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Pharmacology and Medication-related Education for Undergraduate Nursing Students: A Scoping Review Protocol

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Abstract

Objective: To map and summarize evidence on medication-related education for undergraduate nursing students, including educational content, teaching strategies, learning contexts, outcomes, and methods used to evaluate learning.

Introduction: Medication-related competence is essential in undergraduate nursing education. Research in this field spans pharmacology, pharmacotherapy, medication administration, medication calculation, and medication safety, using diverse teaching strategies and outcome measures. Because the evidence is broad and heterogeneous, a scoping review is appropriate to clarify how the field has been studied and identify gaps for future nursing education and research.

Inclusion Criteria: Peer-reviewed empirical studies involving undergraduate nursing students will be considered. Studies with mixed student populations may be included when nursing students are explicitly represented. Eligible studies must address pharmacology, pharmacotherapy, medication-related education, medication administration, medication calculation, medication safety education, or medication-related competencies. Outcomes may include knowledge, skills or competence, confidence or self-efficacy, attitudes, medication safety behaviors, and decision-making. Articles unavailable in English or Japanese and non-empirical or non-peer-reviewed publication types will be excluded.

Methods: The review will follow JBI methodology for scoping reviews and be reported in line with PRISMA-ScR. Database searches informed by the JBI three-step search strategy were completed on December 9, 2025, in PubMed, CINAHL Ultimate, PsycINFO via ProQuest Dialog, Ichushi-Web, and ERIC. Two reviewers will independently screen titles/abstracts and full texts and extract data using a piloted charting instrument. Findings will be mapped using descriptive, tabular, graphical, and narrative presentation. This protocol was developed before screening began and has not been registered. At the time of revision, title and abstract screening is complete, full-text screening has not yet begun, and the planned methods remain unchanged.

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Introduction

Pharmacology and medication-related competence are fundamental components of undergraduate nursing education because nurses have central responsibilities for medication administration, patient assessment, monitoring of therapeutic and adverse effects, medication-related communication, and patient safety. Pharmacology education must therefore extend beyond memorization of drug names, mechanisms, and adverse effects to support the application of pharmacological knowledge to patient assessment, clinical judgment, and safe medication-related decision-making. Previous work has emphasized that pharmacology is a demanding interdisciplinary subject and that meaningful learning requires integration of pharmacological knowledge with clinical contexts and foundational sciences [1,2].

Throughout this protocol, "undergraduate nursing students" refers to students enrolled in undergraduate or other pre-licensure nursing programs leading to initial nurse registration, including baccalaureate and BSN programs. "Medication-related education" is used as the umbrella term encompassing pharmacology, pharmacotherapy, medication administration, dosage calculation, medication safety, and medication-related competency development.

"Pharmacology education" refers specifically to education concerning drugs and their actions, therapeutic uses, and adverse effects, and is treated as one component of medication-related education.

The complexity of medication-related nursing practice has stimulated substantial educational research. Teaching approaches reported in undergraduate nursing pharmacology include online learning, simulation, integrated teaching, active learning, technology-enhanced learning, and other learner-centered strategies. A systematic review by Gill et al. identified 20 studies published between 2001 and 2017 and found considerable variation in teaching approaches, study designs, intervention duration, and outcome measures; online, simulation, and integrated approaches showed favorable effects on

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pharmacology knowledge acquisition and student satisfaction [3]. More recent evidence has continued to support active and technology-enhanced approaches to pharmacology education, including new media teaching strategies such as flipped and multimedia-based learning [4].

Medication-related education in nursing, however, extends beyond formal pharmacology courses. Medication administration safety, dosage calculation, and medication-related competence constitute additional educational domains that require students to integrate cognitive, psychomotor, and clinical judgment skills. Reviews of medication administration safety education have identified simulation, technology aids, and online learning modules as commonly used approaches [5]. A systematic review of clinical simulation for safe medication administration reported improvements in medication-safety knowledge and medication administration competence among nursing students [6]. In addition, reviews of medication calculation education have identified heterogeneous strategies, including traditional pedagogy, technology, psychomotor approaches, blended learning, diagnostic assessment, scaffolding, and e-learning, while also highlighting limitations in the quality and consistency of the available evidence [7,8].

Recent evidence further illustrates the breadth of this field. A 2025 systematic review of undergraduate nursing students' medication administration competency included 32 studies from 12 countries and found substantial diversity in educational strategies and competency assessment, with most assessments occurring in simulation laboratories and relatively few studies evaluating competency in clinical placement settings [9]. Medication-related education is also increasingly situated within interprofessional learning. A 2024 scoping review of interprofessional medication-related education for undergraduate health professions students, including nursing students, identified 14 studies, most of which addressed medication safety or medication errors and used simulation as the principal educational method [10]. These reviews demonstrate an expanding but fragmented evidence base spanning pharmacology teaching, medication administration, dosage calculation, medication safety, simulation, competency assessment, and interprofessional education.

Existing reviews have generally addressed one component of this evidence base rather than the full spectrum of medication-related education for undergraduate nursing students. Gill et al. focused specifically on best practices for teaching pharmacology [3], whereas other reviews have examined medication-administration safety [5], clinical simulation for medication safety [6], drug calculation instruction [7,8], medication administration competency assessment [9], or interprofessional medication-related education [10]. Consequently, these reviews do not provide an overarching map of what medication-related content is taught to undergraduate nursing students, how it is taught across classroom, simulation, online, blended, and clinical placement contexts, which outcomes are evaluated, and how those outcomes are measured.

A preliminary search was conducted to identify existing or ongoing systematic and scoping reviews addressing the same or a substantially similar topic. No review was identified that comprehensively mapped pharmacology, pharmacotherapy, medication administration, medication calculation, medication safety education, and medication-related competencies among undergraduate nursing students across teaching strategies, learning contexts, and educational outcomes. Existing reviews were limited to specific components of this field, such as pharmacology teaching, medication administration safety, simulation, drug calculation, competency assessment, or interprofessional medication-related education. Therefore, the proposed scoping review will address a broader evidence gap by mapping the full range of medication-related education for nursing students.

This gap is particularly relevant because medication-related learning is multidimensional. Knowledge acquisition alone does not capture the full range of competencies expected of nursing graduates. Contemporary nursing education frameworks emphasize competency-based preparation and clinical judgment, while empirical work in nursing pharmacology has highlighted assessment ability, integration of pharmacology with anatomy, physiology and pathophysiology, experiential learning, communication, interprofessional collaboration, and accountability for patient safety as important elements of medication-related practice [11,12]. Mapping these domains together may clarify how educational research conceptualizes medication-related competence and where important gaps remain.

A scoping review is therefore appropriate because the purpose is not to determine the comparative effectiveness of a single intervention, but to map the extent, range, characteristics, and concepts represented in a heterogeneous body of evidence. JBI guidance recommends scoping review methodology when the aim is to clarify concepts, examine how research has been conducted, identify key characteristics or factors related to a concept, and identify knowledge gaps [13,14]. Accordingly, this review will use the Population–Concept–Context framework to systematically map empirical evidence concerning medication-related education for undergraduate nursing students.

Review Objective

The objective of this scoping review is to map and summarize the available empirical evidence on medication-related education for undergraduate nursing students, with particular attention to educational content, teaching strategies, learning contexts, outcomes, evaluation methods, and gaps in the literature.

Review Questions

What evidence is available on medication-related education for undergraduate nursing students?

1. What medication-related educational content is addressed in the literature?
2. What teaching and learning strategies are used?
3. In what educational contexts are these strategies implemented?
4. What outcomes are evaluated, including knowledge, skills/competence, confidence/self-efficacy, attitudes, medication safety behaviors, and decision-making?
5. What study designs and evaluation methods are used to investigate medication-related education?
6. What characteristics of the educational interventions and learning activities are reported?
7. What gaps in the evidence are identifiable for future nursing education and research?

Eligibility Criteria

Participants

This review will consider studies involving undergraduate nursing students, including baccalaureate and BSN students. Studies involving mixed student populations (eg, nursing, medical, or pharmacy students) may be included when nursing students are explicitly part of the sample, even when they constitute a minority of participants. Studies that do not include nursing students, or that focus solely on practicing nurses, other health professionals, or students from non-nursing fields without nursing students, will be excluded.

Concept

The concept of interest is medication-related education in undergraduate nursing education. Eligible content includes pharmacology education, pharmacotherapy, medication administration education, medication calculation training, medication safety education (including learning occurring through clinical placement), and medication-related competencies. Teaching strategies may include blended learning, simulation, online modules, games, and other approaches related to medication therapy. Outcomes of interest include knowledge, skills/competence, confidence/self-efficacy, attitudes, medication safety behaviors, and decision-making.

Studies focusing solely on clinical outcomes, pharmacological effects, drug efficacy, or medication errors in practice without an educational component will be excluded.

Context

The review will consider medication-related education delivered within undergraduate nursing education. Educational activities may occur in classroom, laboratory, simulation, online or blended learning, and clinical placement contexts when the activity concerns learning by nursing students. No geographical restriction is planned.

Types of sources

Peer-reviewed empirical research articles will be eligible. Empirical designs may include quantitative, qualitative, mixed methods, randomized and non-randomized studies, and observational research. Conference abstracts or proceedings, commentaries, letters, opinion pieces, book chapters, narrative reviews, non-peer-reviewed publications, and systematic reviews will be excluded. Systematic reviews may be captured by the search but will be excluded during screening. Only articles available in English or Japanese will be included.

Methods

The proposed scoping review will be conducted in accordance with JBI methodology for scoping reviews, including current guidance for scoping review protocols [13,14], and will be reported in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [15].

This protocol was developed before screening began. Database searches were completed on December 9, 2025. At the time of this revision, title and abstract screening has been completed, and full-text screening has not yet begun. No changes have been made to the planned methods. Any subsequent amendments will be documented and justified in the final review. This protocol has not been registered.

Search strategy

A preliminary search for existing or ongoing systematic and scoping reviews addressing the same or a substantially similar topic was conducted; no comprehensive review matching the scope of the present review was identified.

The subsequent search followed the JBI three-step search strategy. First, a limited search was conducted to identify relevant text words in the titles and abstracts of relevant records and controlled vocabulary used to index them. Second, the identified keywords and index terms were used to develop the database search strategies, which were adapted for each information source. The search strategies were developed, refined, and executed by librarian Satomi Kojima in consultation with the review team. Third, reference lists of included articles will be examined to identify additional eligible studies.

The search was structured around three core concepts: (1) nursing students, (2) pharmacology/pharmacotherapy/medication, and (3) nursing education/teaching and learning strategies. Final searches were conducted on December 9, 2025, in PubMed (921 records), CINAHL Ultimate (955), PsycINFO (200), Ichushi-Web (308), and ERIC (41), yielding 2,425 records (Table 1). Complete database-specific strategies are presented in Appendix I (Supplementary File).

The review is restricted to peer-reviewed empirical research articles available in English or Japanese. Conference abstracts/proceedings, commentaries, letters, opinion pieces, book chapters, narrative reviews, systematic reviews, and other non-peer-reviewed publications are excluded because the review is intended to map empirical educational research with sufficient methodological detail for consistent data charting. No publication date restriction was applied.

Table 1: Deatils of database retrieved records

Database	Records retrieved
PubMed	921
CINAHL Ultimate	955
PsycINFO	200
Ichushi-Web	308
ERIC	41
Total	2,425

Study selection

All retrieved references were imported into Rayyan and duplicates were removed before screening. Before formal screening, the eligibility criteria will be pilot-tested by two reviewers on a sample of records to ensure consistent interpretation. Titles and abstracts will then be screened independently by two reviewers. Potentially eligible articles will be retrieved in full text and independently assessed by two reviewers. Disagreements will be resolved through discussion or, when necessary, consultation with a third reviewer. Reasons for exclusion at full-text review will be recorded. The complete selection process will be reported in a PRISMA flow diagram.

Data extraction

Data will be extracted independently by two reviewers using a structured data charting instrument developed for this review and informed by JBI guidance [16]. The instrument will be pilot-tested

on a small sample of included studies and revised as necessary. Modifications will be documented in the final review. Disagreements will be resolved through discussion or consultation with a third reviewer. Authors of included studies may be contacted for clarification or missing information when required.

Planned extraction fields include bibliographic characteristics; country; study design; participant characteristics; educational context; pharmacology or medication-related topic; teaching strategy; intervention or learning activity characteristics; comparator, where applicable; outcome domains and measurement instruments; timing of assessment; principal findings; and authors' reported educational implications.

Data analysis and presentation

Consistent with JBI guidance for scoping reviews, extracted evidence will be mapped rather than synthesized to estimate intervention effectiveness. Descriptive numerical summaries will characterize publication year, country, study design, participants, educational content, teaching strategies, learning contexts, and outcome domains. Results will be presented in tabular and graphical formats where appropriate, accompanied by a narrative summary organized around the review objective and questions. Methodological quality will not be critically appraised because the purpose is to map the extent, characteristics, and distribution of the evidence rather than determine effectiveness.

Conflicts of Interest

The authors declare no conflicts of interest.

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Use of Generative Artificial Intelligence

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to assist with language editing of the manuscript since English is our second language. The authors critically reviewed and revised all AI-assisted content and take full responsibility for the accuracy, integrity, and final content of the manuscript.

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