

REVIEW

Strengthening Health Systems through Nursing Education: The Role of Self-Efficacy in Academic and Clinical Competence

Fortalecimiento de los sistemas de salud desde la educación en enfermería: el rol de la autoeficacia en la competencia académica y clínica

Yuly Andrea Menéndez Sequeda¹, María Alejandra Rojas Valencia¹, Andrea Carolina Noches Osorio¹, David Andrés Ordoñez Rúales¹, Maria Andreina Pulido Montes¹  , Elveny Laguado Jaimes¹

¹Universidad Cooperativa de Colombia, Facultad de Enfermería. Bucaramanga, Colombia.

Cite as: Menéndez Sequeda YA, Rojas Valencia MA, Noches Osorio AC, Ordoñez Rúales DA, Pulido Montes MA, Laguado Jaimes E. Strengthening Health Systems through Nursing Education: The Role of Self-Efficacy in Academic and Clinical Competence. South Health and Policy. 2026; 5:386. <https://doi.org/10.56294/shp2026386>

Submitted: 26-02-2025

Revised: 03-06-2025

Accepted: 12-01-2026

Published: 13-01-2026

Editor: Dr. Telmo Raúl Aveiro-Róbalo 

Corresponding author: Maria Andreina Pulido Montes 

ABSTRACT

Introduction: the study addressed self-efficacy as a personal belief that significantly influenced the thoughts, emotions, and behaviours of nursing students. According to Bandura and Resnick, self-efficacy was defined as the perception of one's own abilities to cope with situations and achieve goals, which proved to be a key factor in academic and clinical performance.

Development: during the analysis, theories from psychology and nursing were considered that explained how self-efficacy impacted professional training. Bandura argued that individuals with high self-efficacy took on challenges with greater commitment and perseverance. Resnick's theory proposed that this perception was built through real experiences, observation of models, verbal persuasion, and physiological feedback. Research showed that students with higher self-efficacy performed better academically, experienced less fatigue, and were more willing to face complex clinical situations. It was also stated that the institutional context and pedagogical support influenced the development of this competence.

Conclusion: it was concluded that self-efficacy was fundamental in the training of nursing students, as it strengthened their personal confidence, clinical judgement, and ability to provide quality care. Therefore, it was recommended that academic programmes integrate strategies that foster this belief from the teaching-learning processes, thus promoting more competent, confident, and committed professionals.

Keywords: Self-Efficacy; Nursing; Academic Performance; Motivation; Higher Education.

RESUMEN

Introducción: el estudio abordó la autoeficacia como una creencia personal que influyó significativamente en los pensamientos, emociones y comportamientos de los estudiantes de enfermería. Según Bandura y Resnick, esta se definió como la percepción de las propias capacidades para enfrentar situaciones y alcanzar objetivos, lo cual resultó ser un factor clave en el desempeño académico y clínico.

Desarrollo: durante el análisis, se consideraron teorías desde la psicología y la enfermería que explicaron cómo la autoeficacia impactó en la formación profesional. Bandura sostuvo que los individuos con alta autoeficacia asumieron retos con mayor compromiso y perseverancia. Por su parte, la teoría de Resnick propuso que dicha percepción se construyó a través de experiencias reales, observación de modelos, persuasión verbal y retroalimentación fisiológica. Investigaciones demostraron que los estudiantes con mayor autoeficacia presentaron mejor rendimiento académico, menor cansancio y mayor disposición para enfrentar situaciones clínicas complejas. Asimismo, se afirmó que el contexto institucional y el acompañamiento

pedagógico influyeron en el desarrollo de esta competencia.

Conclusión: se concluyó que la autoeficacia fue fundamental en la formación de los estudiantes de enfermería, al fortalecer su seguridad personal, su juicio clínico y su capacidad de brindar atención de calidad. Por ello, se recomendó que los programas académicos integraran estrategias que fomentaran esta creencia desde los procesos de enseñanza-aprendizaje, promoviendo así profesionales más competentes, seguros y comprometidos.

Palabras clave: Autoeficacia; Enfermería; Desempeño Académico; Motivación; Educación Superior.

INTRODUCTION

Self-efficacy is ‘the perception or personal belief of one’s abilities in a given situation, which is why self-efficacy beliefs greatly influence human beings, as they affect their thoughts, feelings and behaviours’.⁽¹⁾

In nursing, there is also a theory of self-efficacy by Barbara Resnick, which explains ‘an individual’s judgement of their ability to organise and execute courses of action necessary to achieve certain types of goals’.⁽²⁾

A study was conducted in two nursing and midwifery faculties in Shiraz and Rafsanjan, Iran.^(3,4,5) It was found that a lack of knowledge and general self-efficacy synchronously predicted variation in academic decline. In contrast, general self-efficacy predicted academic productivity and its total variance. In addition, a lack of cognition calculated the connection between general self-efficacy and academic fatigue ($p<0,001$).^(6,7,8,9) Interventions to improve self-efficacy in nursing students and lack of cognition can help reduce academic fatigue and increase academic performance.⁽¹⁰⁾

Therefore, one of the fundamental challenges of nursing education is the academic fatigue of students due to stressful causes, often accompanied by certain sociodemographic factors affecting students and their academic commitment, such as nursing practices.^(10,11,12,13,14,15)

Similarly, high levels of self-efficacy are vital for nursing students and nurses in both academic and work contexts if they believe in their abilities, use all their resources, and do their best to achieve goals in different situations.^(16,17,18) Conversely, nursing students and nurses with low self-efficacy would not take the necessary actions for their patients, would develop low clinical self-esteem and, as a result, would not begin to perform tasks without confidence in their abilities in order to protect themselves from mistakes, while at the same time depriving their clients of quality and effective care.

Objective

This study analyses the concept of self-efficacy in nursing students from the theoretical perspectives of Bandura and Resnick, as well as its influence on academic, emotional, and professional performance, to understand its importance in comprehensive training and the development of clinical skills.

DEVELOPMENT

Theoretical framework

Two theoretical positions are presented in accordance with the chosen phenomenon, self-efficacy, to present the theoretical framework.

Self-efficacy is a term recently adopted from social psychology. This field aims to explain certain beliefs, patterns, and behaviours of people at different levels of emotional, cognitive, and behavioural analysis.^(19,20,21,22) It is known that the beginning of higher education tends to be a very fundamental phase, not only for training in a discipline such as nursing but also for personal development. At this stage, students begin to get to know themselves and adapt to different situations, differentiating themselves by their way of thinking and acting and demonstrating their own abilities to solve problems that arise.^(23,24,25,26)

Similarly, authors in Chile indicate that the ‘concept of self-efficacy does not refer to the resources that the subject possesses, but to how they perceive that they can use them to achieve their goals’.^(23,24,25,26,27,28,29,30) As a caring science, nursing needs to be equipped to face the challenges posed by the patients they care for daily. Self-efficacy predicts good academic results, translating into better quality care for users and families.^(5,7,8,31,32,33)

This study considers two theoretical positions on self-efficacy, the first from psychology⁽³⁴⁾ and the other from nursing (Resnick). ‘According to Bandura, self-efficacy exposes how a person perceives the desire to complete tasks successfully, beliefs about effectiveness influence goals and aspirations, and the greater the perception of self-efficacy, the more goals will be achieved’.⁽³⁵⁾ Therefore, it can be said that the more goals a student sets, the more consistent their commitment to them will be.

In the Social Learning Theory announced in 1986, perceived self-efficacy was a concept given by Bandura who, according to him, ‘if people are not fully convinced of their effectiveness, they tend to quickly abandon

the skills they have been taught as soon as they stop getting quick results or experience some setback'.⁽³⁶⁾

Three factors predominate positively and negatively in self-efficacy: the affective factor, which includes emotions and feelings, among others; the cognitive factor, which consists of thoughts, tasks, etc.; and finally, the behavioural factor (behaviours), which means that self-efficacy can determine what kind of actions and behaviours a person may have in the future.^(19,37,38,39,40)

Furthermore, this theory proposes that individuals have an internal system that allows them to control their thoughts, emotions, and behaviours. This creates a mutual relationship between behaviour, beliefs, and thoughts, which leads to the individual's beliefs about themselves playing an important role in their control and personal ability to achieve tasks.^(19,41,42,43)

The theory also mentions that human motivation and behaviour are regulated by reasoning and that three models of perspectives are involved in acquiring self-efficacy: firstly, the situation-result model, which mentions the effects produced by environmental events that are independent of personal actions; action-result expectations, referring to the belief that a behaviour will produce specific effects; and perceived self-efficacy, which relates to an individual's belief that they have the abilities to perform actions that will enable them to achieve their goals.^(33,34)

Self-efficacy is included in the student training process through activities and assignments designed to achieve results, giving rise to the belief that they can perform specific actions in the future.^(34,44,45)

In nursing, Barbara Resnick's Middle Range Theory of Self-Efficacy⁽⁴⁶⁾ defines self-efficacy as 'an individual's judgement of their ability to organise and execute courses of action'.⁽⁴⁷⁾ It was developed from Bandura's concepts, which focus on the reciprocal interaction between the individual, behaviour, and the environment, which influence each other and can vary depending on the circumstances.^(47,48,49,50)

Thus, Resnick's theory proposes that 'people's thoughts about themselves are developed and evaluated through four different processes: direct experience with the effects of their actions (actual performance), vicarious or indirect experience, judgements expressed by others, and finally the derivation of additional knowledge from what is already known'.^(47,51,52) These processes are fundamental in nursing education, as they are reflected in people's humanised and holistic care.

Bandura posits that self-efficacy is established based on four principles of information that must be reflected upon to be meaningful.⁽⁵³⁾

- Successful experiences (actual performance): refers to previous achievements that significantly affect a task's effectiveness, influencing the positive sense of self-efficacy. On the other hand, failures decrease self-efficacy, increasing the likelihood of failure.⁽⁵³⁾
- Vicarious experience or learning by observation: When people observe the achievements of other individuals, they tend to compare themselves and visualize themselves in the same situation. This produces expectations of efficacy, assuming that they have the same strengths as the other person and will, therefore, also be successful.⁽⁵³⁾
- Judgements expressed by others - Verbal persuasion: stimuli from other people encouraging or increasing the desired ability or behaviour cause the individual to strive to increase self-efficacy and achieve their goals. It is an expression of confidence in the abilities of others.^(53,54,55)
- Physiological feedback: for a person who achieves their goals, this ensures a state of personal satisfaction and comfort that is adequate for achieving self-efficacy, which is reflected in physical, mental, and social behaviour.^(53,56)

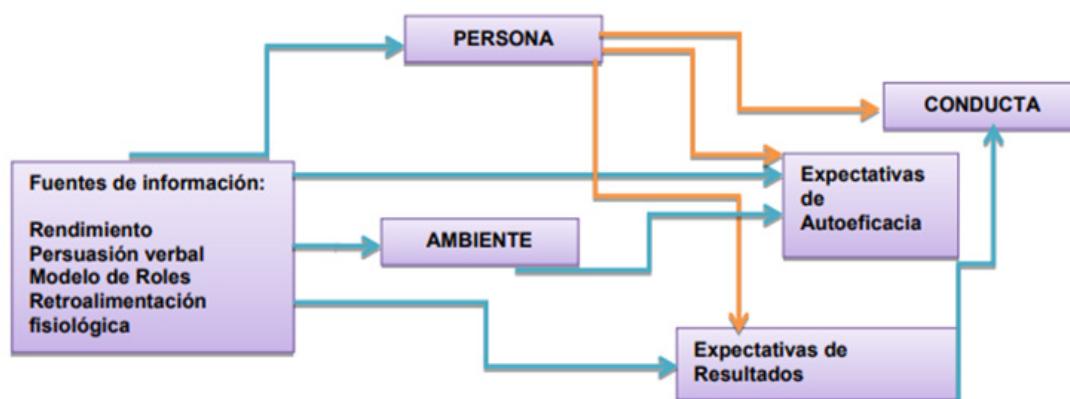


Figure 1. Barbara Resnick's self-efficacy theory.⁽⁴⁶⁾

Source: Adapted from Peterson S, Bredow T. Middle range theories. Application to nursing research. Second edition. EUA: Walters Kluwer Health Lippincott Williams & Wilkins; 2009. P.123⁽⁵⁷⁾

CONCLUSIONS

Self-efficacy is an essential component in nursing students' academic and professional training, as it directly influences their performance, motivation, and ability to deal with complex situations within the educational and clinical environment.

As evidenced in this study, both from the psychological perspective proposed by Albert Bandura and from the approach of Barbara Resnick's Middle Range Theory in nursing, self-efficacy does not only depend on the knowledge or skills acquired, but also on each individual's perception of their ability to use them effectively.

The theoretical analysis shows that students with higher self-efficacy tend to perform better academically, persevere more in the face of challenges, and be more willing to take on responsibilities in the clinical setting. Conversely, those with low levels of self-efficacy may experience insecurity, demotivation, and even avoid important tasks, affecting both their training and the quality of care they provide. This confirms the need to develop teaching strategies and educational environments that actively promote self-efficacy, including promoting successful experiences, vicarious learning, verbal persuasion, and recognition of physiological signals associated with achievement.

The studies reviewed, including research conducted in international and national contexts, agree that self-efficacy is positively related to academic performance, especially in training practices. Social learning theory and explanatory models of self-efficacy provide an understanding of how personal beliefs about one's own competence influence behaviour, decision-making, and the resilience of future nursing professionals.

In addition, the importance of teachers and educational institutions in consolidating these beliefs is highlighted. Fostering learning environments where students feel capable, supported, and positively challenged is crucial for their comprehensive development. Self-efficacy contributes to academic success and strengthens clinical judgement, ethical decision-making, and the construction of a solid professional identity.

In conclusion, promoting self-efficacy in nursing students is an investment in the quality of education and the training of competent, confident professionals committed to humanised care. It should therefore be a cross-cutting objective in the curriculum, teaching practice, and institutional health training policies.

BIBLIOGRAPHICAL REFERENCES

1. Bandura A. Autopercepción del rendimiento académico. 1995.
2. Penagos R, Vargas L. Efectividad de una intervención de enfermería para modificar la autoeficacia y la sobrecarga del cuidador del paciente hemato-oncológico. 2020.
3. Adanaqué Rufasto MV. Relación entre autoeficacia académica y rendimiento en la asignatura de Metodología de la Investigación de los estudiantes del programa "CPEL" para personas con experiencia laboral de la Universidad San Ignacio de Loyola - 2015 [tesis]. Lima: Universidad San Ignacio de Loyola; 2016.
4. Palenzuela D. Procrastinación y autoeficacia académica en estudiantes universitarios limeños. 1983.
5. Hernández R, Fernández C, Baptista P. Metodología de la investigación. 5.^a ed. México: McGraw-Hill; 2008.
6. Bandura A. Autoeficacia: hacia una teoría unificadora de cambio de comportamiento [Internet]. 1977 [citado año de consulta]. Disponible en: <https://psycnet.apa.org/doi/10.1037/0033-295X.84.2.191>
7. Jaworski M, Panczyk M, Lenczuk A, Nowacka A, Gotlib J. La tendencia de las habilidades de liderazgo auténtico en la educación de enfermería: el papel clave del perfeccionismo y la autoeficacia. 2022.
8. Bäßler J, Schwarzer R, Jerusalem M. Spanish adaptation of the General Self-Efficacy Scale Autoeficacia Generalizada. 1993.
9. Comisión Nacional para la Protección de los Sujetos Humanos de Investigación Biomédica y del Comportamiento. Principios y guías éticos para la protección de los sujetos humanos de investigación. Belmont: Informe Belmont; 1979.
10. Naderi Z, Bakhtiari S, Momennasab M, Abootalebi M, Mirzaei T. Predicción del burnout académico y el rendimiento académico basado en la necesidad de cognición y autoeficacia general: un estudio analítico transversal. 2018.
11. Blanco H, Martínez M, Zueck M, Gastélum G. Nivel de autoeficacia en estudiantes de una universidad chilena y su importancia para enfermería. 2011.

5 Menéndez Sequeda YA, et al

12. Brennan B. El impacto del prebriefing basado en la autoeficacia en la competencia clínica y la autoeficacia de los estudiantes de enfermería en la simulación: un estudio experimental [tesis]. 2022.
13. Burgos J. Comprensiones narrativas de los factores asociados al desempeño académico en estudiantes de Boyacá, Colombia. 2018.
14. Burgos K, Salas E. Procrastinación y autoeficacia académica en estudiantes universitarios limeños. 2020.
15. Caballero C, Gallo Y, Suárez Y. Algunas variables de salud mental asociadas con la propensión al abandono de los estudiantes universitarios. 2018.
16. Castellanos V, Latorre D, Mateus S. Modelo explicativo del desempeño académico desde la autoeficacia y los problemas de conducta. 2016.
17. Cheng L, Ye Y, Zhong Z, Zhang F, Hu X, Cui R, et al. Mediating effects of general self-efficacy on the relationship between the source of meaning in life and prosocial behaviours in vocational college nursing students: a cross-sectional study. PLoS One. 2020;15(12):e0243796. Disponible en: <https://doi.org/10.1371/journal.pone.0243796>
18. Criollo M, Romero M, Fontaines T. Autoeficacia para el aprendizaje de la investigación en estudiantes universitarios. 2017.
19. Gonzales D, Pedrozo E, Ahumedo M, Romero I, Blanquicett Y, Cogollo Z. Autoeficacia percibida en estudiantes de enfermería de la Universidad de Cartagena y desempeño académico durante las prácticas formativas. 2017.
20. Asociación Médica Mundial. Declaración de Helsinki - Principios éticos para las investigaciones médicas en seres humanos. Fortaleza, Brasil: Asociación Médica Mundial; 2013..
21. Hogstedt D, Jansson I, Eriksson E, Engström M. Tres caminos hacia una licencia de enfermería sueca: dos para enfermeras formadas internacionalmente y uno para estudiantes regulares de enfermería - un estudio transversal de competencia profesional autoevaluada, autoeficacia y florecimiento. 2022 [citado año de consulta]. Disponible en: <https://www.sciencedirect.com/science/article/pii/S0260691722003318>
22. Eleoterio H, García P, Palota P, Ramos M, Cruz C, Girade M, Alcalá D. Impacto de los síntomas de ansiedad y depresión en la autoeficacia percibida en estudiantes de enfermería. 2021.
23. Espinosa E, Espinoza S, González J, Macaya M. Nivel de autoeficacia en estudiantes de una universidad chilena y su importancia para enfermería. 2021.
24. Fernández-Ayuso R, del Campo Cazallas C, Fernández Ayuso RM, Pérez Olmo JL, Morillo Rodríguez J, Pompa BM. Relación entre la autopercepción y autoeficacia para el desarrollo de competencias en soporte vital en entornos de simulación clínica de alta fidelidad [Internet]. [citado año de consulta]. Disponible en: <https://www.sciencedirect.com/science/article/pii/S1575181317300773>
25. Figueroa C, Gamarra G. Factores asociados con no control metabólico en diabéticos pertenecientes a un programa de riesgo cardiovascular. 2013.
26. Pajares F. Panorama general de la teoría cognitiva social y de la autoeficacia [Internet]. 2002 [citado año de consulta]. Disponible en: <https://www.uky.edu/~eushe2/Pajares/eff.html>
27. Hechenleitner M, Jerez A, Pérez C. Autoeficacia académica en estudiantes de carreras de la salud de una universidad tradicional chilena. 2019.
28. Galleguillos-Herrera P, Olmedo-Moreno E. Academic self-efficacy and motivation: a measurement for the achievement of school objectives. Eur J Investig Health Psychol Educ. 2019;9(3):119-135. Disponible en: <https://doi.org/10.30552/ejihpe.v9i3.329>
29. García P, Heloísa M, Palota E, Palotta G, Ramos S, Alcalá P. Impacto de la intervención psicoeducativa en

la autoeficacia percibida de los estudiantes de enfermería. 2021.

30. Zhao Z. Perceived social support and professional identity in nursing students during the COVID-19 pandemic era: the mediating effects of self-efficacy and the moderating role of anxiety. BMC Med Educ. 2023;23(1):117. Disponible en: <https://pesquisa.bvsalud.org/portal/resource/pt/mdl-36803504>
31. Haririan H, Rahmani A, Portero J, Heidarzadeh M, Azadi A, Faghani S, Moradi N. Actitud y preparación de los estudiantes de enfermería para la prescripción de enfermeras y su relación con la autoeficacia. 2021.
32. Hernández R, Fernández C, Baptista P. Metodología de la investigación. 4.^a ed. México: McGraw-Hill; 2006.
33. Torres Surita I. Estrés académico y autoeficacia académica en estudiantes universitarios de una universidad de Lima. 2021.
34. Bandura A. Fundamentos sociales del pensamiento y la acción: una teoría cognitiva social. México: Trillas; 1986.
35. Barrios S, Urrutia M, Rubio M. Impacto de la simulación en el desarrollo de la autoeficacia y del locus de control en estudiantes de enfermería. 2017.
36. Ballesteros Y, Camacho J, Murillo J. Autoeficacia y adherencia al régimen terapéutico de los adultos mayores diabéticos e hipertensos del hogar del anciano desamparado San Antonio. 2019.
37. Jerusalem M, Schwarzer R. General Self-Efficacy Scale (GSE). 1981.
38. Kupcewicz E, Mikla M, Kaducaková H, Grochans E, Wieder-Huszla S, Jurczak A. Autoeficacia y fatiga percibida por estudiantes de enfermería en Polonia, España y Eslovaquia durante la pandemia de COVID-19 [Internet]. 2022 [citado año de consulta]. Disponible en: <https://pesquisa.bvsalud.org/portal/resource/pt/mdl-35647860>
39. López V. Estudiantes de enfermería, comprometidos con la salud. 2016.
40. Mendoza R, Bernardi J, Palota L, Alcalá D. Efecto de la autoestima y de los factores sociodemográficos sobre la autoeficacia de estudiantes universitarios de enfermería. 2019.
41. Ministerio de Educación Superior Nacional. La educación en Colombia. 2016.
42. Ministerio de Salud. Resolución número 8430 de 1993. 1993.
43. Olaussen C, Steindal SA, Jelsness-Jørgensen LP, et al. Integración del entrenamiento con simulación durante la práctica clínica en hogares de ancianos: un estudio experimental sobre la adquisición de conocimientos, la autoeficacia y las necesidades de aprendizaje de los estudiantes de enfermería. BMC Nurs. 2022;21:47. Disponible en: <https://doi.org/10.1186/s12912-022-00824-2>
44. Pajares F. Panorama general de la teoría cognitiva social y de la autoeficacia [Internet]. [citado año de consulta]. Disponible en: <https://www.uky.edu/~eushe2/Pajares/eff.html>
45. Peterson S, Bredow T. Middle range theories: application to nursing research. 2.^a ed. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2009.
46. Resnick B, Jenkins L. Prueba de la confiabilidad y validez de la escala de autoeficacia para el ejercicio. 2000.
47. Gómez A. Autoeficacia percibida y adherencia al CPAP (presión positiva continua en la vía aérea) en personas con apnea del sueño. 2019.
48. Rincón M. Autoeficacia y adherencia terapéutica en personas con diabetes mellitus tipo 2. 2016.

49. Rivero FM. La presencia de factores promotores de burnout y engagement en estudiantes avanzados de la licenciatura en psicopedagogía de la Universidad Católica Argentina sede Mendoza. 2021.
50. Rohmani N, Andriani R. Correlación entre la autoeficacia académica y el agotamiento originado por el aprendizaje a distancia entre los estudiantes de enfermería en Indonesia durante la pandemia por COVID-19. 2021.
51. Solórzano K. Motivación de logro en alumnos de 4to y 5to de secundaria de la I.E. 5011 Darío Arrus, Cuestas, Callao 2020. 2020.
52. Tang L, Lu S, Lai Y, Deng R. Health as expanding consciousness: change of psychological situation in nursing students. Nurs Open. 2022;10(3):1923-1930. Disponible en: <https://doi.org/10.1002/nop2.1444>
53. Yance M. Clima social y autoeficacia académica en estudiantes del primer grado de secundaria de El Tambo-Huancayo 2017. 2018.
54. Teodoro R, Souza J, Lemos J, Domingos M, Rossi C, Souza J. Papel de los factores sociodemográficos y la autoeficacia en la percepción de apoyo social de estudiantes de enfermería. 2021.
55. Ting L, Xuan Y, Man L, Min W, Xiuli Z, Xiuling Y. Una evaluación de método mixto de un curso integrado para mejorar el pensamiento crítico y la autoeficacia creativa entre los estudiantes de enfermería. 2021.
56. Xiuyu Y, Lingling Y, Yiru S, Zihua K, Xiaoran W. El papel de la autoeficacia en la mediación entre la identidad profesional y la competencia autorreferida entre estudiantes de enfermería en el período de pasantía [Internet]. 2021 [citado año de consulta]. Disponible en: <https://www.sciencedirect.com/science/article/pii/S1471595321002882>
57. Peterson S, Bredow T. Middle range theories: application to nursing research. 3.^a ed. Philadelphia: Wolters Kluwer; 2013.

FINANCING

None.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.

Data curation: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.

Formal analysis: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.

Research: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.

Methodology: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.

Project administration: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.

Resources: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.

Software: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.

Supervision: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.

Validation: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.

Visualization: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.

Writing - original draft: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.

Writing - proofreading and editing: Yuly Andrea Menéndez Sequeda, María Alejandra Rojas Valencia, Andrea Carolina Noches Osorio, David Andrés Ordoñez Rúales, Maria Andreina Pulido Montes, Elveny Laguado Jaimes.