurse's own decision making and skills. Although it is a responsibility of nurses to make effective use of AI with transparency, effective communication with their patients and respect their autonomy.[39]
- **Evidence based Nursing-** Use of AI in clinical nursing equip the nurses with statistical data and suggestions based on available evidences as well as research studies. Based on information nurses can take prompt and accurate decision resulting in improved patient outcome.[40]
- **Patient Satisfaction-** AI technology has provided an extremely valued support system for the treatment of patients by reducing the cost of services, critical analysis, real time monitoring, work flow optimization, prompt action on any deviation, quick notification to health care provider and moreover it has enhanced the satisfaction level of patients as well as their family members.[41,42]
- **Burden of care & Documentation-** Although the use of AI like electronic health records facilitates the documentation burden and allows the more direct patient care, predictive analysis through AI, help in early intervention etc. Still there are challenges about the ethics, nurse patient relationship, privacy of data and dignity in relation to the acceptance to the AI.[43] Hence clear guidelines and training of nurses are required for the integration of AI in the health care system in relation to the cultural and regulatory differences around the world.
- **Robotics & Nursing-** Artificial intelligence has been integrated with robotic processes which also increases the success of any critical procedure and decision making. Robotic implication with AI technology terminates the chances of human error and delayed decision-making process. [44]
- **Tele Nursing-** Artificial intelligence through use of mobile application has been a significant contribution for the facility to provide various health care facility anywhere with low burden of infrastructure. It has also enhanced the cost effectiveness, efficiency and on spot analysis facility for the nurses.[45]
- **Nursing Education-** Whereas AI equipped nursing education tools, applications, simulation platforms, wearable technologies virtual reality-based platforms, chatbot systems has been found to be helpful for students to learn about patients' conditions, critical analysis of their clinical changes, real life demonstration and continuous learning that makes them well skilled and knowledgeable to deal with real patients in clinical set up.[46]

Conclusion. Use of Artificial Intelligence in health settings can transform the care by improving accuracy in clinical diagnosis, treatment plans, and decision-making. However, ethical issues related to artificial intelligence must be addressed must be addressed. AI can augment clinical judgment, enabling healthcare professionals to make more informed decisions. In resource-constrained settings, AI can help with screening and evaluation, particularly when medical expertise is limited. Unlike human decision-making, AI-driven judgments are systematic and algorithm-based, ensuring accountability – not of the machine, but of its developers and users. While AI poses moral dilemmas, it's likely to complement or replace existing systems, ushering in a new era of healthcare. Not leveraging AI may be unscientific and unethical, given its potential benefits.

Abbreviation used: AI- Artificial Intelligence, LLM- Large Language Model, EMR- Electronic Medical Records, EHRs- Electronic Health Records.

References

1. Amisha, Malik P, Pathania M, Rathaur VK. Overview of artificial intelligence in medicine. Journal of Family Medicine and Primary Care. 2019; 8(7):2328-31.
2. Farhud DD, Zokaei S. Ethical issues of artificial intelligence in medicine and healthcare. Iranian Journal of Public Health. 2021; 50(11):i-v.
3. Bouderhem R. Shaping the future of AI in healthcare through ethics and governance. Humanities and Social Sciences Communications. 2024; 11:416.
4. Savulescu J, Giubilini A, Vandersluis R, Mishra A. Ethics of artificial intelligence in medicine. Singapore Medical Journal. 2024; 65(3):150-8.
5. Varkey B. Principles of clinical ethics and their application to practice. Medical Principles and Practice. 2021; 30(1):17-28.
6. Jahn WT. The 4 basic ethical principles that apply to forensic activities are respect for autonomy, beneficence, nonmaleficence, and justice. Journal of Chiropractic Medicine. 2011; 10(3):225-6.
7. World Health Organization. Review of ethical issues in medical genetics [Internet]. Geneva: Human Genetics Programme, Management of Noncommunicable Diseases; 2003. Available from: https://www.who.int/genomics/publications/en/ethical_issuesin_medgenetics%20report.pdf
8. Farhud DD, Nickzat N, Mahmoodi M. Views of group of physicians, nurses and midwives on ethical principles in medical genetics, in Tehran. Iranian Journal of Public Health. 1999; 28(1-4):1-10.
9. Farhud DD. Epigenetic and ethics: how are ethical traits inherited? International Journal of Ethics and Society. 2019; 1(1):1-4.
10. European Parliament, Council of the European Union. Regulation (EU) 2016/679 of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC [Internet]. Official Journal of the European Union. 2016 Available from: https://eur-lex.europa.eu/eli/reg/2016/679/oj
11. American Society of Human Genetics. The Genetic Information Nondiscrimination Act (GINA) [Internet]. Available from: https://www.ashg.org/advocacy/gina/
12. American Medical Association. Informed consent [Internet]. Available from: https://www.ama-assn.org/delivering-care/ethics/informed-consent
13. Markose A, Krishnan R, Ramesh M. Medical ethics. Journal of Pharmacy and Bioallied Sciences. 2016; 8(Suppl 1):S1-4.
14. Nordling L. A fairer way forward for AI in health care. Nature. 2019; 573(7775):S103-5.
15. Builtin. Artificial intelligence in healthcare [Internet]. Available from: https://builtin.com/artificial-intelligence/artificial-intelligence-healthcare
16. Jobin A, Ienca M, Vayena E. The global landscape of AI ethics guidelines. Nature Machine Intelligence. 2019; 1(9):389-99.
17. Perera H, Bandara M, Bandara H, Perera A, Wickramarachchi A, Wijesiriwardana C, et al. A study on the prevalence of human values in software engineering publications, 2015–2018. In: Proceedings of the ACM/IEEE 42nd International Conference on Software Engineering; 2020. p. 409-20.
18. Saleh Z. Artificial intelligence definition, ethics and standards [Internet]. 2019. Available from: https://www.researchgate.net/publication/339850286_Artificial_Intelligence_Definition_Ethics_and_Standards
19. Davenport T, Kalakota R. The potential for artificial intelligence in healthcare. Future Healthcare Journal. 2019; 6(2):94-8.
20. Schwartz SH. An overview of the Schwartz theory of basic values. Online Readings in Psychology and Culture. 2012; 2(1):1-20.
21. Wiens J, Saria S, Sendak M, Ghassemi M, Liu VX, Doshi-Velez F, et al. Do no harm: a roadmap for responsible machine learning for health care. Nature Medicine. 2019; 25(9):1337-40

22. Fiske A, Henningsen P, Buyx A. Your robot therapist will see you now: ethical implications of embodied artificial intelligence in psychiatry, psychology, and psychotherapy. Journal of Medical Internet Research. 2019;21(5):e13216.
23. Jacobson NC, Bentley KH, Walton A, Wang SB, Fortgang RG, Millner AJ, et al. Ethical dilemmas posed by mobile health and machine learning in psychiatry research. Bulletin of the World Health Organization. 2020; 98(4):270-6.
24. Fleming MN. Considerations for the ethical implementation of psychological assessment through social media via machine learning. Ethics & Behavior. 2021; 31(3):181-92.
25. Starke G, Schmidt B, De Clercq E, Elger BS. Computing schizophrenia: ethical challenges for machine learning in psychiatry. Psychological Medicine. 2021; 51(15):2515-21.
26. Chancellor S, Baumer EPS, De Choudhury M. A taxonomy of ethical tensions in inferring mental health states from social media. In: Proceedings of the Conference on Fairness, Accountability, and Transparency (FAT*'19); 2019. p. 79-88. doi:10.1145/3287560.3287587
27. Martinez-Martin N, Kreitmair K. Ethical issues for direct-to-consumer digital psychotherapy apps: addressing accountability, data protection, and consent. JMIR Mental Health. 2018; 5(2):e32.
28. Char DS, Abràmoff MD, Feudtner C. Identifying ethical considerations for machine learning healthcare applications. American Journal of Bioethics. 2020; 20(11):7-17.
29. Conway M, O'Connor D. Social media, big data, and mental health: current advances and ethical implications. Current Opinion in Psychology. 2016; 9:77-82.
30. Vreemann S, Lemmen C, Broekhuis M, van Hillegersberg J, van Hout W, van der Waa J, et al. The frequency of missed breast cancers in women participating in a high-risk MRI screening program. Breast Cancer Research and Treatment. 2018; 169(2):323-31.
31. Lysaght T, Lim HY, Xafis V, Ngiam KY. AI-assisted decision-making in healthcare. Asian Bioethics Review. 2019; 11(3):299-314.
32. Linthicum KP, Schafer KM, Ribeiro JD. Machine learning in suicide science: applications and ethics. Behavioral Sciences & the Law. 2019; 37(3):214-22.
33. Walsh CG, Chaudhry B, Dua P, Goodman KW, Kaplan B, Kavuluru R, et al. Stigma, biomarkers, and algorithmic bias: recommendations for precision behavioral health with artificial intelligence. JAMIA Open. 2020; 3(1):9-15.
34. Dawson D, Schleiger E, Horton J, McLaughlin J, Robinson C, Quezada G, et al. Artificial intelligence: Australia's ethics framework [Internet]. CSIRO Data61; 2019 [cited Available from: https://data61.csiro.au/en/Our-Research/Our-Work/AI-and-Machine-Learning/AI-Ethics-Framework
35. Thieme A, Belgrave D, Doherty G. Machine learning in mental health. ACM Transactions on Computer-Human Interaction. 2020; 27(5):1-53.
36. Carr S. "AI gone mental": engagement and ethics in data-driven technology for mental health. Journal of Mental Health. 2020; 29(2):125-30.
37. World Health Organization. Resources [Internet]. Available from: https://www.who.int/resources
38. Morley J, Floridi L. The ethics of AI in health care: an updated mapping review [Internet]. SSRN. 2024 [cited 2025 Sep 10]. Available from: https://ssrn.com/abstract=4987317
39. Char DS, Shah NH, Magnus D. Implementing machine learning in health care—addressing ethical challenges. New England Journal of Medicine. 2018; 378(11):981-3.
40. Rony MKK, Parvin MR, Ferdousi S. Advancing nursing practice with artificial intelligence: Enhancing preparedness for the future. Nurs Open [Internet]. 2024;11(1):e2070.
41. Clancy TR. Artificial intelligence and nursing: The future is now. Journal of Nursing Administration. 2020; 50(3):125–7.
42. Jeong GH. Artificial intelligence, machine learning, and deep learning in women's health nursing. Korean Journal of Women Health Nursing. 2020; 26(1):5–9.
43. Bajwa J, Munir U, Nori A, Williams B. Artificial intelligence in healthcare: transforming the practice of medicine. Future Health Care Journal. 2021; 8(2):e188-e194.

44. Boumans R, van Meulen F, Hindriks K, Neerincx M, Olde Rikkert MGM. Robot for health data acquisition among older adults: a pilot randomised controlled cross-over trial. BMJ Quality & Safety. 2019; 28(10):793–9.
45. Chang C-Y, Hwang G-J, Gau M-L. Promoting students' learning achievement and self□efficacy: A mobile chatbot approach for nursing training. British Journal of Education and Technology. 2022; 53(1):171–88.
46. Li H, Zhu G, Zhong Y, Zhang Z, Li S, Liu J. Applications of artificial intelligence in psychiatric nursing: A scope review. Studies in Health Technology and Informatics. 2024; 315:74–80.
47. Gandhi Priyanka, Pahwa Sonal. All India Institute of Medical Sciences (AIIMS), Delhi:Cyberattack puts digitalisation under scanner; IMIB Journal of Innovation and Management**;** 2024; 3(2). Available from: https://doi.org/10.1177/ijim.241240911
48. Yadav Neel, Pandey Saumya, Gupta Amit, Dudani1 Pankhuri, Gupta Somesh, Rangarajan Krithika. Data Privacy in Healthcare: In the Era of Artificial Intelligence; Indian Dermatology Online Journal. 2023; 788-92.

Vital Legacy

Juan Guillermo Rojas[1]
https://orcid.org/0000-0002-0255-4344

Editorial

Check for updates

UNIVERSIDAD DE ANTIOQUIA
1803

1 Nurse, PhD. Professor. Dean of the Faculty of Nursing at Universidad de Antioquia, Colombia. Email: guillermo.rojas@udea.edu.co. Corresponding author.

How to cite this article: Rojas JG. Vital Legacy. Investigación y Educación en Enfermería. 2025; 43(3):e16.

DOI: https://doi.org/10.17533/udea.iee.v43n3e16

Investigación y Educación en Enfermería

Vol. 43 No 3, September-December 2025
ISSNp: 0120-5307 • ISSNe: 2216-0280

In 1950s Medellín, the city had nearly 358,000 inhabitants due to migratory flows from the towns of Antioquia into the capital, gradually converting the noble city into a center of industrial development.[1]

By then, the growing social needs motivated the design of the first pilot plan for the city's urban improvement by the Public Improvement Society, which comprised controlled expansion of urban settlements towards the slopes, channeling of the Medellín River, construction of an administrative center, and consolidation of an industrial zone. Gradually, the colonial architecture was replaced by modern construction with Art-Deco designs, which gave an avant-garde touch to the growing and prosperous city of eternal spring.[2] The expansion and urban and population growth brought along other challenges for the city: one was to improve basic sanitation infrastructure, and the other, to effectively respond to the needs of public health care and hospital care with nurses trained in basic sciences, medical sciences and pathology, medications, socio-humanistic aspects, and vast ethical and moral sufficiency.
This was the context in which Doctor Ignacio Vélez Escobar, as Dean of the Faculty of Medicine at Universidad de Antioquia, proposed the creation of the School of Nursing with support from the Dominican Sisters of Charity of the Presentation of Tours, beginning a new chapter in the history of nursing care in Antioquia and Colombia, which in the words of our Professor Cecilia Mabel Restrepo, set the guidelines and laid the foundations for the evolution and development of the profession in our environment.[3]

The historical development of the Faculty of Nursing, as an academic project, has been permeated by changes and social, economic, and political transformations, as well as by the historical events within the profession, which – as indicated by María Victoria López – evidence the learnings from the processes of epistemological, theoretical and practical reflection that have strengthened the profession,[4] and which have served to search for new ways to understand human experiences and propose strategies for formation. This, in the words of Siles, implies that both nursing and care constitute a historical-anthropological reality that categorically reflects the cultural and historical nature of the discipline[5] and the profession in response to the needs for individual care, collective care, and common home care and which mark new pathways for professional training.

It is precisely the capacity to adapt and transform the training over time, which has characterized the Faculty of Nursing, evidencing that social development is manifested in professional curricula, which respond to the demands of the changes that have arisen and the social, cultural, political and economic requirements in which the disciplines develop.[6]

Celebrating the 75 years of the Faculty of Nursing represents the vital legacy that today calls us to re-elaborate and dimension the past history, to understand the present reality of the profession and propose the utopias of the future.[3]

This vital legacy that connects us with history, which, like culture, is configured as a web of symbols and meanings that according to Geertz,[7] must be known and interpreted as the context to understand the social phenomena that describe the profession's cultural history and the symbols that identify it.

The history of the Faculty of Nursing has been constructed from the framework of the history of thousands of men and women who have assumed their commitment to human care, transcending practical facts and actions to a philosophy of life that crosses borders and surpasses the limits of time, leaving a mark and setting the course for the future. This is what Professor Cecilia Mabel Restrepo has referred to, calling on us to recover the collective memory of nursing, which allows revealing the meanings embedded in the fabric of the collective unconscious, which permits finding

and understanding that which prevails in the minds of contemporary actors.

In 75 years, many moments, events, and stories have taken place, which is why it is necessary to recognize our teachers of care, both religious and lay; those who accompany us today and those who have already transcended the earthly plane, they all bravely took on the challenge of laying the foundations on which the current academic project is based. The humanistic, avant-garde, and resilient thinking of these teachers has made it possible to overcome the critical moments that both the University and the Faculty have experienced.

Today, it is essential to specially recognize the professors and students, as protagonists of the present of the Faculty, which faces multiple challenges in the current context of political and financial crisis the country is going through. However, their impetus and critical analysis are the promise of value to find the best alternative solutions to maintain a public, open, and functioning university.

Similarly, the training work has been possible due to the effort and dedication of our administrative support and maintenance collaborators; their life stories and struggles have also taught us to live care as a transformative experience built through teamwork.

We recognize our graduates who are the living image of the University in society and connect the philosophical, theoretical, and scientific postulates of the discipline with the reality of practice under the university values and principles. Today, our graduates contribute to care in different scenarios and stand out for their high level of social sensitivity. They are even part of the diaspora of nursing knowledge that has spread throughout the world, contributing to care in other countries with high levels of humanism and quality.

The history of our Faculty is also a history of transformation, like a river that flows forth and widens over the years, the conversion from School to Faculty, the expansion of research and extension, the emergence of the Journal Investigación y Educación en Enfermería, the creation of the Research Center, the creation and recognition of five research groups, the creation of master's in interdisciplinary Collective Health, the development of four clinical specializations, a disciplinary master's and a PhD, which have given thousands of nursing professionals and related professions the opportunity to expand their skills into specialized fields that have positively impacted care in clinical, community, and decision-making settings.

Within this transformation process, the Faculty of Nursing has ventured into managing health intervention projects, public policy management, support for caregiver networks, volunteer actions in health and lifelong education through the mission axis of extension, sealing the commitment to university social responsibility.

In the construction of this historical path, the character of nursing as a professional discipline of a practical nature imposes a series of challenges for training in the future: to consolidate an academically and socially relevant quality training program, that is, to respond to local and global health challenges with a high sense of humanism, with an interprofessional approach, which aims to care for the planet, that responds efficiently to the expansion of advanced nursing practice and that helps in the consolidation of a just and peaceful society.

Likewise, consolidating the new forms of formative interaction through the use of ICTs by strengthening the virtual campus and the use of innovative strategies, bringing the responsible use of emerging technologies and artificial intelligence closer to the care service. Also, advancing on an inclusive formation that allows youth from the region and

the country to access quality public university education as a way of democratizing knowledge and promoting social development.
Another challenge is to continue expanding research as a means to preserve and expand disciplinary knowledge and as a basis to improve training processes in response to the needs of the context. This Faculty has been and expects to remain the scenario for individual and collective reflection and creative thinking that continues enhancing nursing.

In synthesis, the historical development of the Faculty of Nursing must not be seen as a sum of facts or events, but rather as an integrative vision of history that contributes to strengthening the collective awareness and identity around the disciplinary object as an essential service for humanity.[5]

Facing the 21st century, we assume the challenge of continuing the vital legacy that connects the past, present, and future with the conviction that Universidad de Antioquia and, particularly, the Faculty of Nursing will continue to be a "beacon of light" for society in the search to improve care for all society.

We honor the past, care for the present, shape the future

References

1. Señal Memoria RTVC. Dirección de Información y Propaganda del Estado. Medellín en los años 50 [Internet]; 2021 [cited 30 Sept 2025]. Available from: https://www.senalmemoria.co/medellin-en-los-a%C3%B1os-50
2. Correa-Restrepo V. Espacio y Percepción en la Arquitectura Moderna del Centro de Medellín entre 1940 y 1980 [Internet]. Medellín, Universidad Pontificia Bolivariana; 2025 [cited 30 Sept 2025]. Available from: https://repository.upb.edu.co/handle/20.500.11912/12755?locale-attribute=en
3. Restrepo CM. Historia de la Facultad de Enfermería de la Universidad de Antioquia. Una aproximación a la historia de la Enfermería en Antioquia. Medellín; 1997.
4. López MV. Enfermería y ciencias sociales: posibilidades para la formación profesional. Editorial Universidad de Antioquia, Medellín; 2021.
5. Siles González J. Historia cultural de enfermería: reflexión epistemológica y metodológica. Avances de Enfermería. 2010; 28 (Suppl 1):120-8.
6. Acevedo-Gamboa FE. Construcción metodológica para la enseñanza de la disciplina de enfermería: aspectos históricos y reflexiones. Investigación en Enfermería: Imagen y Desarrollo. 2009; 11(1):53-66.
7. Geerzt C. La interpretación de las culturas. Barcelona: Gedisa; 2003.

Curricular and Administrative Transformation of the Nursing Program at Universidad de Antioquia. 75 Years of History

Essay

Elvigia María Posada Vera[1,3]
https://orcid.org/0000-0003-3944-8788
Hugo Alberto Múnera Gaviria[2,3]
https://orcid.org/0000-0001-8785-0304

1 Nurse, Ph.D. Professor. Email: emaria.posada@udea.edu.co
2 Nurse, M.Sc. Professor. Email: hugo.munera@udea.edu.co
3 Faculty of Nursing at Universidad de Antioquia; Medellín, Colombia.

Received: 29 August 2025.
Approved: 6 October 2025.
Conflicts of interest: none.

How to cite this article: Posada EM, Múnera HA. Curricular and Administrative Transformation of the Nursing Program at Universidad de Antioquia. 75 Years of History. Investigación y Educación en Enfermería. 2025; 43(3):e17.

DOI: https://doi.org/10.17533/udea.iee.v43n3e17

Curricular and Administrative Transformation of the Nursing Program at Universidad de Antioquia. 75 Years of History

Abstract

This essay describes the curricular and administrative transformation of the Nursing Program at Universidad de Antioquia since its founding in 1950, identifying progress and challenges up to current times in professional formation, institutional management, and care as disciplinary knowledge. The information has been organized by decades, which evidences historical processes, recognizes change patterns, and highlights relevant milestones more clearly, facilitating a critical analysis of academic evolution in long-term contexts. The institutional trajectory reveals an adaptive capacity regarding social and educational challenges. The most significant milestones include the transition from School to Faculty (1980), the high-quality accreditation from the National Ministry of Education (1999, 2006, 2013, and 2022), incorporation of high technology to teaching (2017), creation of a PhD degree in Nursing (2010), and strengthened work with international networks (as of 2022). These processes have consolidated a critical, humanistic, and socially relevant training in students and graduates. The recovery of this institutional memory strengthens the disciplinary identity and allows projecting a transformative nursing program into the future, committed to academic excellence, social justice, and educational innovation. The historical overview offers tools to address contemporary challenges in health and education, and reaffirms the Faculty's role as a national benchmark in higher education in nursing.

Descriptors: nursing education; curriculum; history of nursing; students, nursing.

Transformación curricular y administrativa del programa de Enfermería de la Universidad de Antioquia. 75 años de historia

Resumen

Este ensayo describe la transformación curricular y administrativa del programa de Enfermería de la Universidad de Antioquia desde su fundación en 1950, identificando avances y desafíos hasta la actualidad en la formación profesional, la gestión institucional y el cuidado como saber disciplinar. La información se organizó por décadas, lo que permitió evidenciar procesos históricos, reconocer patrones de cambio y destacar hitos relevantes con mayor claridad, facilitando un análisis crítico de la evolución académica en contextos de largo plazo. La trayectoria institucional revela una capacidad adaptativa frente a los desafíos sociales y educativos. Entre los hitos más significativos se encuentran la transición de Escuela a Facultad (1980), la acreditación de alta calidad por el Ministerio de Educación Nacional (1999, 2006,

2013 y 2022), la incorporación de alta tecnología en la enseñanza (2017), la creación del Doctorado en Enfermería (2010) y el fortalecimiento de trabajo con redes internacionales (a partir de 2022). Estos procesos han consolidado una formación crítica, humanista y socialmente pertinente en estudiantes y egresados. La recuperación de esta memoria institucional fortalece la identidad disciplinar y permite proyectar a futuro, una enfermería transformadora, comprometida con la excelencia académica, la justicia social y la innovación educativa. El recorrido histórico ofrece herramientas para enfrentar los retos contemporáneos en salud y educación, y reafirma el papel de la Facultad como referente nacional en la formación superior en enfermería.

Descriptores: educación en enfermería; currículo; historia de la enfermería; estudiantes de enfermería.

Transformação curricular e administrativa do curso de Enfermagem da Universidade de Antioquia. 75 anos de história

Resumo

Este ensaio descreve a transformação curricular e administrativa do programa de Enfermagem da Universidade de Antioquia desde sua fundação em 1950, identificando avanços e desafios até o presente na formação profissional, na gestão institucional e no cuidado como domínio disciplinar. As informações foram organizadas por década, o que nos permitiu destacar processos históricos, reconhecer padrões de mudança e destacar marcos relevantes com maior clareza, facilitando uma análise crítica da evolução acadêmica em contextos de longo prazo. A trajetória institucional revela uma capacidade adaptativa diante dos desafios sociais e educacionais. Entre os marcos mais significativos estão a transição de Escola para Faculdade (1980), a acreditação de alta qualidade pelo Ministério da Educação Nacional (1999, 2006, 2013 e 2022), a incorporação de tecnologia avançada no ensino (2017), a criação do Doutorado em Enfermagem (2010) e o fortalecimento do trabalho com redes internacionais (a partir de 2022). Esses processos consolidaram uma formação crítica, humanística e socialmente relevante para estudantes e graduados. A recuperação dessa memória institucional fortalece a identidade disciplinar e nos permite projetar um futuro transformador para a enfermagem, comprometido com a excelência acadêmica, a justiça social e a inovação educacional. Este panorama histórico oferece ferramentas para enfrentar os desafios contemporâneos em saúde e educação e reafirma o papel da Faculdade como referência nacional no ensino superior de enfermagem.

Descriptores: Educação em Enfermagem; currículo; história da enfermagem; estudantes de enfermagem.

Introduction

Throughout its 75-year trajectory, the Nursing program at Universidad de Antioquia has been the scenario of profound curricular and administrative transformations that have consolidated ethical, pertinent, and scientifically rigorous professional formation. These processes have responded to the country's social, political, and health challenges, strengthening institutional autonomy and raising the standards of academic quality. Curricular evolution has integrated research, critical, and humanistic skills, while administrative reforms have facilitated the accreditation of programs, internationalization, and participatory governance. As Parra warns,[1] the nursing curriculum reflects tensions between disciplinary knowledge and social demands, so its transformation requires reflection, evidence, and historical commitment.

Within this context, this essay describes how said transformations, articulated to formative proposals aimed at a socially relevant graduation profile, have responded to academic, political, and professional demands, configuring specific care needs according to each period. For such, primary sources were consulted, such as publications by professors, specially the text by professor Cecilia Mabel Restrepo "History of the Faculty of Nursing at Universidad de Antioquia: an approach to the history of nursing in Antioquia. 1997", who rigorously documents the history of the Nursing program since its creation in 1950 until the early 1990s; as well as meeting minutes, management reports from various deanships, focus group reports, and professor testimonies. The information was organized by decades to comply with the proposed objective and establish a historically coherent narrative. During the consultation process, the documents were kept with strict conservation measures, preventing their reproduction without due authorization.

The 1950s: Founding of the School of Nursing at Universidad de Antioquia. Religious fundamentals, professionalization of care, and first steps toward autonomy.

The creation of the School of Nursing at Universidad de Antioquia in 1950 marked a milestone in the professionalization of care in Colombia. In response to the health needs of the time, the University's Board of Directors approved, through Resolution 30 of 29 September, its establishment as a dependency of the Faculty of Medicine. The sociopolitical and cultural context of the time, influenced by medical positivism, Christian charity, and the empirical practice of health, shaped a training proposal that articulated technical knowledge with a religious vocation. The Dominican Sisters of the Presentation of Tours played a decisive role in consolidating this initiative, providing structure, discipline, and institutional vision.[2]

The School began its activities on 27 October 1950, at Colegio de la Presentación, under the direction of Sister Lucía de la Pasión, a nurse trained at Universidad Javeriana, with additional studies in Rochester and Baltimore. Her experience in academic organization was key for the initial curricular and administrative design. The government structure was conformed through a mixed Board of Directors, integrated by the dean of Medicine, two doctors and two nuns with nursing degrees recognized by the State. The institutional purpose reflected the vision of the time: to train religious personnel capable of collaborating with physicians in preserving health, with emphasis on moral and spiritual well-being.

In May 1951, the University requested from the National Ministry of Education the School's official recognition, given that its creation had been internal. This recognition was formalized in 1961 through Agreement 31, which endorsed its study plan and legitimized the degrees issued. To resolve the ambiguity of the degrees issued during the first decade, it was decided to include the University's main seal on the diplomas. In addition, the Academy of Medicine issued a Resolution backing the School's scientific level of the School, urging institutions, like the Colombian Social Security Institute (ICSS, for the term in Spanish) and healthcare centers to offer job opportunities to its graduates. The official approval permitted access to publications from the National School of Nurses, facilitating the acquisition of scientific texts, scarce at the time. The School did not have its own library until November 1951, when a nursing section was authorized in the library of the Faculty of Medicine.

The training, which lasted three years, was based on biomedical theory, conventual discipline, and strict regulations. The students knew the rules and sanctions since their admission, and ensured compliance of such. The regime was so demanding that there were no vacations and shifts could extend up to 15 days without a break. Further, the religious community could designate or remove the nuns without consulting with the University. As of 1957, reforms began that paved the way for autonomy. On August 9 of that year, the School's director chaired the Advisory Council for the first time, replacing the Dean of Medicine. In 1958, the reorganization of the Superior Council permitted including student representation, and the School voted on an outstanding third-year student. This generated a critical attitude among the students, highlighting the gap between university regulations and the conventual logic governing the School. Demands arose to adhere to the university calendar, modify the disciplinary regime, and reduce the academic load.

The 1960s: Disciplinary rupture, curricular reform, and critical thinking: the decade that sowed the seeds of modern nursing.

During the 1960s, the School of Nursing at Universidad de Antioquia underwent a profound transformation, influenced by the national political context and by the university reforms promoted from abroad. In particular, the proposals promoted by US organizations to modernize Latin American universities introduced management models that restricted the democratic participation of students and professors.[3] This trend was also reflected at Universidad de Antioquia, generating internal tensions that led to student and academic mobilizations. In the School of Nursing, these mobilizations led to a rupture with traditional disciplinary schemes. Students began to adopt more-critical stances regarding institutional regulations, influenced by emerging social movements, such as feminism and hippies, which permeated the university environment. Although the Advisory Council reaffirmed the existing standards through Agreement 17 of December 1961, students' profiles changed significantly, moving away from the passive obedience that had characterized previous generations.

In 1963, the School began a curricular reorganization process in response to recommendations from international organisms, such as the World Health Organization (WHO), which pointed to deficiencies in the formation of nurses in areas like public health, research and teaching. This reform sought to align the curriculum with the country's social needs, incorporating hygienic and health principles, and promoting a professional practice based on scientific knowledge and community care.

In 1965, following the guidelines by the Colombian Association of Nursing Faculties (ACOFAEN, for the term in Spanish), the complementary Bachelor's Degree in Nursing program was created, with an additional year of training, through Agreement No. 1 of 15 January. This program sought to strengthen the graduate's competencies in administration and teaching. For its implementation, an interdisciplinary School Council was comprised, made up of representatives from the faculties of Medicine and Education, as well as directors from the schools of Nursing, Public Health, and the Institute of General Studies. In addition, a research committee with its own regulations was established, recognizing this area's importance to develop critical thinking and improve quality in nursing services.

Coexistence of basic and complementary programs implied significant administrative and academic adjustments. In 1966, the School adopted the university statutes, the institutional academic calendar, and the admissions exam as sole admission mechanism. The students began their first semester at the Institute of General Sciences, which marked a rupture with the model focused exclusively in the San Vicente de Paúl Hospital as practice scenario. This reorganization allowed the practices to be distributed by areas of care, in coherence with the new curricular focus. These changes reflect a philosophical transformation in nursing formation, aimed at preventive, community, and critical care, in tune with the social and academic demands of the period.

The 1970s: Autonomy, secularization, and curricular reform: the decade that redefined institutional identity.

The 1970s marked a substantial advance in the consolidation of the academic and administrative autonomy of the School of Nursing at Universidad de Antioquia. In 1967, as part of the institutional modernization, participation by the director as president of the Advisory Council was made official. Nevertheless, it was in 1971 when full autonomy was granted to lead the Nursing program, which allowed her to initiate a progressive curricular reform, approved by the Board of Directors in 1970. This reform responded to the recommendations by the National Health Plan and by international organisms, and redefined the institutional philosophy, guiding the formation toward the development of critical awareness in professionals, emphasizing comprehensive care of individuals, families, and communities. The organic charter was modified, establishing new academic sections: basic sciences, medical-surgical, maternal-child, administration, psychiatry, public health, and continuing education. Internal committees were reorganized to address the specific needs of each area.

In the administrative setting, relevant progress was made. The director began attending Board of Directors meetings as a permanent guest, although without voting rights, due to her dependence on the Faculty of Medicine. In 1972, entry of faculty staff into the university hierarchy was authorized, and in 1974 the positions of deputy director and section heads were officially recognized, with their respective salary assignments. The national socio-political context also impacted the School's internal dynamics. Increasing participation in university debates and openness to new currents of thought generated tensions among the different levels. In November 1974, the nuns submitted their final resignation from the academic and administrative leadership, marking the end of a period characterized by strong moral and religious influence. This event allowed greater freedom of

institutional expression and gave way to a critical environment, with diverse political postures and administrative challenges faced by the first secular female dean.

Secularization as a path of uncertainty was evident with the departure of the nuns in 1974, an event that marked an institutional shift in the School of Nursing at Universidad de Antioquia and gave way to a stage of administrative and academic reorganization. In 1975, through Agreement 6 by the Superior Council, its separation from the Faculty of Medicine was officialized, remaining as a teaching unit under the Academic Direction. As of then, the School acquired autonomy to coordinate its programs, with support from a deputy director, a School Council, and an Advisory Council with student participation. Five departments were created: Fundamentals of Nursing, Medical-Surgical, Maternal-Infant, Administration of Nursing Services, and Continuing Education. In 1978, Agreement 13 authorized its internal subdivision by sections, based on the academic and administrative load. For example, The Medical-Surgical Department was organized into internal medicine, surgery, psychiatry, and mental health; the Maternal-Child Department into obstetrics and pediatrics; and the Administration Department into hospitalization and outpatient care.

Department chiefs were assigned by the Board of Directors, based on the director's proposals, and each established its own regulatory council. However, the School faced an abrupt expansion in the number of students, going from 467 in 1974 to 914 in 1975, without increasing proportionally the physical resources, professors, or practice scenarios. In the absence of defined criteria for hiring professors, the Academic Council expedited Resolution 09 of 1976, establishing minimum requirements, such as professional degree, specific experience, and skills for collaborative work. This measure sought to guarantee academic quality amid a growing demand. Pressure on the practice scenarios led the health institutions to limit the number of students per professor. The lack of formal agreements between the university and healthcare services generated operational tensions. Only until Decree 1210 of 1978 were teaching and healthcare activities regulated, allowing agreements between universities and health entities.

In 1979, The School formalized the coordination of practice fields through Resolution 16 of the Academic Council. As a pedagogical response, the skills laboratory was created, which was a simulation space that complemented clinical practice. At the same time, regulatory changes in health and education required a profound curricular reform. Incorporation of concepts, like health/illness, community, culture, and human development, along with the institutionalization of mandatory social service (Decree 2184 of 1976 and Resolution 2050 of 1977), justified the inclusion of rural practice in the final year of the program. Nursing formation began to be guided toward the social and collective, with an intersectoral and interdisciplinary approach. This transformation encouraged a critical reflection on care focused exclusively on the clinical aspect, promoting a broader vision of the health-society relationship. Qualitative research gained relevance, strengthening the epistemological debate and becoming consolidated during the following decade. The curricular reform was structured over a new philosophical framework that integrated the clinical, social, and community aspects. The study plan was organized by levels of complexity, considering individuals in their social context and promoting prevention, recovery, and rehabilitation. For its implementation, teacher training was strengthened by the Department of Continuing Education, which in 1978 focused its efforts on preparing the faculty staff under the new conceptual guidelines.

The 1980s: From School to Faculty: academic autonomy, curricular reform, and research expansion.

The 1980s marked an inflexion point in the academic consolidation of the School of Nursing at Universidad de Antioquia. In 1980, the Colombian Institute for the Promotion of Higher Education (ICFES, for the term in Spanish) endorsed a new four-year curricular plan, structured into eight semesters, which replaced the complementary bachelor's program, closed in 1979. This plan was approved by the University through Resolution 026 of 11 December 1980 and ratified by the ICFES with Agreement 046 of 24 February 1981. In parallel, the Superior Council recognized the School as a teaching unit with academic autonomy, transforming it into Faculty through Agreement 10 of 1980. This decision involved an organizational restructuring formalized in Agreement 11 of 9 May 1981, which established a deanship, a vice-deanship and four departments: Comprehensive Adult Health Care (AISA, for the term in Spanish), Maternal and Child Care, Health Administration, and Research and Education. Each was subdivided into specific sections, responding to the training and operational needs of the Faculty.

Implementing the new plan required defining a professional profile for the students, as condition established by the ICFES to certify the program. Moreover, the teaching-caring relationship was strengthened through the creation of the Hospital-University Coordinating Committee, which promoted articulation between health institutions and the Faculty. The professors actively participated in SENA committees and hospitals in Medellín, which facilitated the formalization of practice scenarios through institutional contracts. In the midst of a turbulent social context, professors began reflective processes on their professional work, which led to significant research. These efforts drove the creation of an academic journal and a research center (1987), which later obtained national and international recognition. In addition, extension services in advisory, consulting, and training were consolidated, and the foundations were laid for the first graduate programs.

The institutional crisis of 1985, which led to the temporary closure of the University by decision of the Superior Council, motivated an overall restructuring. In 1986, the Academic Council issued Agreement 2, establishing guidelines to reform the curricular plans. This initiative was articulated with the self-assessment project promoted by the Colombian Association of Faculties of Medicine (ASCOFAME, for the term in Spanish), the Colombian Association of Nursing Faculties (ACOFAEN, for the term in Spanish), and the Association of Faculties of Dentistry (ACFO, for the term in Spanish), which called on health faculties to review their programs in light of new social demands. The Faculty of Nursing actively participated in the process, developing internal debates about professional functions, thinking, and practice. As a result, the objectives of the undergraduate program were redefined, and the study plan was reorganized into three components: core subjects, professional subjects, and complementary subjects. This proposal was approved by the Faculty Council in early 1989. Finally, the Academic Council issued Resolution 1001 of 1989, delegating in the Faculty councils the partial modification of study plans, approval of academic calendars, and formation of curricular committees, subject to approval by the Academic Directorate. This measure streamlined academic-administrative processes and strengthened the faculties' curricular autonomy.

The 1990s: Regulatory reforms, pedagogic innovation, and institutional consolidation: the decade that redefined nursing.

During the 1990s, Colombia underwent a regulatory reconfiguration in health and education sectors that directly impacted the nursing formation. Legislation 30 of 1992 introduced a pedagogical approach focused on students

as active, autonomous, and critical subjects, promoting more comprehensive and participative educational models.[4] This transformation required institutions to overcome rote learning and adopt perspectives that recognized the complexity of human beings in their formative process. Within this context, the Faculty of Nursing at Universidad de Antioquia undertook a thorough review of its academic program. Since 1991, the Prospective Analysis and Normative Model Group proposed a curricular update that would respond to social, normative and disciplinary changes, integrating diverse knowledge and redefining the institutional educational philosophy. This proposal was consolidated in the Institutional Educational Project (PEI, for the term in Spanish), which guided formation toward a graduate profile with scientific, technical and social skills, capable of practicing nursing in a critical and reflective manner.

The new curriculum, lasting eight semesters, was structured into three lines: Basic Foundation, Professional Foundation, and Advanced In-depth Foundation. The latter allowed students to specialize in a management area, strengthening their skills as caregivers, researchers, managers, and educators. The conceptual framework was organized around categories, like the human being, care, environment, and the human vital process, with nursing care as articulating axis of the formative process.

At the same time, a significant administrative transformation was carried out. Superior Agreement 005 of 1994 redefined the Faculty's organizational structure; the Dean's Office was established as the head, followed by the Vice-Dean's Office, the Curriculum Committee, the Planning Committee, and the Faculty Council. The departments of Basic Professional Training, Professional Training, Extension and Graduate Studies, as well as the Research Center, emerged from the latter. Professors from the first departments supported the extension, research, and graduate processes according to projects underway. Key bodies were strengthened, such as the Tutoring Committee (Resolution 042 of 1990), the Curriculum Committee (Agreements 007 of 1992 and 010 of 1994), the Concertation Committee (Resolution 114 of 1993), and the Professor Performance Evaluation Committee (Resolution 102 of 1992), all under the direction of the Faculty Council. These instances guaranteed participation from professors, students, and graduates in academic decision-making, promoting collegial management. As result of this progress, on 17 March 1999 the Faculty obtained for the first time the high-quality accreditation granted by the National Ministry of Education, recognition that has been renovated in 2006, 2013, and 2022.

A significant achievement was the creation of the first graduate programs: three clinical specializations and an interdisciplinary master's in Collective Health. These programs responded to the conceptual strengthening of nursing as a discipline and profession, and to the advancement of research with greater theoretical and methodological maturity. The Faculty was positioned nationally and internationally, increasing its participation in academic events and administrative structures of entities such as ACOFAEN and the Latin American Association of Nursing Faculties (ALADEFE, for the term in Spanish), from where it influenced strategic decisions for the development of nursing in Colombia and Latin America. Another important achievement was the creation and graduation in 1999 of the first class of the program "University Training of Nursing Aides", a program that responded to the call and the need for professional formation of this human resource. In 1998, the Faculty's publishing project was approved, aimed at publishing scientific texts and articles in the discipline; today, it is the Journal *Investigación y Educación en Enfermería*. This initiative responded to the growing intellectual productivity of faculty, students, and graduates, and called for a clearer administrative structure, with greater dedication to teaching and research support.

During this decade, interinstitutional projects were also consolidated, strengthening the teaching-care relationship and the Faculty's academic visibility. These include the Metropolitan Area Interinstitutional Nursing Committee (COINDEN, for the term in Spanish), with participation by nursing directors from healthcare institutions; the multidisciplinary teaching-care research program in the northeast region; and the UNI project, which articulated the university, community, and social system of the municipality of Rionegro. These initiatives were led by or had leading representation by the Faculty. In addition, ties with institutions were strengthened through training, consulting, internships, and the Nursing Academic Meetings (RAE, for the term in Spanish), consolidating a more structured Faculty in administrative, academic, and scientific terms. In sum, the 1990s represented a period of profound curricular and administrative transformation for the Faculty of Nursing at Universidad de Antioquia. Articulation among national regulations, disciplinary advances, and institutional vision allowed to consolidate a comprehensive educational model, strengthen the organizational structure, and project the Faculty as an academic benchmark in the country and the region.

Decade from 2000-2010: a decade of disciplinary expansion, regional articulation, and strategic internationalization.

During the first decade of the 21st century, the Faculty of Nursing at Universidad de Antioquia consolidated a curricular transformation that strengthened the professional profile in individual and collective care, as well as in socio-political research. Ties with the healthcare sector were strengthened through the RAE, the COINDEN of Antioquia, and participation of graduates in academic groups.

Growth of research groups, four of them classified by COLCIENCIAS, drove the disciplinary development. Continuing education and postgraduate programs were expanded, including specializations, master's degrees, and the opening of the first PhD in Nursing cohort in 2010.[5] The undergraduate high-quality reaccreditation for seven years and the qualified registration for regional programs evidence the institutional quality.

The professionalization of nursing aides and technicians was strengthened in regions, like Bajo Cauca and Urabá, and the Primary Health Care (APS, for the term in Spanish) project was implemented in 2006, 2007, and 2010 in agreement with the department of Antioquia, which permitted its presence in all the regions of the department. The teaching-service relationship was formalized through the Self-Regulation Model approved in 2004, and the Network of Nursing Practice Coordinators (REDECOPE, for the term in Spanish) was created. This strategy was created and led by the Faculty of Nursing at Universidad de Antioquia to articulate nursing training institutions around the teaching-service relationship.

Internationalization was reflected in student mobility with Mexico and Canada, and in the creation of the Interinstitutional Cooperation Committee. Finally, constant administrative adaptation allowed for the articulation of substantive functions and strategic planning under Superior Agreement 255 of 2003.

Decade of 2011-2020: Academic consolidation and territorial expansion: recent milestones in the Faculty of Nursing

During this decade, the Faculty of Nursing at Universidad de Antioquia materialized significant progress in its curricular and administrative transformation. Highlights include the opening of the program in Eastern Antioquia, the first cohort of the Master's in Collective Health in Urabá, and the expansion of continuing education in three regions of the department. Participation in the formulation of public policies on caregivers positioned the Faculty as a relevant actor in the city.

The first PhDs in nursing graduated, the specialization in cancer patient care was

consolidated, and the skills laboratory was enhanced with high-tech simulators. Internationalization was evidenced by the increase in internships and student mobility. The pandemic boosted strategies, such as UdeA Nursing takes care of you, reaffirming the faculty's social commitment to its academic community and society in general.

The curricular reform proposed in 2019 extended the undergraduate program to five years, with greater emphasis on areas, like family and community health, mental health, care in old age and aging, political training, management and research, as well as learning a second language. The pedagogical model adopted is based on the integration of knowledge, innovation, and flexibility, giving students an active role in their training process. These changes generated administrative impact with the creation of committees, relocation of staff, and more rigorous academic demands.

Period of the years 2021-2025: Educating for caring in a changing world regarding the challenges of the digital era.

During the five-year period 2021–2025, the Faculty of Nursing at Universidad de Antioquia has consolidated important academic and administrative progress with a strategic vision. The implementation of the new ten-semester study plan, a proposal endorsed by the National Ministry of Education, began through Resolution 24208 of 23 December 2022, year in which the Faculty also again received the high-quality accreditation for eight years. During this implementation, the curriculum was strengthened, the use of technological tools as teaching strategies was strengthened, and the proposal to expand the educational offer in the regions of the Department of Antioquia was reactivated. The Specialization in Maternal Perinatal Nursing was created, and internationalization and interculturality processes were promoted in teaching, research, and extension. Project management permits improving the attainment of resources, while financial analysis became a key axis of discussion to face one of the biggest economic crises of the university. The Faculty's virtual campus was developed, and the institutional journal was positioned as the most prominent in Latin America. Likewise, the administrative structure was adapted to respond to post-pandemic challenges and new ways of teaching and learning, in an environment marked by technology and artificial intelligence and with a generation of teachers, students, and graduates committed to knowledge, science, and new ways of caring. This progress has permitted the Faculty to actively join international nursing and health networks, as well as signing agreements with universities in other countries and regions. Said alliances have facilitated academic exchange, advisory services, consultancies and other international cooperation activities that enrich institutional training and projection.

In synthesis, the first quarter century has represented for the Nursing program at Universidad de Antioquia a stage of consolidation and permanent renovation. Amid a confusing and challenging environment, the institution has responded with strategic vision, academic rigor, and social commitment, reaffirming its leadership in the formation of nursing professionals with critical, ethical, and transforming capacity.

Final reflections

The trajectory of the Nursing program at Universidad de Antioquia, throughout its 75 years, evidences sustained commitment with academic excellence, social pertinence, institutional transformation. This process has been possible due to the participation of all its members, who have responded with openness, continuous training, and willingness to change in the face of the challenges of each era. Curricular advances have required adjustments in content and methodologies, as well as a flexible attitude by professors and students. This flexibility, understood as organizational and pedagogical principle, must be extended to administrative

processes, communication channels, and to the regulatory interpretation, generating conditions that favor academic development and student wellbeing. In contemporary contexts, where students assume multiple social roles, this institutional adaptability becomes indispensable.

The Faculty's evolution has been marked by strategic decisions that have permitted its transition from School to autonomous academic unit, with capacity to respond to social, university, and disciplinary demands. In this sense, the nursing formation has been oriented toward autonomy, quality, and social justice. In the current context, characterized by globalization, academic mobility, recognition of degrees, multi-center research, and curriculum internationalization, the Faculty faces new challenges. Inter-institutional cooperation, strengthening of applied research, knowledge management, and the ethical incorporation of emerging technologies – including artificial intelligence – are elements that must be critically integrated into professional training.[6]

The Faculty's recent history also reveals a commitment to pedagogical innovation, expansion of educational offerings in the regions, strengthening of graduate programs, and consolidation of international networks. These processes have been accompanied by administrative restructuring that seeks greater functionality, coherence with the University's General Statute, and articulation with the current substantive functions of teaching, research, and extension.

The historical reconstruction of the processes occurring as of the 21st century faces an important limitation: scarce academic bibliography available on the recent evolution of the Faculty. A good part of this narrative has been constructed from the direct experience of the authors, testimonies from professors, and unpublished institutional documents. This situation evidences the need to advance in documentary systematization and in academic production about the contemporary institutional history.

In conclusion, since its founding to the present, the Nursing program at Universidad de Antioquia has managed to consolidate itself as an academic benchmark in Colombia and Latin America, given its great capacity for curricular and administrative transformation. Its history not only narrates an organizational evolution, but also the commitment made to care as a critical, humanistic, and socially relevant practice. Within a challenging global environment, recovering this institutional memory is key to project a Nursing program committed with equity, innovation, and academic excellence. The future requires continuing to strengthen research, internationalization, and organizational flexibility, without losing sight of the ethical and emancipatory horizon that has guided its development.

References

1. Parra F. Reforma curricular de la carrera de enfermería: una historia y varias adaptaciones [Internet]. Medellín: Academia.edu; 2019 [cited 2025 Sept 15]. Available from: https://www.academia.edu/125425821
2. Velandia Mora A. Historia de la enfermería en Colombia. 2a ed. Bogotá: Universidad Nacional de Colombia, Facultad de Enfermería; 2016 [cited 2025 Sept 15]. p. 41.
3. Atcon RP. La universidad latinoamericana: reforma y contrarreforma. Caracas: Editorial Universitaria; 1961.
4. Congreso de Colombia. Ley 30 de 1992: por la cual se organiza el servicio público de la educación superior. Diario Oficial No. 40.700, 29 de diciembre de 1992. 1992 [cited 2025 Sept 15] Available from: https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=253
5. Castrillón Agudelo MC. Apertura del Doctorado en Enfermería de la Universidad de Antioquia: el camino recorrido, fundamentos y esperanzas. Investigación y Educación en Enfermería. 2010; 28(3):475–83.
6. Duque Daza J. El desafío de la interinstitucionalidad como estrategia de gestión en programas de formación avanzada. UNIPLURI/VERSIDAD. 2011; 11(3). Available from: https://dialnet.unirioja.es/descarga/articulo/7580348.pdf

Graduate Training in the Faculty of Nursing at Universidad de Antioquia. A Contribution to Society's Needs for Care

Essay

Elvigia María Posada Vera[1]
https://orcid.org/0000-0003-3944-8788

1 Nurse, PhD. Professor. Faculty of Nursing at Universidad de Antioquia; Medellín, Colombia. Email: emaria.posada@udea.edu.co . Corresponding author.

Received: 29 August 2025.
Approved: 6 October 2025.
Conflicts of interest: none.

How to cite this article: Posada EM. Graduate Training in the Faculty of Nursing at Universidad de Antioquia. A Contribution to Society's Needs for Care. Investigación y Educación en Enfermería. 2025; 43(3):e18.

DOI: https://doi.org/10.17533/udea.iee.v43n3e17

Graduate Training in the Faculty of Nursing at Universidad de Antioquia. A Contribution to Society's Needs for Care

Abstract

Creation of graduate studies as academic programs in the Faculty of Nursing at Universidad de Antioquia began during the 1980s as a result of the generation of knowledge product of profound academic discussions in research and disciplinary areas. The Master's, specialization, and PhD programs have generated an important academic production that helps make the Faculty visible in the world. These programs are permanently subjected to self-evaluation processes, which lead to improvement plans aimed at raising their quality in response to scientific progress, social needs, and health and education policies within the framework of graduate training for nursing professionals, which guarantees the social pertinence of their formation. Currently, the Faculty's graduate programs are pertinent in their purpose of training professionals capable of confronting society's heterogeneity and proposing solution alternatives according to the new challenges from the context to live with quality and dignity. This text seeks to show the historical development of graduate training in the Faculty of Nursing at Universidad de Antioquia in its 75 years of existence and its contribution to care and development of nursing in our society.

Descriptors: students, nursing; education, nursing; schools, nursing; education, graduate.

Formación posgradual en la Facultad de Enfermería de la Universidad de Antioquia. Un aporte a las necesidades de cuidado de la sociedad

Resumen

La creación de posgrados como programas académicos de la Facultad de Enfermería de la Universidad de Antioquia se inició en la década de los 80 como resultado de la generación de conocimiento producto de profundas discusiones académicas en las áreas investigativa y disciplinar. Los programas de maestrías, especializaciones y doctorado han generado una importante producción académica que ayuda a la visibilización de la Facultad ante el mundo. Estos programas están sometidos permanentemente a procesos de autoevaluación, que conllevan a planes de mejoramiento orientados a elevar su calidad en respuesta a los avances científicos, a las necesidades sociales y a las políticas de salud y de educación en el marco de la formación posgraduada de profesionales de enfermería, lo que garantiza

la pertinencia social de su formación. En la actualidad, los programas de posgrados de la Facultad son pertinentes en su propósito de formar profesionales capaces de enfrentar la heterogeneidad de la sociedad y proponer alternativas de solución de acuerdo a los nuevos desafíos del contexto para vivir con calidad y dignidad. Este texto pretende mostrar el desarrollo histórico de la formación posgradual en la Facultad de Enfermería de la Universidad de Antioquia en sus 75 años de existencia y su contribución al cuidado y desarrollo de la enfermería en nuestra sociedad.

Descriptores: estudiantes de enfermería; educación en enfermería; facultades de enfermería; educación de postgrado.

Formação de pós-graduação na Faculdade de Enfermagem da Universidade de Antioquia. Uma contribuição às necessidades de cuidado da sociedade.

Resumo

A criação de programas de pós-graduação como programas acadêmicos na Faculdade de Enfermagem da Universidade de Antioquia teve início na década de 1980, como resultado da geração de conhecimento resultante de discussões acadêmicas aprofundadas nas áreas de pesquisa e disciplinas. Os programas de mestrado, especialização e doutorado geraram uma produção acadêmica significativa que contribui para a visibilidade da Faculdade em todo o mundo. Esses programas são submetidos permanentemente a processos de autoavaliação, que levam a planos de melhoria que visam elevar sua qualidade em resposta aos avanços científicos, às necessidades sociais e às políticas de saúde e educação no âmbito da formação de pós-graduação para profissionais de enfermagem, garantindo assim a relevância social de sua formação. Atualmente, os programas de pós-graduação da Faculdade são relevantes em seu propósito de formar profissionais capazes de enfrentar a heterogeneidade da sociedade e propor soluções alternativas de acordo com os novos desafios do contexto, a fim de viver com qualidade e dignidade. Este texto tem como objetivo mostrar o desenvolvimento histórico da formação de pós-graduação na Faculdade de Enfermagem da Universidade de Antioquia ao longo de seus 75 anos de existência e sua contribuição para o cuidado e o desenvolvimento da enfermagem em nossa sociedade.

Descritores: estudantes de enfermagem; educação em enfermagem; escolas de enfermagem; educação de pós-graduação**.**

Introduction

Given that nursing is a social and practical discipline, its practice and development are influenced by the complex phenomena of an accelerated context that impacts morbidity and mortality profiles and, to that extent, requires renewal of care plans to satisfy new social needs, therefore, highly qualified personnel is needed to lead relevant and timely processes in response to the care needs of each environment. An effective way of facing these challenges is the creation of graduate programs that stimulate the scientific-technical development of nursing in the continuous search to improve the quality of care and its consolidation as science and discipline. The creation of graduate studies as training programs in the Faculty of Nursing at Universidad de Antioquia required profound academic discussions and excellent research training of its professors, evidenced in the formation of groups and lines of research with a high scientific production as a necessary input for their development. These graduate programs focus on four specializations, two master's, one disciplinary PhD and an interdisciplinary PhD to successfully meet the social, professional, and disciplinary needs of individuals, families and groups.

Beginnings of a Dream: Advanced Training

The Nursing program at Universidad de Antioquia, with 75 years dedicated to the formation of professionals, has had important development that have led it along paths of professional and disciplinary growth around care, its object of study. By the year of its founding, there were already inter-American organizations in the country, like the Pan-American Health Organization and entities such as the Rockefeller and the WK Kellogg foundations, which supported the creation of nursing schools with funding and training, while also granting scholarships to train their professors in the areas of health and education, which became effective in Universidad de Antioquia in the late 1950s.[1]

This opportunity favored the qualification of professors, and by 1963 there were three specialists in medical-surgical nursing and two in public health. This was potentiated in the 1960s and 1970s with graduate training of several professors in national and international universities and with internships in numerous training centers. In 1997, professor Mabel Restrepo, in her book "History of the Faculty of Nursing at Universidad de Antioquia", considered that as the School was permeated with more advanced knowledge and other visions of nursing in terms of profession and discipline, its academic growth was on the rise, which strengthened the capacities of the professors and their active participation in interdisciplinary research groups that later became the niches that supported the creation of the Research Center and the first graduate programs in the already renowned Faculty of Nursing.

By the 1980s, development in research, the presence in the Faculty of a greater number of professors with specialization and master's degrees, the needs of the context, and guidance by ACOFAEN for the time were reasons that motivated the creation of graduate studies. Parallel to the interest generated in creating the journal and the research center, another project that gained relevance was the creation of several specialties in the clinical areas of medical-surgical and rehabilitation, and another in community health. Consequently, the Faculty Council, convinced of the need and importance of supporting graduate formation, created the graduate studies policy through Agreement 003 of 23 January 1990, which favors both academically and administratively the execution of these projects. Despite having achieved approval from the curricular committee, the first project continued being debated until considering of greater social pertinence a specialization in nursing care of patients in critical state, given the increase in intensive care units and specialized operating rooms in the country, which favored the future employment of graduates and generated greater impact on care.[2]

Academic-administrative structure of the graduate programs

Once the graduate policy was approved, there was greater interest in consolidating projects in relation to the proposed programs. One of these began in 1992, which required administrative and academic support that guided and backed the development of the programs. This is how, in the organizational restructuring of the Faculty, given in 1994 by Superior Agreement 005 of May 19, the Department of Extension and Graduate Studies was created. Thereafter, the University responded to its growth in the offer of graduate programs, considered fundamental to achieve academic excellence, by creating the University Graduate System through Superior Agreement 058 of 4 December 1995, which regulated the area's academic and administrative activities, with its autonomy, decentralization, deconcentration, and coordination, as important cores. This agreement also defined what criteria and procedures must be brought conducted in the university to create and offer these programs. Said norm was modified by Superior Agreement 306 of December 2005 that established the system's functions, making the Graduate Program Committees, Graduate Committees of each department, Faculty, School or Institute Councils, Graduate Area Committees (exact and natural sciences - health sciences - social or human sciences), the Central Graduate Committee, the Academic Council, and the University Higher Council responsible for their compliance, in that order. Moreover, graduate training levels were recognized, such as specializations, master's and PhD degrees, specifying the scope of each of them.

By 1998, the University's Graduate Department was created by Superior Agreement 149 of August 10, to ensure the quality of its programs, from the interdisciplinarity, heterogeneity, and efficiency of its processes in direct relationship with research. The existence of this link favored the organization, development, and consolidation of groups and lines of research. In keeping with the foregoing, in 2025 the Faculty has five groups classified by COLCIENCIAS: *Nursing Practice in the Social Context* (category A1), *Social Policies and Health Services* (category A), *Women's Health, Health Promotion, and Emergencies and Disasters* (category C), with 23 lines of research. These groups and lines of research fostered key areas of knowledge, where students and professors could conduct socially pertinent research that contribute to the discipline and respond to solving specific problems derived from the practice. Through these lines, communication is also established with peers from other national and international universities to evaluate research work, thus increasing the reliability and quality of the knowledge generated in said work and in turn nourishing the interdisciplinary perspective of the programs.

Normative platform

Within the framework of the University System, a broad regulatory platform was established that regulates all the academic and administrative processes of graduate studies in Universidad de Antioquia, as a compass for action on which these processes are based in the Faculty of Nursing, with its own regulations when authorized by the central structure. In broader terms, the general student regulations for graduate programs (Superior Agreement 432 of 25 November 2014) and a specific one for each unit are mentioned, endorsed in Nursing by Agreement 097 of 26 September 2018. Currently being updated, both regulations are supported by the graduate student affairs committee, whose function is to review and resolve students' academic requests. The compulsory nature of a second language is regulated as a central aspect to support internationalization of the curriculum, international mobility of students through strategic alliances that favor agreements, internships, exchanges, scholarship management and scientific and cultural collaboration events, as well as participation in international knowledge networks, which permits access to new sources of information and increased scientific production to improve the quality of the programs. All this was supported by the University's Interinstitutional Nursing Cooperation Committee and the International Relations Department.

Quality conditions

Adherence to and ongoing evaluation of the quality conditions established in Decree 1330 of 25 July 2019 accounts for the social commitment and responsibility of the Faculty of Nursing with the academic excellence of its formative processes. From the Graduate Department, work is underway regarding this objective, through self-assessment and ongoing evaluation processes with participation from internal and external stakeholders that results in an improvement plan, in search of obtaining or renewing the qualified registrations of each of the programs and the accreditation of those that meet said requirements, such as the Master's in Collective Health, already accredited, and the Master's and PhD in Nursing in process of being accredited.

Graduate programs in the Faculty of Nursing: a contribution to the development of the profession and to socially pertinent care

1 Specialization in Nursing Rehabilitation

This was one of the projects proposed towards the late 1980s, becoming a reality through ICFES Resolution 082 of 4 June 1992 designed for three face-to-face semesters with a preventive focus, with exclusive dedication and practical theory. This program began in February 1993 and had 27 graduates distributed into three non-continuous cohorts, granting the title of Specialist in Nursing Rehabilitation. It closed in 2000, at the end of the third cohort, given that the purpose of its creation to cover the need for professionals in the field had been fulfilled; the limited labor recognition by employing institutions and availability of the physical therapy program in other educational institutions were also considered, which risked the job offer for graduates.

2 Master's in Collective Health. Interdisciplinary project with validity in its social relevance.

According to the Master Document of the Collective Health Program, the idea of specialization in the community area, which was conceived in the 1980s, was nourished by the discourse and theories of the social medicine movement in Latin America, which permeated the Faculty with greater strength in the early 1990s, posing a critique of the neoliberal model and a biomedical and positivist perspective focused on disease and epidemiological problems unresolved by healthcare systems.[1] These reflections identified challenges that shifted research toward other more qualitative and comprehensive axes, increasing scientific production that was strengthened by the view of national and international experts,

and contributing to shaping a serious, solid, and flexible program that was shaped after a profound interdisciplinary discussion in the workshop "Social sciences in graduate programs in social medicine in Latin America and in the Master's in Collective Health". This master's was approved via academic Agreement 166 of 26 November 1991, and created by Superior Agreement 197 of 11 December of the same year and, finally, approved by the Colombian Institute for the Evaluation of Education through agreement 177 of August 13, 1992. It began its first cohort in 1994 with a study plan focused on understanding health articulated to social processes and a research emphasis from a critical perspective that questions and seeks to impact conditions and quality of life of human groups.[1]

Constant efforts to continually improve the program's quality allowed it to receive the "Luis López de Mesa Order on Education and Public Faith" from the National Ministry of Education, through Resolution 10567 of December 2011. In 2012, it extended to the Urabá region in Antioquia, with Qualified Registration granted for seven years, by Resolution 10407 of November 26, 2010, where only one cohort with three graduates was offered. Its quality has been certified and accredited by the National Ministry of Education under strict internal and external evaluation processes; currently, with qualified registration number 008737 of 30 April 2025 for seven years, extended to the Urabá region, and accredited until 2027, through Resolution 018122 of 27 September 2021. In 2025, the master's added 31 years of being offered under the guidelines established for graduate formation in the University, maintaining its initial purpose of training professionals from different disciplines, under the analytical articulation of social sciences and health, recognizing the political and economic influence exerted on the practices of the biomedical model and the need for intersectoral effort in meeting this sector's needs. Currently, the Master's in Collective Health has 100 graduates in Medellín and 3 in Urabá, who are professionals from the social areas of health, which accounts for understanding the necessary interdisciplinary approach to complex problems, such as caring for human beings.

3 Specializations in Adult Care and in Care of Children in Critical Health Conditions

The experience acquired, enhancement of knowledge, greater research production, and a sounder academic-administrative structure were the elements that drove the creation of the Specialization in Nursing in Care of Adults in Critical Health Conditions, whose project was being worked on since the early 1990s in response to the needs of a complex health panorama with high mortality and morbidity indices that required urgent and specialized care in high-technology units, such as intensive care, which required nursing professionals with greater training, capable of responding to the complexity of the needs of the subject of care and the management of the clinical-administrative processes that will support such care; a challenge assumed by the Faculty of Nursing by creating two specializations – one in Care for Adults in Critical Health Conditions (Resolution 001050 of 1 February 2022), and another in Care of Children in Critical Health Conditions (Resolution 013239 of 8 July 2022 from the Ministry of Education), being the first higher education institution in Antioquia to prepare specialists in this area.

Both specializations were approved by Academic Agreement 109 of 15 July 1997, with a duration of three semesters, granting the title of Specialist in Nursing in Care of Adults in Critical Health Conditions or Specialist in Nursing in Care of Children in Critical Health Conditions. The program's academic axes focused on the care of individuals in critical health conditions, as an object of study, research through structuring monographic works, management of Intensive Care Units, and practice in Intensive Care Units and Special Care Units or Intermediate Care, in addition to two elective courses to delve into the

care of patients with critical health disorders of neurological and cardiovascular origin.

Nowadays, the pertinence of these specializations is still valid given the characteristics of the health context, which evidences, among other things, the transition from the epidemiological profile with prevalence of rare diseases, trauma, increased cancer and decompensated chronic diseases; along with transplants and interventional radiology therapies, which lead to an increased demand for care in critical care units with greater scientific and technological progress, requiring greater training for healthcare staff. Thus, the formative components are aligned with five axes of the Educational Project of the Graduate Department Program: care, disciplinary foundation, bioethics, management and research, considered key elements in humane and quality care of patients in critical care. The aim is for specialist nurses to acquire skills to work in ICUs, coronary and transplant units, third-level emergency services, interventional radiology, hemodynamics and electrophysiology, among others, by integrating knowledge in reflective and coherent manner, in concordance with the demands of patients, the structure of services and institutional policies, and the Colombian healthcare system. Both programs have obtained qualified registration for three consecutive times, the last of these in 2022, with an extension of the opening to the eastern campus of Universidad de Antioquia, both for seven years.

Bearing in mind the guidelines by the National Ministry of Education, and the University's projections regarding graduate programs, Both specializations diminished their duration to two semesters, in line with other programs in the country, delivering trained professionals in less time with quality training at lower costs.[3] In 2025, the Nursing specialization in Care for Adults in Critical Health Conditions completed cohort 16 with 179 graduates and the specialization of Child Critical Care has 14 cohorts with 99 graduates.

4 Specialization in cancer patient care

The master document of the Specialization in Oncological Nursing Program indicates that the interest by the Faculty of Nursing in training professionals capable of responding to the health needs of the environment and the high rates of morbidity and mortality due to pathologies, like cancer, justified in 1996 this specialization's creation, which was carried out in association with Pontificia Universidad Javeriana. The idea was to train clinical professionals with a comprehensive approach to preventive, curative and rehabilitative care for cancer patients and their families, also seeking the development of research in this field. In 1999, eleven specialists graduated of which four were professors from the Faculty; this program only carried out one cohort.

Given that the need for these specialists was on the rise, evidenced on the increased global incidence of this disease,[4] seen as one of the diseases with the greatest human and social cost, the Faculty again considers the creation of the program to train competent specialists to provide specialized care to those suffering from cancer through a reflective practice inspired by the different conceptualizations that exist from the discipline for care and which evidence needs for applied research in the area. This program was created by Academic Agreement 387 of 3 February 2011 as Nursing specialization in Care of Cancer Patients and their Families, initiating the first cohort in 2013, based on the postulates of the nursing metaparadigm: care, person, context, nursing and health-disease process, considering epistemological, conceptual, and methodological elements of the discipline to support practice.

In February 2021, during the second renovation process of the qualified registration, the National Ministry of Education recommended adjusting the program's name to a more precise denomination, in concordance with that generally accepted in health specialties, modifying it for Specialization in Oncological Nursing because it is a nationally and

internationally recognized denomination. Thus, through Academic Agreement 572 of 25 February 2021, the program's name change was approved and then endorsed by the National Ministry of Education through Resolution 017583 of 16 September 2021, extending the qualified registry for seven more years, favoring the qualification of professionals and consolidation of the program in the academic and social setting by being the only one offered in the Andean region and throughout north-central Colombia. The study plan for this new version was developed through nuclei focused on oncology nursing, research, and management, promoting critical reflection on care experiences in professional practice, which demonstrate the need for research. Until 2025, eight cohorts have been carried out, seven of them completed with 94 graduates.

5 Specialization in Maternal Perinatal Nursing

The Faculty's Maternal Perinatal Nursing Specialization emerges from the national need for comprehensive, safe, differential, and inclusive care for the maternal perinatal population to diminish morbidity and mortality indicators in said population. In Medellín, gynecology and obstetrics services in health institutions do not have nursing professionals specialized in the area, and those practicing there receive empirical training from professional peers who have the skills, but have no theoretical and practical training from a formal specialization program that certifies their knowledge.

The program is also offered, in coherence with the requirements of Resolution 3280 of 2018, expressed in the Comprehensive Maternal Perinatal Care Route, which empowers recognized and trained nursing professionals to be leaders in the direct care of low-risk births and continuous care of women and newborns from preconception to postpartum, as a public health commitment to improve the quality of life and health of mothers and children. Its creation, as the only one in the region, contributes to improving the health situation of this population, facilitating access to advanced training for nurses from other areas of the department and the country, supported by a disciplinary and professional approach in the maternal perinatal area. The program is based on concepts and theories of the nursing discipline and on postulates from the biological sciences that allow understanding the physiology of the reproductive process and its alterations. This specialization was created through Academic Agreement 590 of 25 February 2022, endorsed by Ministry of Education Resolution 5526 of 5 April 2023. In 2025, with a cohort of six graduates, it is about to open a second cohort.

6 Master's in Nursing

By the 1990s, the arrival of the first female nursing PhDs gave rise to the disciplinary discourse in the country, which was disseminated through academic settings, such as colloquia, seminars, nursing congresses and internships; this, added to the arrival to the Faculty of Nursing of experts in disciplinary concepts modified the mentalities of its professors, who promoted a movement of reflection on disciplinary conceptualization and strengthened research processes on the subject. Thus, epistemological concepts were enhanced, together with the adoption of nursing vocabulary and disciplinary practices, such as the application and use of the Nursing Care Plan and its models and theories. Consistently, publications focused on the disciplinary topic began to increase. Works on this topic favored the promotion and consolidation of disciplinary knowledge in the Faculty, showing a promising perspective for the creation of the master's degree in nursing,[1] which was carried out through Academic Agreement 190 of 2001 to deepen the discipline's scientific knowledge and research to solve specific problems of the practice, thereby, contributing to the profession's development in the department of Antioquia and the region. The cohort in 2005 had nine graduates, mostly professors from the Faculty, which favored greater positioning of the disciplinary discourse in this academic unit and

promoted large projects, such as the subsequent creation of the PhD in nursing.

As the first program of this level in the department, it prioritized in its formation four curricular axes: care, research, discipline, and the profession, supported on other knowledge, such as social and human sciences, ethics, and management of health services. This has allowed graduates to direct their practice towards solving care problems in the context of individuals, families, and human groups within the framework of knowledge of interest to nursing, strengthening the discipline and the transformation and innovation of its practice in care, research, education, consulting and the exercise of citizenship from the field of nursing.

Within the framework of the Graduate Policy at Universidad de Antioquia, the master's programs may be offered from two perspectives: in-depth, to delve into an area of knowledge from specific situations to solve problems of disciplinary, interdisciplinary, or professional nature; and research, aimed at developing skills in research processes toward new knowledge. The same program can have these two approaches, with the differentiating elements being the type of research carried out, the credits and the academic activities developed by the students. Hence, The Faculty of Nursing, taking advantage of the qualifications and academic production of its research groups, the knowledge and expertise of its teaching staff and the strengthening of the teaching-service relationship with good practice scenarios, proposes a curriculum for the program with both modalities, approved through Faculty Council Agreement 046 of 2013, and Ministry of Education Resolution 1268 of 12 February 2013. With this new option, students have the possibility of qualifying their transformative and innovative practice by applying the scientific method in the area of emphasis, an important differentiating feature as it is a possibility few programs in the country offer.

The master's degrees in depth were offered according to the following phenomena of interest: care for people with chronic health problems, women's health care, child and adolescent care, care for people in critical health conditions, management, administration and management of care, mental health care in populations, ethics and bioethics of care, care for people with wounds and ostomies, care during the aging process and old age, care for people with cancer. These lines were offered according to needs detected in the program's self-assessment processes. Guided, observation and field visits were specific teaching modalities for this modality.

The in-depth line was offered from 2018 to 2021, since in the process of renewing the qualified registration, the National Ministry of Education required independent qualified registrations for each of the modalities, giving real importance in this case to the teaching-service relationship, with a sufficient and effective offer of practice scenarios, sufficiency and availability of expert professors in each of the lines offered by cohort and a sufficiently solid administrative structure to support the program. Considering the time available for the process and the procedures to obtain practice scenarios, it was decided to continue with the research modality, with a future projection to reopen the in-depth modality.

Two emphasis courses were held: the first on caring for patients in critical health conditions, from which two students graduated; and the second on caring for patients with wounds and ostomies, from which four students graduated. The line of research is ongoing, with eight cohorts developed, seven of which completed with 47 graduates, and an underway cohort with eight students registered. The master's program is currently undergoing high-quality accreditation.

7 Nursing Doctorate

Between 1997 and 2001, the Faculty worked on a joint doctoral proposal with five universities:

Universidad de Antioquia, Pontificia Universidad Javeriana, Universidad Nacional de Colombia, Universidad Pedagógica y Tecnológica de Colombia, and Universidad del Valle. This proposal was supported by the Association of Schools and Faculties of Nursing and advised by foreign universities, such as the University of California in San Francisco, for the joint design of a PhD degree in Nursing. Due to differences in the academic and administrative autonomy of the participating universities *vis-à-vis* the National PhD Commission, Universidad Nacional with this autonomy closed its internal process and withdrew from the consortium. Therefore, the project under this modality was suspended and halted, and the agreement was canceled by the Rector's Office and the Legal Advisory Office at Universidad de Antioquia.

The autonomy of Universidad Nacional de Colombia in approving the program ended with the Interuniversity Agreement signed for this purpose, and it approved its own PhD program. The other faculties decided to continue their work independently.[1] This experience enabled participation by professors from the Faculty in multiple national and international training settings regarding the disciplinary topics, debates, and internships in different universities around the world that already had a PhD degree in nursing, increasing their knowledge and qualifications to resume the PhD proposal at the Faculty, added to the conceptual and methodological maturity that had already been achieved in terms of discipline by the first decade of 2000 thanks to the development of the master's degrees in nursing and Collective Health and the growth of the groups and lines of research.

This is how, through Academic Agreement 350 of 7 May 2009, the PhD program in Nursing at Universidad de Antioquia was created, seeking to align itself with the possibilities and needs to develop the profession in the local context and with the trends of professional and research development in the international context, seeking to solve social problems through the generation and empirical verification of theories and application of scientific progress in the practice of caring for individuals and groups.[1] The program's first cohort started in 2010 with a study plan that favors the qualification of Nursing professionals for the development of knowledge in autonomous research exercise, with a high humanistic, ethical and high-quality level to deepen in the epistemological aspects of nursing care and the theories and models of the area. It took as central axes care, health, people, and the complex relationships among such categories, as well as the dynamic processes that develop inter-articulated in a complex health context, seeking to strengthen the discipline and the practice with academic, social, and scientific pertinence. By 2025 the program has carried out six cohorts with 25 graduates, a cohort underway with two students registered.

8 Education and Health Doctorate: A commitment to transdisciplinarity and cooperation among academic units for scientific training at the University

The relationship between education and health, as complex phenomenon, must be studied in depth as it is one of the central axes in the implementation of public health policies in the country. Due to this, the demand for training in this field must be addressed from a transdisciplinary perspective within the framework of a PhD program, given the theoretical support required by its practice, which must be resolved through high-level academic research development. To meet this need, Universidad de Antioquia created the PhD in Education and Health, approved through Academic Agreement 614 of 17 April 2024 and Resolution 18498 of 21 October 2024 from the National Ministry of Education. It is the first in this field in Latin America, with great relevance given the limited research development in the line of study proposed.

Cooperative and collaborative inter-professional work facilitates academic work in terms of research and appropriation of knowledge, which

strengthens the students' quality formation with rationality of resources, achieving expansion of research and training development within the university, with a broader social, ethical and political impact. In this sense, the PhD program becomes an opportunity to promote human formation and transformation, from a transdisciplinary, intersectional, and intersectoral perspective that articulates, integrates and recontextualizes the fields of education and health.[5] This is a proposal for inter-academic unit cooperation, with the participation of the Faculty of Nursing, School of Microbiology, School of Nutrition and Dietetics, Faculty of Agricultural Sciences, Faculty of Medicine, National Faculty of Public Health, University Institute of Physical Education and Sport, and Faculty of Education. Each of them from their specific knowledge, with representation of highly qualified professors and support from groups and lines of research, such as that of social policies and health services and health promotion for nursing, with their respective lines of research, education as a social practice and health education. In all, it will have 10 research groups and 11 lines of research, belonging to the academic units involved.[5] It is a six-semester PhD program, in face-to-face modality with support from ICTs, aimed at professionals with experience in the health system or in the educational sector. Administratively, it is represented by the National Faculty of Public Health, with academic support and teaching management from all associated units. It began its second cohort during the second semester of 2025 with 15 students registered.

Academic management of graduate programs

Direct management of the graduate programs is the responsibility of each program's coordinator, in support of the regulations set forth and the guidelines by the department's head. From the academic point of view, there is support from the Curriculum Committee, which guides the formulation, development, and modifications of the study plans, which are revised at the beginning of each cohort, to integrate the new knowledge, assuring articulation among the disciplinary, research, practical, philosophical, and ethical components, and – thus – the continuity of its social pertinence. The new demands of educational policy and the administrative and academic needs of the moment are also considered. In this sense, methodologies that integrate information and communication technologies into the teaching-learning process have been implemented, besides strengthening the flexibility of the curriculum by offering elective courses per program and internships that seek to enhance specific formation areas according to students' needs and interests, with a focus on their area of performance.

Challenges

In the Faculty of Nursing at Universidad de Antioquia, graduate training is conceived as one of the pillars for social transformation and the search for better levels of wellbeing in the population. The complexity and dynamism of the overall context, the accelerated technological development, and rapid generation of knowledge – characteristics of the current world – require highly qualified personnel in the scientific field, capable of leading these processes and correctly responding to the population's interests, needs, and problems, which requires mastery of the disciplinary theories and those specific to each area of the technical and research processes.

Graduate programs are a source of high scientific production whose dissemination through different academic settings makes the Faculty and the University visible and established in the academic world. All this drives its own development and – in turn – generates new research alternatives, which demands continuity in the formation of researchers and enhancement of technical skills in the specific fields required by a society in permanent movement. Considering the current speed in scientific progress, the transitory nature of the contents and approach of graduate

programs must be recognized; so, to sustain their social relevance, considerable academic and administrative flexibility is required, which supports the prompt adaptation of their training proposals to the trends of new knowledge.

The scientific consolidation and visibility that graduate programs give to the University and Faculty also generate internal challenges. It is fitting to consider the national and international demand for the Faculty's graduate programs, and its in-person modality that makes it difficult for students from other regions of the country and the world to enter, so a challenge is to offer them in bimodal manner, availing of the possibility offered by ICTs of simultaneous connection in real time or asynchronously, without geographical barriers, according to the characteristics of potential students and the sustainability of the programs in the university.

It is also necessary to strengthen interdisciplinary research with other groups and research lines in the university that allows the use and cooperation to rationalize human, technical, and scientific resources and enhance the generation of knowledge from a broader and more productive perspective. Lastly, the need is recognized to establish a more effective relationship between the graduate and the undergraduate programs, so that the latter is permeated by the theoretical and methodological progress achieved in the first of these. In the discussions, debates, and defense of degree projects, faculty and undergraduate students should be present as a way to promote new projects, stimulate advanced training in them, and more strongly adopt disciplinary and professional issues in the Faculty.

References

1. Castrillón C. Formación universitaria de enfermeras en Colombia 1937-1980. Investigación y Educación en Enfermería. 1986; 4(1):53-92.
2. Orrego S, Castrillón MC. Una propuesta de investigación en el área clínica. Investigación y Educación en Enfermería. 1988; 6(2):63-70.
3. Gómez Tabares GE. Facultad de Enfermería: Hacia la profesionalización, entre rupturas y cambios. Crónicas Universitarias. Universidad de Antioquia 200 años. Medellín: Universidad de Antioquia; 2003. p. 149-59.
4. World Health Organization. Global cancer burden growing, amidst mounting need for services [Internet]. WHO, Geneva. 2025 [cited 25 Sept 2025] Available from: https://www.who.int/news/item/01-02-2024-global-cancer-burden-growing-amidst-mounting-need-for-services
5. Universidad de Antioquia, Facultad de Enfermería, Doctorado en Educación y Salud – Información básica [Internet]. Medellín: Universidad de Antioquia; [cited 2025 Sept 23]. Available from: https://www.udea.edu.co/wps/portal/udea/web/inicio/unidades-academicas/salud_publica/estudiar-facultad/posgrados/doctorado-educacion-salud/Content/asContentsMenu