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# Effect of clinical simulation on the development of clinical skills in neonatal nursing

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## ADMINISTRATIVE INFORMATION

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**Review Stage at time of this submission -** Data analysis.

**Conflicts of interest -** None declared.

**INPLASY registration number:** INPLASY202650140

**Amendments -** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 26 May 2026 and was last updated on 26 May 2026.

## INTRODUCTION

**Review question / Objective** To provide a synthesis of the current knowledge regarding the effect of an educational intervention such as clinical simulation on the development of clinical skills in neonatal nurses through a systematic review.

The research question was formulated according to the PICO acronym (Population, Intervention, Comparison, and Outcome), where P stands for neonatal nurses; I, clinical simulation; C, conventional education; and O, development of clinical skills.

A search for articles was conducted following the 2020 PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, up to April 2026, in the PubMed, Web of Science, Scopus, SciELO, and LILACS databases, as well as in the gray literature; using the following keywords and search strategy ((((nursing education) OR (neonatal nurse practitioner)) AND (educational intervention)) AND (simulation-based learning AND clinical decision-making)) AND (clinical competence)

This study presents a synthesis of the knowledge on the effect of an educational intervention, such as clinical simulation, on the development of clinical skills in neonatal nurses through a systematic review.

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AND (simulation-based learning AND clinical decision-making)) AND (clinical competence).

**Rationale** Simulation is a teaching-learning strategy that replicates real or potential situations in education, practice, and research; it employs various modalities such as realistic full-body or partial-body computer-controlled manikins, trained actors, procedural task trainers, and virtual reality [1].

Simulation-based professional training in neonatal nursing is increasingly used in developing countries to improve clinical skills within a safe, controlled environment for personalized learning by offering realistic experiences that mimic real-world scenarios; thus, its application is particularly relevant in dynamic, demanding, and high-risk settings such as the Neonatal Intensive Care Unit (NICU) [2,3].

Traditional teaching methods lack the realism necessary for nurses to perform optimally in emerging scenarios; conversely, it has been reported that simulation improves professional clinical competence by fostering greater satisfaction, confidence, self-efficacy, skills, and knowledge to improve neonatal outcomes, as well as key aspects of teamwork such as effective communication and collaboration [3]. Furthermore, simulation allows for the development of clinical judgment and decision-making while enabling participants to recognize the consequences and evaluate the effectiveness of their actions [4].

Although simulation-based education in various healthcare fields is widely associated with positive outcomes, the evidence regarding its effects in developing contexts and specialized fields is insufficient to assess the impact of training and education in nursing.

The rationale for this systematic review lies in the need to synthesize the available evidence supporting clinical simulation as an educational intervention grounded in evidence-based teaching, to identify gaps, and to inform the most effective educational practice.

**Condition being studied** Simulation-based learning (SBL) is a significant pedagogical strategy in nursing education, recognized for its effectiveness in strengthening nursing students' competencies in complex scenarios and technical skills; however, there remains a lack of evidence regarding the long-term retention of these skills, making it necessary to conduct research that supports the implementation of SBL and investigates its applicability to clinical settings [5].

It has been reported [6] that cognitive processes such as clinical decision-making among neonatal nurses are at intermediate levels, whereas higher levels were expected given the characteristics of the study population, specialized knowledge, and clinical experience; thus, the design of professional development and competency programs is a priority.

## METHODS

**Search strategy** DESC/MESH terms and keywords were used in the search strategy: ((((Nursing education) OR (Neonatal Nurse practitioner)) AND (Educational intervention)) AND (Simulation based learning AND Clinical decision-making)) AND (Clinical competence).

**Participant or population** The review will target neonatal nursing students, neonatal nurse specialists, and nurses in training in critical care settings.

**Intervention** The intervention to be evaluated in this review involves clinical simulation in quasi-experimental studies with one or two groups using a pre-test/post-test design, which are aimed at developing clinical skills, decision-making abilities, or professional competencies in clinical settings.

**Comparator** The control group for the target population will be the conventional education system.

**Study designs to be included** Studies were included that met the following criteria:• Population: nursing students, nurses in specialized training, or nursing professionals, with an emphasis on maternal-neonatal care or critical care. • Intervention: training using clinical simulation programs (low, medium, or high fidelity) aimed at developing clinical skills, decision-making, or professional competencies in clinical areas.• Comparison: traditional educational methods. • Outcomes: Primary: results of clinical decision-making skill assessments.Secondary: results of competency and self-confidence assessments.• Study.

**Eligibility criteria** Studies with any of the following characteristics were excluded:

- Studies involving healthcare professionals other than nurses.
- Narrative reviews, letters to the editor, editorials, or theoretical studies.
- Studies that did not assess outcomes related to clinical skills or decision-making.
- Research involving virtual simulation not applied to clinical scenarios or conducted in situ.
- Articles without access to the full text.

**Information sources** The search was conducted through April 2026 using the databases PubMed, Web of Science, Scopus, SciELO, and LILACS, with no time limit. The following search strategy was used: ((((Nursing education) OR (Neonatal Nurse Practitioner)) AND (Educational intervention)) AND (Simulation-based learning AND Clinical decision-making)) AND (Clinical competence).

**Main outcome(s)** The main outcome of this systematic review will be the effect of clinical simulation on the development of clinical skills among neonatal nursing staff. Primary outcomes will include clinical competence, clinical judgment, clinical decision-making, psychomotor skills, critical thinking, communication skills, confidence/self-efficacy, reduced anxiety, and performance in neonatal care settings.

The included studies reported statistically significant improvements in several outcomes following simulation-based interventions; for example, scenario-based clinical simulation significantly improved students' clinical skills, with 100% of participants in the intervention group achieving a good skill level, compared with 20% in the control group ($P < 0.001$), while severe anxiety decreased from 43.3% in the controls to 6.7% in the intervention group.

Other studies demonstrated higher scores in clinical judgment following simulation interventions ($P < 0.001$), better retention of decision-making skills at the six-week follow-up, and increased self-confidence and self-efficacy following repeated simulation experiences.

The reported measures of effect in the studies include mean differences, standardized mean differences, percentages, changes in scores before and after the intervention, confidence intervals, p-values, and effect sizes. Results assessed immediately after the intervention and during follow-up periods will be considered.

**Additional outcome(s)** Secondary outcomes include self-confidence, perceived clinical competence, clinical performance, and anxiety levels associated with clinical decision-making during simulated scenarios.

**Data management** All records identified through the database search will be exported and managed using reference management software to identify and remove duplicate studies. The screening and selection process will follow the PRISMA 2020 guidelines. Titles and abstracts will be independently reviewed by two reviewers according to the predefined eligibility criteria. Subsequently, full-text articles will be assessed for inclusion. Disagreements between reviewers will be resolved through discussion and consensus, and when necessary, by consultation with a third reviewer. Data from the included studies will be extracted using a standardized data extraction form developed by the research team. Extracted information will include author, year, country, study design, sample characteristics, educational intervention, simulation modality, comparator, outcome measures, instruments used, statistical results, and main findings related to clinical skills development in neonatal nursing. The extracted data will be organized in evidence tables and synthesized narratively. When appropriate, quantitative findings and effect measures reported in the studies will also be compared and summarized.

**Quality assessment / Risk of bias analysis** The methodological quality and risk of bias of the included studies will be independently assessed by two reviewers using the Cochrane Risk of Bias Tool version 1 (ROB 1). Given that most of the included studies are quasi-experimental educational intervention studies, the assessment will focus on domains including selection bias, performance bias, detection bias, attrition bias, reporting bias, and other potential sources of bias. Each domain will be classified as low, high, or unclear risk of bias according to the ROB 1 criteria. Disagreements between reviewers will be resolved through discussion and consensus, with consultation from a third reviewer when necessary. The results of the quality assessment will be summarized in tables and considered during data synthesis and interpretation of findings.

**Strategy of data synthesis** A narrative synthesis of the findings will be conducted due to the expected methodological heterogeneity among the included studies regarding simulation modalities, educational interventions, outcome measures, and assessment instruments. Extracted data will be organized into evidence tables summarizing study characteristics, participants, type of simulation intervention, comparator, outcome variables, instruments used, and principal findings. Quantitative results related to the effectiveness of simulation-based learning on clinical skills development in neonatal nursing will be compared descriptively using reported statistical measures such as means, standard deviations, percentages, p-values, confidence intervals, and effect sizes. Outcomes including clinical competence, clinical judgment, decision-making, psychomotor skills, self-confidence, self-efficacy, anxiety reduction, communication, and critical thinking will be synthesized according to thematic categories. When studies present sufficient methodological

homogeneity in design, intervention characteristics, and outcome measurements, the feasibility of conducting a meta-analysis will be considered. The interpretation of results will also take into account the methodological quality and risk of bias of the included studies.

**Subgroup analysis** If data permits, subgroup analyses will be conducted based on the type of clinical simulation used (e.g., high-fidelity manikins, hybrid simulation, screen-based scenarios) to determine varying effects on clinical skills.

**Sensitivity analysis** A sensitivity analysis will be performed to assess the robustness of the synthesized results by excluding studies evaluated as having a serious overall risk ofbias.

**Language restriction** Included studies will be restricted to those published in English, Spanish, and Portuguese.

**Country(ies) involved** Mexico.

**Keywords** Neonatal nursing; Simulation-based learning; Clinical decision-making; Clinical competence; Educational intervention.

**Dissemination plans** The findings of this systematic review will be submitted for publication in peer-reviewed nursing journals and presented at relevant academic conferences.

**Contributions of each author**

Author 1 - Karen Vianey Serrano-Madrid - Author 1 developed and conducted the systematic review, including protocol development, literature search, study selection, data extraction, critical appraisal, data synthesis, and manuscript preparation.
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