

## The concept of metacognition applied to nursing education: a scoping review

## O conceito de metacognição aplicada à formação do enfermeiro: uma revisão de escopo

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**ABSTRACT | INTRODUCTION:** Metacognition, the awareness of one's own cognitive processes, is a valuable skill for learning as it is related to clinical reasoning development and contributes to academic performance. Despite the importance of this topic, there are no scoping reviews about metacognition being related to nursing education. **OBJECTIVE:** Therefore, this review intended to map the application of metacognition as a concept in nursing education. **METHODS:** A scoping review was conducted following the Joana Briggs Institute recommendations. A total of 21 articles were selected based on eligibility criteria out of the 142 found on databases such as PubMed, Eric, SciELO and BVS. **RESULTS:** The findings revealed that metacognition has a broad application in nursing education, including the relationship between metacognition level and learning, teaching methods and skill development. Although nursing students did not reach the highest levels of metacognition, educational interventions were shown to have enhanced it, which positively impacted academic performance and essential nursing skill development. **CONCLUSION:** In that regard, metacognition seems to be critically important for the development of clinical reasoning, skills for clinical practice and the reduction of medical errors. Thus, this topic must be explored in higher education and scientific research, especially in longitudinal studies, which can verify the effects of metacognition on nursing education.

**KEYWORDS:** Metacognition. Nursing. Nursing Students. Nursing Education.

**RESUMO | INTRODUÇÃO:** A metacognição, entendida como a consciência dos seus próprios processos cognitivos, é uma habilidade importante para o aprendizado, contribuindo para o desempenho acadêmico, além de se relacionar ao desenvolvimento de raciocínio clínico. No entanto, não há revisões de escopo sobre o tema na educação em enfermagem. **OBJETIVO:** Assim, buscou-se mapear a aplicação do conceito de metacognição na formação de enfermeiros. **MÉTODO:** Realizou-se uma revisão de escopo seguindo as recomendações do Instituto Joana Briggs. Dos 142 artigos identificados nas bases de dados PubMed, Eric, SciELO e BVS, foram incluídos 21 após se aplicar critérios de elegibilidade. **RESULTADOS:** Encontrou-se que a metacognição possui uma vasta aplicação para a formação do enfermeiro, incluindo a relação entre: o nível de metacognição e o aprendizado; métodos de ensino; e desenvolvimento de habilidades. Embora os estudantes de enfermagem não atinjam os níveis mais elevados de metacognição, a aplicação de intervenções educacionais parece ter o potencial de aumentá-la, o que contribui para a otimização do desempenho acadêmico e no desenvolvimento de competências essenciais para o campo da enfermagem. **CONCLUSÃO:** Nesse sentido, a metacognição demonstra ser de grande importância para o desenvolvimento do raciocínio clínico do enfermeiro, de habilidades para a prática clínica e para a redução de erros. Portanto, a aplicação da metacognição deve ser explorada na universidade e em estudos longitudinais que ratifiquem seus efeitos na formação do enfermeiro.

**PALAVRAS-CHAVE:** Metacognição. Enfermagem. Estudantes de Enfermagem. Educação em Enfermagem.

## 1. Introduction

Metacognition is an individual's ability to reflect on their own cognitive processes. It is divided into two categories: knowledge, which is related to memory and learning, and control, which is related to organization and planning a task<sup>1</sup>. This concept has been studied in neuroscience and educational research. Its correlation with learning and academic performance has been investigated and shown to be positive, depending on the interventions carried out<sup>2</sup>.

Similarly, studies in the field of health investigating the influence of metacognition on nursing students' performance endorse the role of metacognitive level as a predictor of academic performance and motivation<sup>3</sup>. In this sense, verifying the role of metacognition in critical thinking development may be important in undergraduate studies, given the observed deficit in nursing students, who presented only a low to moderate level in one study<sup>4</sup>.

Critical thinking can be understood as an intentional assessment process that guides decision-making and results in the interpretation, analysis, and elucidation of phenomena based on evidence<sup>5</sup>. Therefore, it is important for health students to develop critical thinking skills for clinical practice, given its effectiveness in reducing medical errors, and metacognition is related to improving this process<sup>6</sup>. This can promote awareness of errors in thought processes, self-control in clinical decision-making, and reduced biases in diagnosis preparation<sup>7</sup>.

Furthermore, metacognition is related to clinical reasoning, which contributes to the quality of care that underlies the development of nursing diagnoses<sup>8</sup>. The North American Nursing Diagnosis Association defines this as a "clinical judgment about the human response to the health-illness process"<sup>9</sup> and states it helps nurses make decisions and choose interventions for patients. Thus, the accuracy of a nursing diagnosis depends on the cognitive processes underlying the nursing process and problem-solving<sup>10</sup>. Despite the fact that the role of cognitive biases in medical diagnostic errors and the relationship between

thought processes and medical practice are well-known<sup>6</sup>, this area of research remains underexplored in nursing education literature.

Thus, understanding the role of metacognition in this context and its impact on nursing education is essential. The scoping review approach was chosen for this study because it is compatible with the defined objective. This approach allows for broad research questions and provides an overview of the topics. Additionally, it is increasingly used in the nursing field<sup>11</sup>. Therefore, reviews like this one contribute to the current body of knowledge on metacognition by highlighting existing evidence regarding undergraduate nursing. In an educational context, this study's importance relates to the quality of nursing training, which impacts the quality of nursing care.

Based on this, the aim of this research is to map the application of the concept of metacognition in nursing education. Additionally, the study aims to describe the level of metacognition among nursing students and explore its relationship with teaching methods and skill development.

## 2. Methodology

### 2.1 Study design

This scoping review is based on the JBI's methodological guidelines and the PRISMA extension for scoping reviews' recommendations<sup>12</sup>. Preliminary research preceded the protocol's development and was modeled on Arksey and O'Malley's framework<sup>13</sup>. The protocol is available on the Open Science Framework website (<https://osf.io/8qbem/>).

### 2.2 Search strategy

On October 15th, 2024, the search was conducted in the following databases: MEDLINE (PubMed), VHL (LILACS and BDENF), SciELO, and ERIC. The search was limited to the fields of health and education.

The selected terms were based on keywords and health sciences descriptors (DECS/MESH) used in the articles. These terms were adjusted in subsequent searches of the research protocol by removing those that were irrelevant to the research objective based on the results obtained: “cognition”, “learning”, “self-regulated learning”, and “clinical reasoning or clinical competency”. As an example of the updated process, the following search strategy was used in MEDLINE: (“Metacognition” [Title/Abstract] OR “Metacognition” [MeSH Major Topic] OR “Metacognition” [MeSH Terms]) AND (“nursing” [Title/Abstract] OR “nursing” [MeSH Major Topic] OR “education, nursing” [MeSH Terms] OR “students, nursing” [MeSH Terms]). This stage was guided by the following research question: What is the application of the concept of metacognition in the context of undergraduate nursing training? This question was developed based on the PCC<sup>14</sup> strategy, which is detailed in the subtopics below.

## 2.3 Population

Given its exploratory nature, the review included undergraduate nursing students without restrictions, regarding age, color, race, sex, or academic year.

## 2.4 Concept

Metacognition is defined as an individual's awareness of cognitive processes or a secondary system of cognitive regulation. It is subdivided into the knowledge and regulation of cognition, which encompasses planning, monitoring, and assessment<sup>1,2,15</sup>. The selected articles explored the repercussions of this concept in the fields of education<sup>16</sup> and healthcare<sup>6</sup>. Furthermore, the instruments used to assess the level of metacognition, as well as the respective results presented as an individual or general population average, were described. These results were obtained using either a quantitative or qualitative approach and refer to undergraduate nursing students.

## 2.5 Context

The research addressed the educational context of undergraduate nursing programs, which occur in various environments such as university facilities and healthcare institutions in all geographic regions.

## 2.6 Article selection

Articles found in the databases were exported to the Rayyan application. Following the eligibility criteria, articles were selected based on title and abstract for full-text review. Peer review was used to resolve discrepancies in the selection process through discussion. The aforementioned technology automatically detected duplicate articles. The complete article inclusion process is outlined in the PRISMA 2020 scoping review extension flowchart, found in the Results section.

## 2.7 Inclusion criteria

The following were included in the review: a) studies whose population included undergraduate nursing students; b) studies that addressed the concept of metacognition in the introduction and results; c) studies conducted in any setting as part of undergraduate activities; d) primary studies (experimental, quasi-experimental, cross-sectional, longitudinal); e) articles written in Portuguese and English. There was no restriction on publication date.

## 2.8 Exclusion criteria

The following were excluded from the review: a) studies in which nursing students comprised part of the population, without any separation of data in the results displayed; b) articles whose full text was unavailable for review.

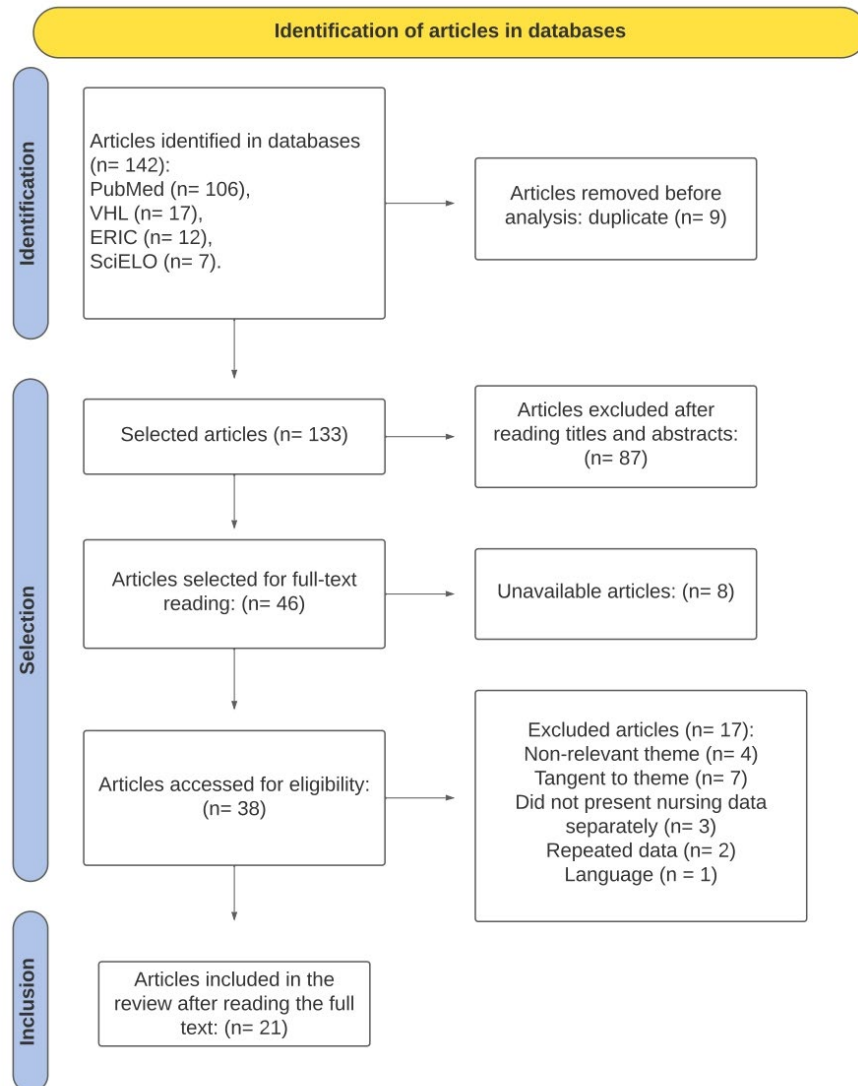
## 2.9 Data analysis

The data extracted from the selected articles were tabulated in a tested and adjusted Microsoft Excel 2016 spreadsheet containing items such as article title, authorship, year of publication, country, objective, study design, population, academic year, concept, assessment, intervention, results, and main findings. Additionally, a metacognition concept map and a diagram summarizing the review findings according to topic frequency in the articles were created using the Lucidchart application (<https://www.lucidchart.com/>).

### 3. Results and discussion

A literature review was conducted and 142 articles were found. Of those, 21 met the eligibility criteria. Figure 1 shows the selection process and the resulting articles.

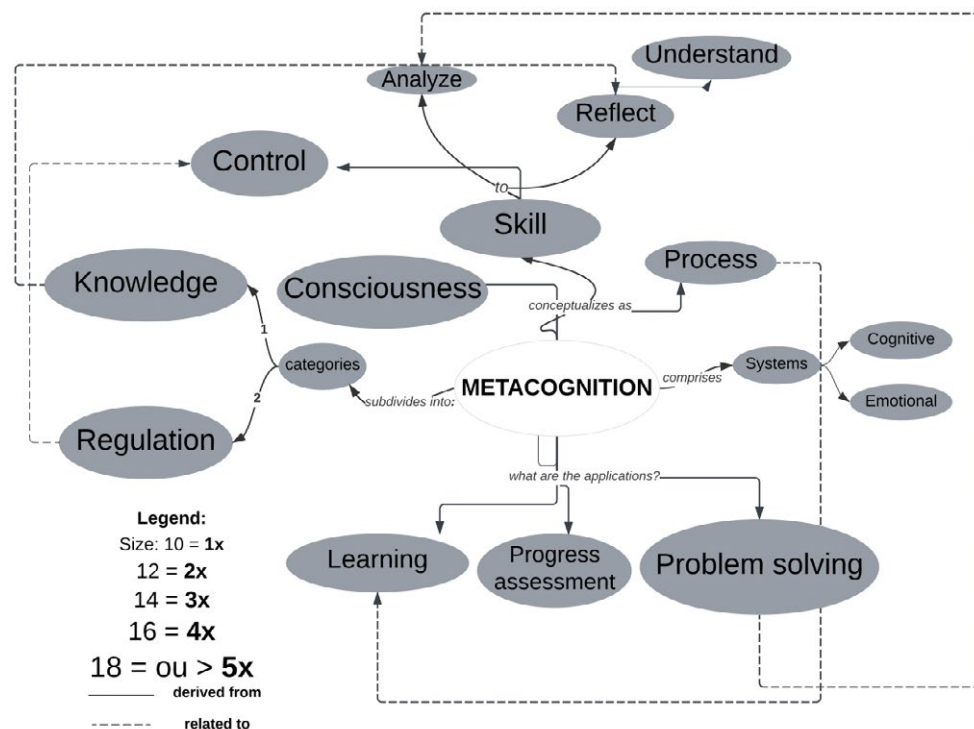
Figure 1. PRISMA flowchart



Source: the authors (2025).

Figure 2 highlights how the selected authors present the concept of metacognition, which is most frequently defined as a skill or awareness. This skill or awareness is subdivided into knowledge and metacognitive regulation, and it is mainly related to problem-solving.

**Figure 2.** Metacognition concept map



Source: the authors (2025).

The data extracted from these articles are displayed in Tables 1 and 2, which contain articles with and without educational interventions, respectively. The tables demonstrate that research on metacognition in nursing education aims to assess students' self-reflection, test the effectiveness of teaching methods in developing metacognitive awareness, and understand how metacognition contributes to skill development. The sections below will address these three aspects.

**Table 1.** Studies without intervention (to be continued)

Identification	Objective	Study design	Population	Assessment	Results	Main findings
Silva et al. <sup>17</sup> 2011. Dificuldades dos estudantes de enfermagem na aprendizagem do diagnóstico de enfermagem, na perspectiva da metacognição. Brazil	Investigate the learning of nursing diagnosis in the hospital area, by students completing the undergraduate course, from a metacognitive perspective.	Descriptive qualitative.	19 fifth-year students. 14 women. Age: 21 to 52 years old.	Form; Learning and learning difficulties of nursing diagnosis.	Based on "learning", the subcategory "Difficulties in learning nursing diagnosis" was identified. The related factors were: a) lack of theoretical basis; b) the mental process required to use diagnostic knowledge; and c) the topics associated with the Thought Process. The topics associated with the Thought Process were: 1) doubts about what to investigate; 2) not knowing what to do with patient data; 3) not knowing how to discern whether it is a medical diagnosis or a nursing diagnosis; and 4) how to arrive at the diagnosis.	Twelve of the 19 participants demonstrated difficulty in making a nursing diagnosis, which was associated with a deficit in the metacognitive process, especially in the awareness and metacognitive control of the learning necessary to develop a diagnosis.
Hsu and Hsieh <sup>18</sup> 2014. Factors affecting metacognition of undergraduate nursing students in a blended learning environment. Taiwan	Examine the influence of demographics, engagement, and learning performance on the metacognition of nursing students in blended learning.	Cross-sectional.	99 female second-semester students. Mean age: 22.96 years old.	Case Analysis Attitude Scale (CAAS), Case Analysis Self-Assessment (CASES), level of satisfaction with hybrid teaching (BLSS), Metacognition Scale (MS) using the Likert Scale.	Mean performance in the ethics module 80.83, CAAS 34.06 (SD 4.26), CASES 43.15 (SD 5.57), BLSS 64.20 (SD 9.83), MS 94.92 (SD 13.63). The scores were independent predictors of total metacognition.	The use of blended learning facilitates the development of metacognitive skills.
Chen et al. <sup>19</sup> 2019. Self-regulated learning ability, metacognitive ability, and general self-efficacy in a sample of nursing students: A cross-sectional and correlational study. China	Describe levels of general self-efficacy (GSE), metacognition, and self-regulated learning (SRL) and explore their relationships in second- and third-year students.	Cross-sectional.	199 second- and third-year students. 94% women. Mean age: 20.7 years old (SD 0.94). 57.8% second-year students, 42.2% third-year students.	Self-Directed Learning (SRL) Scale, Chinese Metacognitive Ability Scale (Likert Scale), General Self-Efficacy (GSE).	A total of 32.2% demonstrated interest in nursing. There were positive correlations between SRL and GSE ( $P<0.001$ ), metacognitive ability and SRL ( $P<0.001$ ). Third-year students presented higher levels of SRL ability (104.5 SD: 10.5; $P<0.010$ ) and lower levels of GSE (23.5 SD: 4.2) compared to second-year students (101.2 SD: 11.9; QSE 24.8 SD: 4.3; $p<0.038$ ). No significant differences were identified in metacognitive ability and SRL subitems between second- and third-year students.	There was no difference in metacognition between the two classes. The moderate and low levels of the variables studied may be influenced by the students' level of interest.
"Chen, Sun and Jao <sup>20</sup> 2020. A predictive model of student nursing competency in clinical practicum: A structural equation modelling approach. Taiwan"	Analyze the pathways of relationships that affect learning outcomes in nursing students' clinical practice; explore the relationships between teaching competency, clinical learning environment, metacognition, reflective thinking, and nursing competency and compare their differences by career intention.	Cross-sectional.	392 seniors.	Competency Inventory of Nursing Students (CINS); Reflective Thinking Questionnaire (RTQ); Metacognitive Inventory for Nursing Students (MINS), Likert Scale; Student Evaluation of the Clinical Education Environment (SECEE); Faculty Competency; Teacher Competency Nursing Questionnaire (TCNP).	It was observed that teacher competence had no direct effect on nurse competency, but it may have an indirect effect through its effect on metacognition and reflection. Metacognition and reflection were predictive factors that affected the development of nursing competency, regardless of differences in employment planning. The relationships between the variables differed according to participants' employment plan.	A clinical learning environment that provides students with diverse learning opportunities, allowing them to practice problem-solving, planning, monitoring, and modifying their learning needs, can improve their metacognition and learning.

**Table 1.** Studies without intervention (continuation)

Identification	Objective	Study design	Population	Assessment	Results	Main findings
Jin and Ji <sup>21</sup> 2020. The correlation of metacognitive ability, self-directed learning ability and critical thinking in nursing students: A cross-sectional study. China	Understand the relationship between metacognitive ability, self-directed learning, and critical thinking in students.	Cross-sectional.	3,000 students from first to fifth year. 92.63% women. Mean age: 17.6.	Metacognitive Ability Scale (Likert Scale).	Total mean metacognitive skill = 81.18 (SD = 13.51). The metacognitive assessment showed a better real-to-total score ratio compared to regulation. There was a positive relationship between metacognitive skill, self-directed learning ( $p < .01$ ); and critical thinking ( $p < .01$ ). The levels of metacognitive skill and critical thinking were higher in the fourth-grade class compared to other classes, as well as those in the third-grade class compared to the second-grade class.	The nursing students' metacognitive skills did not show high levels, and their levels of critical thinking and self-directed learning were moderate. These competencies should be developed by educators in the academic setting.
Espindola et al. <sup>22</sup> 2021. Perfil metacognitivo de estudantes de enfermagem e desempenho acadêmico. Brazil	Identify the metacognitive profile of incoming nursing students and its potential to predict academic performance during the first semester.	Longitudinal observational.	77 first-semester students. 75% female, up to 21 years old.	Metacognitive Awareness Inventory (MCI); Likert Scale.	Fifty-one percent of the sample scored between 6 and 7.99. The mean metacognition score was 3. The metacognition subcategory "planning" correlated positively with performance ( $0.05 < p < 0.10$ ).	Planning skills have the highest correlation with performance, but correction is the most frequently used strategy by students.
Bektas et al. <sup>23</sup> 2021. The predict of metacognitive awareness of nursing students on self-confidence and anxiety in clinical decision-making. Turkey	Investigate the effect of metacognitive behavior on self-confidence and anxiety related to clinical decision-making in nursing students.	Cross-sectional.	186 students (72 third-year and 114 fourth-year students). 76.3% (n = 142) female. Mean age: 21.97, 61.3% (n = 114) fourth-year students.	Nursing Anxiety, Self-Esteem, and Clinical Decision Scale (NASC-CDM), MCI; Likert Scale.	Mean metacognition = 194.66 (SD = 25.82). This variable was able to predict anxiety in clinical decision-making ( $p = 0.05$ ).	There is a correlation between the level of metacognition and components of self-confidence and clinical decision-making.
Choi and Jeon <sup>24</sup> 2022. Factors Influencing Problem-Solving Competence of Nursing Students: A Cross-Sectional Study. South Korea	Examine the relationship between metacognition, communication, and problem-solving skills in nursing students; identify factors that affect problem-solving.	Cross-sectional.	192 second-, third-, and fourth-year students. 81.3% female. Mean age: 21.56 SD 1.99.	Metacognitive State Inventory (Likert Scale). Communication Competency Scale, Life Skills Tool.	Mean metacognition: 3.86 (SD 0.47). Communication skills: 3.92 (SD 0.42). Problem-solving skills: 3.63 (SD 0.35). There was a positive correlation between metacognition and problem-solving and between metacognition and communication ( $p < 0.001$ ). The variable that demonstrated the greatest influence on problem-solving was metacognition.	Metacognition is an important factor in improving problem-solving, an essential skill for nurses.
Kim <sup>25</sup> 2024. The effect of metacognition and self-directed learning readiness on learning performance of nursing students in online practice classes during the COVID-19 pandemic period. South Korea	Explain the impact of metacognition and self-directed learning on nursing students' performance in remote learning.	Cross-sectional.	135 third-year students. 75.56% female.	MAI; Likert scale. Self-Directed Learning and Readiness Scale (SDLRS).	There was a positive correlation between self-directed learning readiness and metacognition with subjective and objective learning performance. However, metacognitive control had the greatest impact ( $p > 0.001$ ) on these variables.	The development of metacognitive skills can influence learning performance improvements in remote clinical nursing education.



**Table 1.** Studies without intervention (conclusion)

Identification	Objective	Study design	Population	Assessment	Results	Main findings
Seidel-Fischer et al. <sup>26</sup> 2024. Interaction between overconfidence effects and training formats in nurses' education in hand hygiene. Germany	Clarify the existence of overconfidence in nursing students during hand hygiene, communication, and feedback.	Cross-sectional.	94 students. 78.72% female. Mean age: 22 years old.	Self-assessment scale of proficiency in infection prevention and control; Assessment of knowledge about hand disinfection; Assessment of frequency of use of different teaching methods; Self-assessment of hand hygiene; Assessment of feedback and metacognition.	Self-assessment biases regarding knowledge of hand hygiene and infection prevention were detected in nursing students. The interactive teaching method demonstrated a positive effect on self-assessment bias (overplacement) only when students demonstrated a high level of metacognition.	The presence of metacognition can help reduce biases in conjunction with the interactive teaching method, consequently promoting effective learning and reducing errors in the hand hygiene process.
Lee, Park and Yu <sup>27</sup> 2024. The mediating role of positive psychological capital in the relationship between metacognition and self-directed learning ability: A cross-sectional study. South Korea	Examine the mediating effect of positive psychological capital on the relationship between metacognition and self-learning ability.	Cross-sectional.	172 students. 87.6% female. Mean age: 21.6 years old.	Metacognitive State Inventory; Positive Psychological Capital Questionnaire; Self-Directed Learning Instrument.	The metacognition level was 3.86 (SD 0.44). There was a positive relationship between metacognition and course satisfaction ( $p > 0.001$ ) and grade point mean ( $p > 0.002$ ). There was a positive correlation between metacognition, positive psychological capital, and self-directed learning ability ( $p > 0.001$ ).	The relatively higher level of metacognition than found in other studies was associated with skill development during remote learning. The impact of this on performance was not assessed.
Wang et al. <sup>28</sup> 2024. The relationship between personality traits, metacognition and professional commitment in Chinese nursing students: a cross-sectional study. China	Assess the relationship between personality types and metacognition in nursing students' professional performance.	Cross-sectional.	3,631 students. 84% women. Mean age: 55% between 19 and 20 years old. 48.8% freshmen.	Big Five Personality Test; Professional Commitment Scale; Student Metacognition Questionnaire; Likert scale.	Students with an ordinary and positive open profile (OR 7.01; 21.09) and a higher level of metacognition (OR 5.95) are more likely to be professionally committed. The negative sensitive profile (65.2% of students) with higher levels of metacognition is more likely to be professionally committed compared to the ordinary and positive open personalities (OR: 4.21; 2.91; 3.40). There is a positive correlation between metacognition and professional commitment ( $p > .001$ ).	The development of metacognition can have a positive impact on professional commitment, even when students have negative personality traits.

Source: the authors (2025).



**Table 2.** Studies with intervention (to be continued)

Identification	Objective	Study design	Population	Assessment	Intervention	Results	Main findings
Gholami et al. <sup>29</sup> 2016. Comparing the effects of problem-based learning and the traditional lecture method on critical thinking skills and metacognitive awareness in nursing students in a critical care nursing course. Iran	Compare the effect of PBL and traditional reading methods on nursing students' critical thinking skills and metacognitive awareness.	Quasi-experimental, single-group, pre- and post-test.	40 third-year students. 62.5% (n=25) female. Mean age: 21.89 (SD: 1.26) years.	California Critical Thinking Skills Test-B (CCTST-B).	Lecture method for 3 weeks, followed by PBL. Conducted in 32-hour blocks, 4 hours per week, for 8 weeks.	"Total critical thinking ability (Max.: 34) (Mean, SD): Pre-test: 9.74 (2.13); After lecture: 9.72 (2.44) (p=0.8). After PBL: 10.75 (2.41) (p=0.002) Total metacognitive awareness (Max.: 364) (Mean, SD): Pre-test: 2.50 (54.43); After lecture: 2.47 (50.27) (p=0.2) After PBL: 2.76 (36.91) (p=0.000) There was a significant change in critical thinking and metacognitive awareness only after the use of PBL."	Classroom management and the details of PBL implementation are essential for the subsequent development of critical thinking and metacognitive skills.
Lee, Nam and Kim <sup>30</sup> 2017. Effects of Simulation With Problem-Based Learning Program on Metacognition, Team Efficacy, and Learning Attitude in Nursing Students. South Korea	Identify the effects of a simulation-based clinical practice program with PBL on metacognition, group effectiveness, and learning attitude.	Quasi-experimental.	176 first-year students. 87.5% female. Mean age: 21.38 (SD: 1.63).	IMAI, 7-point scale. Administered at the beginning and end of each intervention.	Two 4-hour PBL sessions with a 1-week break, followed by simulation training in the third week and subsequent assessment.	Pre-test metacognition: 2.97 (SD 0.29) and post-test: 3.06 (SD 0.29; P .002). Positive correlation (P = .040) between metacognition and choice of nursing course, with students motivated by job opportunities having higher scores compared to personal preference.	The use of PBL increases nursing students' metacognition.
Oh <sup>31</sup> 2019. Impact of Metacognition on Clinical Judgment and Competence in Simulation-Based Blended Learning. South Korea	Assess the impact of metacognition on nursing students' judgment and clinical competence in simulation using blended learning.	Quasi-experimental.	56 fourth-year students. 89.3% female. Mean age: 21 years.	Klein Metacognition Scale (modified by Shin); Likert scale.	Simulation applied with hybrid learning. 7 to 8 groups with 3 to 4 students, 1 teacher, and 1 teaching assistant. Assessment before and after simulation.	Metacognition (MC) pre-test: 3.43 (SD 0.41), post-test: 3.50 (SD 0.36) (p<0.083). Clinical judgment pre-test: 26.00 (SD 3.18), post-test: 33.5 (SD 3.23) (p<0.001). Clinical competence pre-test: 3.43 (SD 0.31), post-test: 3.83 (p<0.001). Correlation between MC and competence: high-level MC: 3.60 pre-test and 4.15 post-test; moderate MC: 3.41 pre-test and 3.67 post-test; and mild MC: 3.32 in the pre-test and 3.73 post-test (Pre p=0.027, Post= p: 0.004). Metacognition and clinical judgment: high MC: 27.06 in the pre-test and 34.06 post-test; moderate MC: 25.30 in the pre-test and 34.60 post-test; low MC: 25.85 in the pre-test and 32.05 post-test (Pre p=0.250, Post p= 0.029).	Although the level of metacognition increased after the intervention, there was no statistically significant difference. A correlation was found between clinical competence and metacognition for the high-level groups. There was also a correlation between metacognition and clinical judgment, with greater differences in the moderate-level group.

**Table 2.** Studies with intervention (continuation)

Identification	Objective	Study design	Population	Assessment	Intervention	Results	Main findings
Donaldson <sup>32</sup> 2020. Building Metacognition and Thinking Using a Deliberate Approach. Canada	Gain an understanding of how CBL strategies affect students' abilities to think and self-reflect (metacognition) and how faculty implement teaching strategies to develop thinking and self-reflection in students.	Qualitative cross-sectional.	9 nursing students who completed the 6 courses ("Life Transitional"). 6 Program Instructors.	Focus group, interview guide with open-ended questions, recorded. Analysis: Silverman's comparison method.	Concept-Based Learning (groups of 8 to 12 students and 1 faculty member discuss nursing concepts in pre-determined clinical cases. Duration: 10 to 12 weeks.	Teachers and students reported that the course structure stimulated thinking and metacognition, especially through group discussion of presentations based on concept analysis. Active listening and speaking skills were important for developing thinking and self-reflection. It was noted that in groups with eight or more members, the development of critical thinking decreased, as the number of presentations increased and discussion time decreased.	A safe learning environment allows for the development of self-reflection and metacognition. Greater teacher control, as well as larger group sizes, decreases student engagement and reasoning.
Millanzi and Kibusi <sup>33</sup> 2020. Exploring the effect of problem-based facilitatory teaching approach on metacognition in nursing education: A quasi-experimental study of nurse students in Tanzania. Tanzania	Determine the effect of FPBE on the metacognition of nursing students in Tanzania.	Quasi-experimental.	401 students (134 intervention group; 267 control group). 65.8% male, 73.6% aged 25 to 29.	Nursing Metacognitive Strategies Questionnaire (NMSQ) 2-point ordinal scale 0 = false, 1 = true.	Assessment conducted before and after intervention in the experimental group with Facilitated Problem-Based Education (FPBE) and in the control group with traditional teaching.	No difference was identified between metacognition levels at baseline (I = 23.27 SD 1.716; C = 22.73 SD 1.302). An increase in metacognition was observed in the post-test (I = 66.31 SD 6.204; C = 45.71 SD 3.621).	The FPBE had a positive effect on the overall level of metacognition and the mastery of metacognitive regulation.
Lovell et al. <sup>34</sup> 2020. Visual Arts in Nursing Education. United States	Determine whether an art program designed to cultivate critical thinking increases metacognitive awareness in baccalaureate nursing programs.	Longitudinal.	218 students (56 traditional program; 162 accelerated program) in the first semester. 83.3% female. Mean age: 24.5 SD 5.4.	MAI.	Art program for nursing with three 1.5-hour sessions for groups of 10 students, 1 facilitator with an undergraduate degree in art, and 1 clinical nursing instructor at the beginning, middle, and end of the semester. Assessment in the first week and after the last session.	Both groups showed increases in declarative knowledge and planning. Comprehension monitoring differed between pre- and post-test for the traditional group ( $P < .0001$ ).	The promotion of metacognition through the art program aids in the implementation of holistic nursing practice.

**Table 2.** Studies with intervention (conclusion)

Identification	Objective	Study design	Population	Assessment	Intervention	Results	Main findings
Rashwan et al. <sup>35</sup> 2021. Effect of guided reciprocal peer questioning strategy on pediatric nursing students' self-esteem and metacognitive awareness: Current approach and future directions. Egypt	Investigate the impact of the GRPQS peer-guided reciprocal questioning strategy on the self-esteem and metacognitive awareness of pediatric nursing students.	Quasi-experimental.	89 students (41 control; 48 study group). 78.0% female. Mean age: 22.3 SD 0.73.	MAI (Likert Scale; Rosenberg Self-Esteem Scale).	Training on the GRPQS method was conducted and administered to groups of 4 to 6 students in pediatric nursing classes. The control group received traditional instruction followed by group discussion.	The mean score for 43.8% of the study group and 53.7% of the control group was 2.5 (p=0.84). Declarative knowledge increased after the GRPQS intervention to 3.25 (SD 0.64) compared to 2.71 (SD 1.03) in the control group; Planning before the intervention was 3.48 (SD 0.55) in the study group compared to 2.37 (SD 0.80) in the control group.	The GRPQS method had a positive effect on metacognition by increasing the level of the subcategories conditional, procedural, and declarative knowledge, planning, monitoring, and assessment.
Li et al. <sup>36</sup> 2022. Effect of a Nursing Comprehensive Skill Training Course (NCST-C) on Nursing Students' Metacognitive Awareness: A Quasi-experimental Study. China	Explore the effect of comprehensive nursing skills training on nursing students' metacognitive awareness.	Quasi-experimental.	96 students; 48 control group and 48 intervention third-year students. 83.4 control group and 87.5 intervention group female. Mean age: 21.07 (SD 1.03).	MAI; Likert Scale.	A 16-week comprehensive nursing training course. The experimental group received a blended online and offline methodology with interactive activities and discussion. The control group received traditional laboratory instruction. Assessments were conducted in weeks 0, 16, and 20.	At baseline, the group factor had no effect on metacognitive awareness or its subcategories (intervention = 197.48 SD 36.05; Control 199.21 SD 42.72; ps > .05). At week 16, the groups had an effect on metacognition (intervention = 239.69 (SD 35.48); Control 204.69 (SD 30.98; ps > .01)). One month after the intervention, it was detected that the intervention group showed a greater effect compared to the control group (intervention = 242.64 (SD 29.18); Control 204.48 (SD 27.05; d> 0.56)).	The proposed training had a positive effect on the metacognition of nursing students.
Al-Moteri <sup>37</sup> 2023. Metacognition and learning transfer under uncertainty. Saudi Arabia	Investigate the relationship between metacognition and transfer of learning after a clinical simulation.	Cross-sectional.	87 fourth-year students. 51.7 female. Mean age: 22.8 (SD 1.7).	Metacognitive Awareness Scale – Domain Specific (MCAS-DS). (Likert Scale 1 to 5). Canadian Triage and Acuity Scale (CTAS).	Groups of 9 to 11 students. Individual assessments were conducted after clinical simulation.	The mean metacognition score was 33.9 (SD 5.7). The mean grade was 3.09 (SD 0.52). 51% of participants incorrectly triaged patients in the simulation.	Metacognition among students was moderate and correlated positively with transfer of learning, but without understanding how they influence each other.

Source: the authors (2025).

### 3.1 Level of metacognition in nursing students

Different studies assessed metacognition in various ways (Tables 1 and 2). These studies used validated questionnaires and rating systems with numerical or psychometric scales, such as the Likert<sup>18-31,33-37</sup> scale, or verbal reports of students' mental processes<sup>17,32</sup>. Among the assessment instruments, the Metacognitive Awareness Inventory was used most frequently<sup>22,23,25,29,34-36</sup>, and the result is obtained by a simple average of the total on a psychometric scale.

The other studies presented instruments created or adapted for their cultural context, namely: Chinese Metacognitive Ability Scale<sup>19</sup>, Metacognition Scale<sup>18</sup>, Metacognitive Skills Scale<sup>21</sup>, Motivation Strategies for Learning Questionnaire<sup>31</sup>, Metacognitive State Inventory<sup>24,27</sup>, Klein Metacognition Scale<sup>19</sup>, Metacognitive Awareness Scale, Domain Specific<sup>37</sup>, Student Metacognition Questionnaire<sup>28</sup>. In the same way, Fleur et al.<sup>2</sup> highlights that questionnaires based on self-report and interviews are the most widely used methods of assessing metacognition in research.

Regarding the metacognitive values in studies without an educational intervention (Table 1), it is noted that none of the assessed classes reached the maximum level, regardless of the classification parameter<sup>18,19,21-24,27,30</sup>. These findings suggest that undergraduate students have underdeveloped metacognitive skills, which corroborates the deficit of metacognitive skills in medical students and the low utilization of planning and assessment subcategories<sup>16</sup>. Furthermore, it implies less effective performance. According to Schraw and Denison<sup>38</sup>, the relationship between metacognitive ability and positive performance outcomes is direct: the higher the score, the better the results tend to be.

Thus, some studies that proposed comparing results across different groups of nursing students did not find statistically significant differences in metacognitive levels between groups or academic years<sup>19,31</sup>. Others demonstrated results below expectations, though they gradually increased from the second to the fourth year<sup>21</sup>. These results suggest that students rarely develop metacognition to its full extent during their undergraduate studies. These results are similar to those observed in medical

school, where no difference in metacognitive level was observed between the third and fourth years, indicating a deficit in metacognitive knowledge<sup>39</sup>, and in nursing school, where students demonstrated low metacognitive ability, which was accompanied by greater difficulty and lower performance on high-level questions<sup>40</sup>.

### 3.2 Relationship between metacognition and teaching methods

However, metacognition levels were significantly higher after the application of educational interventions (Table 2) in the nine studies found<sup>29-37</sup>, most of which employed a quasi-experimental approach. The approaches implemented were problem-based learning (PBL), PBL with simulation, visual arts program for nursing, peer-guided reciprocal questioning strategy, comprehensive nursing skills training, and blended learning.

The first is a student-centered pedagogical practice that aims to develop clinical skills and has been associated with a significant increase in the level of metacognition<sup>29,30,33</sup>. Furthermore, context-based learning (CBL), a method derived from PBL, also contributed to encouraging thinking and metacognition when applied to the study of clinical nursing cases<sup>32</sup>. These results are reiterated by a meta-analysis that points to the effectiveness of using PBL in this context when observing positive effects on the psychomotor, affective and cognitive domains of learning in nursing students<sup>41</sup>.

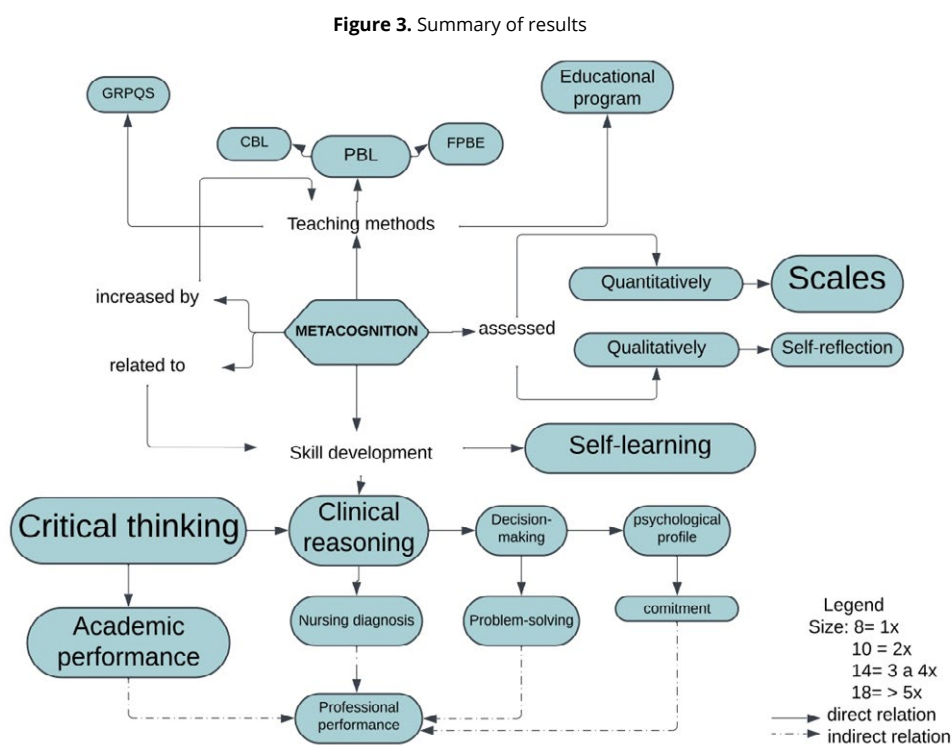
The implementation of interventions such as interdisciplinary skills training<sup>36</sup>, an interdisciplinary arts program focused on critical thinking<sup>34</sup>, and clinical simulation in a virtual environment<sup>37</sup> were associated with a significant increase in metacognitive awareness and its subcategories (Table 2). These practices promote the integration of theory and practice, which is effective for training nurses for the job market. By encouraging reflection, these practices are related to preventing errors in diagnosis caused by overestimating one's own abilities<sup>42</sup>. This is important because, although most nursing students believed they were correct in their patient triage assessments in a simulation, 51% were mistaken<sup>37</sup>.

Thus, metacognitive development is also linked to the methods discussed in the articles, such as self-reflection and self-assessment. These methods improve the performance of nurses in training by identifying knowledge deficits and selecting appropriate learning strategies<sup>31,32</sup>. This aligns with a study that highlights the reflective approach as a key aspect of training to develop critical thinking and metacognition. This approach helps reconcile theory and clinical practice by identifying reasoning errors and their solutions. These processes are essential for healthcare professionals<sup>43</sup>. Therefore, providing students with feedback on their performance increases their awareness of the factors necessary to achieve the desired competencies. This can be achieved by creating a safe and permissive learning environment<sup>44</sup>.

Finally, some studies have addressed the context of hybrid teaching. These studies have classified hybrid teaching as effective for developing metacognition<sup>18</sup>, ineffective at promoting significant immediate changes<sup>31</sup>, and positively influenced by greater metacognitive control<sup>25</sup>. This variation can be explained by findings from a quasi-experimental study<sup>45</sup> in which the type of hybrid teaching applied and the teaching strategy used influenced the effect on student learning and behavior.

### 3.3 Relationship between metacognition and skill development in nursing students

Figure 3 summarizes the evidence from this review and shows that metacognition levels can be optimized with educational interventions. The results also revealed a relationship between metacognition and skill development in nursing students. It is observed that research on critical thinking, clinical reasoning, and academic performance predominates. These are interconnected with theoretical learning and have only an indirect relationship with professional performance.



Source: the authors (2025).

In the context of theoretical learning, a statistically significant relationship was found between metacognition, critical thinking, and self-directed learning. Self-directed learning is associated with efficiency and autonomy in learning<sup>21</sup> and is strongly associated with problem-solving ability<sup>24</sup>. Another study found that metacognition predicts academic performance, with planning being the most important but least used skill<sup>22,25</sup>. This finding is supported by literature on the failure of medical students to use metacognitive skills, especially in the assessment and planning subcategories, which are important for problem solving and improving performance<sup>16</sup>.

Only one study has proposed investigating the development of nursing diagnoses<sup>17</sup>. The study identified difficulties in learning and applying the diagnostic process in practice. These difficulties are associated with a deficit in diagnostic reasoning, among other factors. This underscores the importance of metacognitive awareness in enabling students to recognize issues, establish objectives, and devise effective solutions. Although a recent review article suggested using a metacognitive-based diagnostic model, highlighting metacognition as a driver of diagnostic reasoning, little has been published or discussed in academia on the topic. This confirms the point raised at the beginning of the review that there is insufficient discussion of the impact of metacognition on the nursing process, especially in the diagnostic stage. This topic has been explored more in medical education<sup>6,46-48</sup>.

In addition to these findings, a study aimed to investigate the relationship between metacognition and overconfidence<sup>26</sup>, which identified self-assessment bias in nursing students' knowledge of hand hygiene. The study also found that a higher level of metacognition can reduce errors. Therefore, it is clear that introducing metacognition during training is important for promoting awareness of errors in thought processes and improving self-control in clinical decision-making while reducing biases in diagnostics<sup>7</sup>.

In the context of clinical practice, the selected studies found a correlation between metacognition and clinical judgment and competency. The higher the level of metacognition, the stronger the correlation<sup>31</sup>. Furthermore, metacognition was identified as a factor capable of predicting the development of skills in nursing students<sup>21</sup> and anxiety in clinical decision-making. This is because metacognition is related to the ability to gather resources, obtain information, and use these resources to gain a comprehensive understanding of the clinical situation<sup>23</sup>. A previous study identified metacognition as a potential protective factor against psychological disorders associated with stress from performing high-cognitive-effort tasks in medical practice<sup>49</sup>.

Furthermore, a relationship was also found between metacognition and psychological factors. This was associated with positive psychological capital<sup>27</sup> and greater professional commitment related to personality traits<sup>28</sup>. These findings align with those from studies conducted with nurses in

hospital settings, where professionals with higher metacognitive abilities exhibited greater resilience in negative and challenging situations and demonstrated superior clinical performance<sup>50</sup>.

Since nurses must assess patients' conditions, reflect on available information to make clinical judgments, plan goals, and monitor responses to interventions, metacognition is crucial in clinical nursing practice. Therefore, this topic should be widely discussed in universities.

### 3.4 Practical applications

Regarding the teaching-learning process, it was observed that metacognition can be operationalized in several ways. One method is realistic simulation, which focuses on problem-solving and the creation of conceptual maps for each clinical case. Another method is personalized guidance on student performance<sup>30</sup>. Additionally, reflective methodologies such as PBL and CBL can be adopted. These methodologies value group discussion of clinical cases and the exercise of organizational, argumentation, and listening skills. This expands the understanding of nursing concepts<sup>29,32</sup>. Hence, interdisciplinarity can also stimulate metacognition. Students are challenged to think about patients beyond the definitions in nursing books and to identify common elements with other areas of knowledge, such as communication, context, biases, and different perspectives. This process fosters deep reflection<sup>34</sup>.

In the context of healthcare, studies suggest that metacognition promotes assertiveness in clinical decision-making<sup>23</sup>. In relation to patient care, this means carefully assessing clinical evidence, correctly prescribing medications, developing effective therapeutic plans, and avoiding unnecessary procedures. It has also been associated with a sense of professional commitment, contributing to the development of dedicated nurses<sup>28</sup>, which can translate into attendance, effectiveness, efficiency, and a motivation to improve in practice. This indirectly contributes to increased service quality. Furthermore, metacognition reduces false sense of knowledge and self-assessment bias<sup>26</sup>, which involves not trusting one's own knowledge when diagnosing or prescribing and prioritizing double-checking clinical data.

Finally, the intersection of metacognition, teaching, and care is evident in results demonstrating an



association between metacognition and optimization in student performance in competency and clinical judgment<sup>31</sup>. These are indispensable and valuable skills for clinical nurses. The results also demonstrate an association between metacognition and the integration and adequate application of theoretical and practical knowledge acquired in clinical simulations. These simulations prepare nurses in training for professional life<sup>37</sup>.

## 4. Conclusions and recommendations

Studies have demonstrated that metacognition has a wide range of applications in nursing education. It can help nursing undergraduates develop essential skills to optimize their theoretical learning, academic performance, and clinical practice. These applications reveal its correlation with other fundamental nursing concepts, such as critical thinking, self-learning, self-confidence, clinical decision-making, reducing bias, clinical competency, professional commitment, problem solving, and developing nursing diagnoses.

Furthermore, it was found that certain teaching methods can influence the level of metacognition, which tends to be low or moderate among students. Given the positive effects of metacognition on learning, it is important to study educational interventions that impact it. However, studies with this objective have limitations and methodological weaknesses that require more rigorous and extensive research for an in-depth analysis<sup>3</sup>.

Therefore, since most studies' research methodologies make it impossible to detect causality and metacognition is influenced by various factors over time, longitudinal studies are necessary. These studies should primarily explore under-explored topics, such as learning nursing diagnoses, given their importance in clinical practice.

Thus, this review clarifies the use of metacognition in undergraduate nursing programs and helps direct future research by identifying gaps in the relationship between metacognition, nursing diagnoses, and clinical decision-making. Furthermore, it emphasizes the importance of discussing this topic

in universities and finding effective and efficient ways to incorporate metacognition into the entire nursing education process.

### 4.1 Limitations

Due to the amount of time, human and financial resources available, it was decided to exclude articles written in languages other than Portuguese or English, as well as theses, editorials, and other gray literature formats. These limitations were considered when conducting this review.

### Authors' contributions

The authors declared that they have made substantial contributions to the work in terms of research conception or design, data acquisition, analysis, or interpretation for the work, and drafting or critically revising it for relevant intellectual content. All authors approved the final version to be published and agree to take public responsibility for all aspects of the study.

### Competing interest

No financial, legal, or political conflicts involving third parties (government, private companies and foundations, etc.) have been declared for any aspect of the submitted work (including but not limited to grants and funding, advisory board membership, study design, manuscript preparation, statistical analysis, etc.).

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