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Simulation-Based Education for Developing Pharmacy Students' Competence in Self-Medication and Self-Care Consultations: A Systematic Review

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ABSTRACT: As the most accessible healthcare professionals, pharmacists play a pivotal role in guiding safe self-medication. Yet pharmacy curricula often leave students underprepared for the clinical reasoning these consultations demand, and the impact of simulation-based training on this competency remains unclear. This systematic review aimed to examine how patient simulation has been used to develop and assess pharmacy students' competence in self-medication and self-care consultations, synthesising evidence on educational outcomes, observed competency gaps, and implications for pharmacy curricula. The review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 statement and registered with the International Prospective Register of Systematic Reviews (CRD420251155488). Five databases were searched from inception to August 2025, with two reviewers independently screening studies, extracting data, and assessing risk of bias; findings were synthesised narratively due to methodological heterogeneity. Six studies from six countries employed varied simulation approaches, including standardised patients, objective structured clinical examinations, virtual human platforms, and digital simulations. Communication skills and structured consultation approaches improved consistently, whereas gains in red flag recognition and referral judgement were inconsistent. One randomised trial found examination-based training more effective than product-focused teaching. Overall, simulation strengthens communication competence more reliably than clinical judgement, and a staged framework progressing from virtual simulation to examination-based verification is recommended.

1. INTRODUCTION

Access to over-the-counter (OTC) medicines allows individuals to self-manage common illnesses with a minimum of primary care involvement, which may reduce the burden on primary healthcare services. Still, self-medication can lead to several issues, such as wrong diagnosis, adverse drug effects, drug-drug interactions, and disadvantageous postponement of medical visits (James et al., 2006; Ocan et al., 2015; Ruiz, 2010). Pharmacists are often the first-line health care professionals to consult with patients for advice on treating minor ailments. They are responsible for completing a symptom screening process that involves patient counselling, identifying red flags, and referring patients to suitable health care services (Bennadi, 2014; Chautrakarn et al., 2021).

The terms "self-medication" and "self-care" are interpreted differently in various countries. According to the Accreditation Council for Pharmacy Education (ACPE), self-care involves therapeutic needs assessment, triage, non-prescription product recommendation, and counselling (ACPE, 2015). Both of these terms have been combined in this review to cover the wide range of international literature. Self-medication consultation requires pharmacotherapeutic knowledge, clinical reasoning, and communication skills, with suboptimal outcomes if these are lacking, and direct patient safety implications due to suboptimal

recommendations or missed referrals (Anderson et al., 2003; Ayele et al., 2018; Berger et al., 2005; Mesquita et al., 2010; Watson et al., 2006).

The definition of practice readiness, according to this review, is the ability to observe the application of pharmacotherapeutic knowledge, clinical decision-making, and communication skills in simulated or authentic patient scenarios, consistent with the competency-based education (CBE) principles (Medina et al., 2013) and International Pharmaceutical Federation (FIP) Global Competency Framework (GbCF) (FIP, 2020). This includes performance as well as accuracy in making decisions, which are separate constructs from self-perceived readiness that do not always go hand in hand.

Controlled environments for practice and training of clinical skills without the risk of harm to actual patients are referred to as 'simulation-based education' and may involve the use of standardised patient encounters, OSCEs, or virtual patient platforms (Oestreich and Guy, 2022; Smithson et al., 2015; Wallman et al., 2013). Meta-analyses have validated the evidence of enhanced knowledge, skills, and clinical actions over standard teaching (Cook et al., 2011; Kononowicz et al., 2019). There has been a mixed picture with respect to the effectiveness of simulation-based education, specifically in preparing pharmacy students for self-medication and self-care consultations; however, the evidence is scattered across a variety of educational and simulation contexts. To our knowledge, no systematic review has synthesized the effect of simulation on the readiness of pharmacy students. Thus, the purpose of this review was to examine how patient simulation has been used to develop and assess pharmacy students' competence in self-medication and self-care consultations, synthesising evidence on educational outcomes, observed competency gaps, and implications for pharmacy curricula.

2. MATERIALS AND METHODS

2.1 Protocol and Registration

The protocol was prospectively registered in PROSPERO (University of York, UK) to make the review transparent and prevent duplication (Registration ID: CRD420251155488), and the study was carried out according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021).

2.2 Eligibility Criteria

Inclusion: Studies that assessed self-medication or self-care consultation competence of pharmacy students through a patient simulation were included; randomised controlled trials (RCTs), observational, quasi-experimental, mixed methods, and studies without comparators were included. Domains of interest include clinical reasoning, decision-making, communication, counselling, and patient safety. Studies addressing antibiotic misuse were included, given OTC antibiotic availability in some jurisdictions and the pharmacist's role in minor ailment management. Studies combining self-care and prescription scenarios were included only where self-medication outcomes were separately extractable. Eligible studies included both (i) educational interventions using simulation to develop or improve consultation competence and (ii) simulation-based assessments characterising students' existing competence. Only peer-reviewed English-language publications, including peer-reviewed conference proceedings reporting original research, were included.

Exclusion: Studies not involving pharmacy students, not using patient simulation, or lacking relevant competency outcome data, non-peer-reviewed publications, conference abstracts with incomplete data, letters, and case reports were excluded.

2.3 Search Strategy

Searches were conducted in PubMed, Scopus, Web of Science, Cochrane Central, and Google Scholar through August 2025, combining controlled vocabulary and free text for patient simulation, self-medication, self-care, competency, and pharmacy students (Table 1). The term "self-care" was included with "self-medication" to address the different terms used globally. Reference lists of included studies were hand-searched.

Table 1. Search Strategies Used in the Study

Database	Search Strategy
PubMed	(("Students, Pharmacy"[MeSH] OR "pharmacy students")) AND (("Patients, Simulated"[MeSH] OR "standardized patient" OR "simulated patient" OR "clinical role play")) AND (("Self Medication"[MeSH]

	OR "self medication" OR "self-medication" OR "self care" OR "Self Care"[MeSH] OR "over the counter" OR "minor ailment" OR "nonprescription medicine"))
Scopus	("pharmacy student" OR "pharmacy undergraduate") AND (competence OR competency OR skill OR performance) AND ("self medication" OR "self-medication" OR "self care" OR "OTC medicine") AND (simulation OR "simulated patient" OR "standardized patient" OR "role play")
Cochrane (CENTRAL)	(pharmacy student OR "pharmD" OR "pharmacy education") AND ("self medication" OR "self-medication" OR "over the counter" OR OTC OR "antibiotic misuse") AND ("standardized patient" OR "simulated patient" OR "virtual patient" OR OSCE) AND (competence OR skill OR "clinical reasoning" OR "communication skill" OR "decision making")
Web of Science	TS=("pharmacy students" OR "pharmacy trainees") AND TS=(competency OR skills OR "clinical competence") AND TS=("self medication" OR "non-prescription medicine" OR "self care") AND TS=("standardized patients" OR "simulated patients" OR "patient simulation" OR "role play")
Google Scholar	("pharmacy students" AND ("competency" OR "assessment") AND ("self medication" OR "self-medication" OR "self care") AND "patient simulation")

2.4 Study selection

All references were added to Rayyan so that they are managed systematically, and duplicates are removed automatically. The selection of studies was done in two stages. First, titles and abstracts were screened by two independent reviewers to identify studies that evaluated the competence of pharmacy students in handling self-medication requests by simulating patients, whereas disagreements were resolved either by discussion or by a third reviewer. Secondly, full texts were evaluated in terms of relevance to competency assessment and patient simulation utilization. Excluded studies and reasons were mentioned in the PRISMA 2020 flow diagram. There was also hand-searching of the reference lists of included studies and other related reviews to find additional eligible articles.

2.5 Data extraction

A structured data extraction form was developed to conduct this review. The information that was extracted included the authors' details, year of publication, study design, sample size, level of participants' education, and the study setting. In the intervention groups, the information about the simulation process, the nature of the self-medication situation, and the length of the simulation was documented. In experiments that used comparison groups, the comparator character was observed. Outcome data consisted of primary and secondary results, follow-up period, competency score changes, statistical significance, and qualitative information in mixed-methods research studies. Systematic data extraction was done to address incompleteness.

2.6 Risk of bias assessment

The risk of bias was assessed with the help of the right tools based on the study design. In randomized controlled trials, the Cochrane Risk of Bias 2.0 (RoB 2) (Sterne et al., 2019) tool was used to evaluate areas like randomization, nonadherence to planned interventions, absence of outcome data, outcome measurement, and reporting bias. In the case of non-randomized studies, the ROBINS-I tool (Sterne et al., 2016) was used to evaluate confounding, selection bias, misclassification, adherence to interventions, missing data, measurement bias, and selective reporting. Bias assessment was done by two reviewers who were independent of each other, and disagreements were resolved by discussion or consulting a third reviewer.

2.7 Data synthesis

A narrative synthesis approach was employed because of a considerable heterogeneity in the study designs, interventions, measurement tools, and outcome measures. Results were contrasted to determine similarities, differences, and gaps in the competency of the pharmacy students in self-medication request management. The narrative description of quantitative findings was provided in terms of changes in scores, effect sizes, and statistical significance. It was not possible to perform a meta-analysis because of methodological differences. The results of qualitative analysis were incorporated to present the educational importance of simulated patients in enhancing self-medication skills. Narrative synthesis was employed due to the large number of different study designs, modalities, assessment tools, and outcome measures, so it was not possible to conduct a meta-

analysis. The outcomes were based on Miller's competency pyramid (Miller, 1990) and Kirkpatrick's evaluation framework (Kirkpatrick and Kirkpatrick, 2006).

3. RESULTS AND DISCUSSION

3.1 Study Selection

A total of 418 records were identified from database searches (PubMed: 25; Cochrane: 1; Scopus: 362; Web of Science: 4; Google Scholar: 26). Following the elimination of 51 duplicates and 120 irrelevant records, 247 records were screened for title and abstract, with 207 records being eliminated. Among the 40 articles that were found and subjected to full-text review, four were not available via institutional access or online sources. Based on information provided from titles and abstracts, these studies were not found to meet the pre-established inclusion criteria and were not further evaluated. A total of 36 full texts were assessed, of which 30 were excluded (Not focused on pharmacy students (n = 12); Not addressing self-medication (n = 8); Not using simulated patient methods (n = 6); Ineligible study design or outcomes (n = 4)). A total of six studies fulfilled all the inclusion criteria (Figure 1).

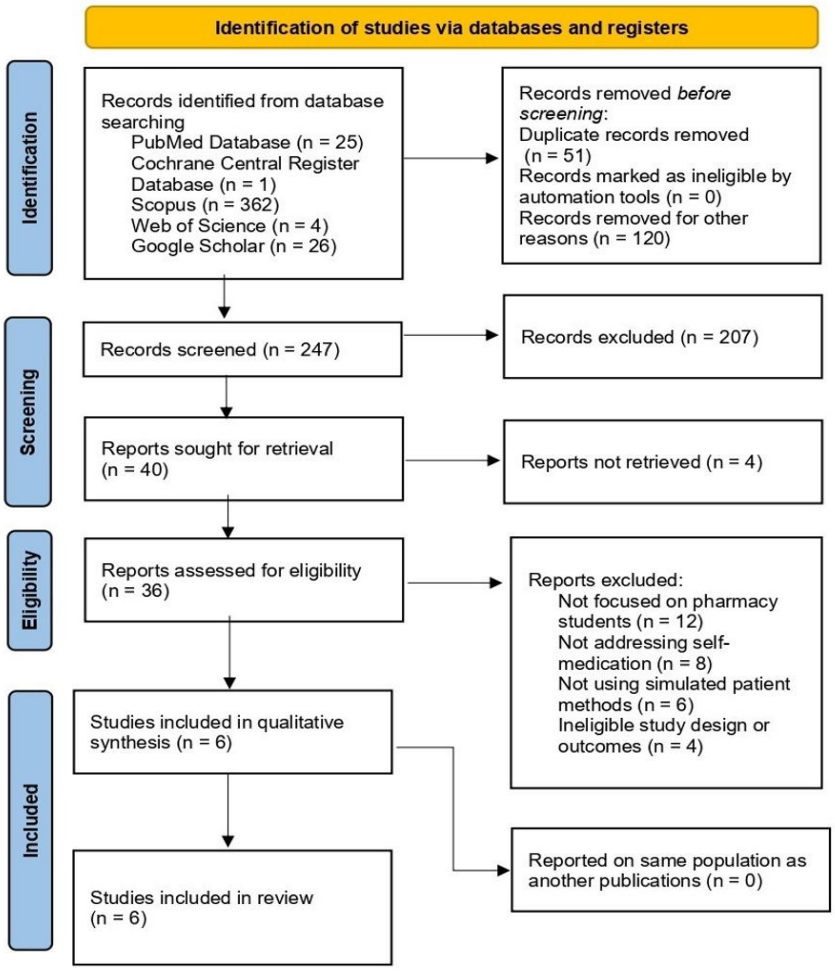


Figure 1. PRISMA 2020 flow diagram illustrating the study selection process

3.2 Characteristics of Included Studies

Six studies (n = 541) from six different countries (USA, Indonesia, Saudi Arabia, India, Iran, Portugal) were selected, which included OSCEs, standardised patients, virtual human platforms, and digital pharmacy simulations (Table 2). Educational levels varied considerably across studies, with some being first-year undergraduate students, while others were final-year B Pharm or

Pharm D students, and the students had variable prior exposure to simulation scenarios dealing with prescription medications, which makes it difficult to compare the results across the studies.

Hastings et al. (2010) achieved a mean OSCE score of 88% in 34 third-year Pharm D students. Brata et al. (2021) reported that only 23.5% of the 183 students were able to give the correct advice in simulated cough scenarios. Better performance in product-based than symptom-based cases. Rude et al. (2023) showed that there were significant improvements in communication, confidence, and referral knowledge after the intervention using a digital pharmacy simulation. Following Self-Medication Consultation Training (SMCT), Ponnusankar et al. (2024) reported an increase in the percentage of optimal advice from 46.7% to 91.1%, and that more intense questioning was associated with safer advice. The only RCT (n = 40) demonstrated that OSCE-based training produced greater gains in counselling skills and self-confidence than SmPC-based instruction, with comparable improvements in communication skills in both groups (Farahani et al., 2021). Cláudio et al. (2016) showed that the Virtual Human Simulation (VHS) helped to boost the confidence of the students in their communication skills, but realism was found to be an aspect that needed improvement.

Table 2. Included Studies Characteristics

S. No	Author and Year	Study Design	Sample size	Population	Control Group	Intervention	Main Outcomes	Duration	Key Findings
1	(Hastings et al., 2010) [24]	Elective course with OSCE (cross-sectional)	34	Third-year PharmD students enrolled in an Advanced Nonprescription Medicines elective course at the University of Arkansas for Medical Sciences College of Pharmacy	None specified	Integration of an Objective Structured Clinical Examination (OSCE)	1. Student OSCE performance with an average score of 88%. 2. Standardized patients' satisfaction and ranking of student performance. 3. Comparison of course grades and evaluations to the previous year. 4. Student satisfaction and perceived learning improvement	One academic semester	1. Incorporating OSCEs improved opportunities. 2. Standardized patients could differentiate between student performance levels, indicating the reliability of the assessment.

2	(Brata et al., 2021) [25]	Cross-sectional	183	Third-year Indonesian pharmacy students	No control	Simulated patient presenting with product-based and symptom-based cough scenarios	1. Only 23.5% of students provided appropriate advice 2. Better performance in product-based than symptom-based cases 3. Students lacked adequate questioning and red-flag recognition 4. Prior coursework and work experience improved scores	14 weeks	1. Overall moderate competency; major gaps in information gathering and decision-making 2. Indicates need for enhanced simulation-based education and experiential training
3	(Rude et al., 2023) [26]	Quasi-experiment	120	Undergraduate pharmacy students from two universities in Saudi Arabia	No control	MyDispense-based OTC simulation, surveys before and after	1. Significant improvement in communication, confidence, and counselling post-intervention 2. Enhanced knowledge and ability to identify referral cases 3. Positive feedback on learning experience	One academic term	1. Simulation-based education effectively improves students' self-medication counselling skills 2. Highlights the benefits of integrating SP-based learning into pharmacy curriculum
4	(Ponnusankar et al.,	Prospective, interventional, cross-section	90	Pharmacy Students (fourth B Pharm, third Pharm D, fourth Pharm D, and first Pharm D[PB]	No control	Self-Medication Consultation Training (SMCT)	1. Percentage of students providing optimal advice before and after SMCT	3 months	1. Pharmacy students showed better skills in giving self-medication advice for cough

	2024) [27]	al study					from 46.7% to 91.1%. 2. Information-gathering behaviours 3. Factors associated with the provision of appropriate advice 4. Improvement in overall competency post-training		after SMCT training. 2. Students who asked more questions gave safer advice 3. The simulation method was effective
5	(Farahani et al., 2021) [28]	Randomized controlled study with pre–post design	40	Pharmacy students	Received training using summaries of product characteristics (SmPCs) for OTC drugs	OSCE-based self-medication counselling training, including feedback, practice cases, and group work	1. Improvement in counselling skills, self-confidence, and self-perceived proficiency 2. Both groups showed improvement in communication skills, but no significant difference between them. 3. High student satisfaction with the OSCE-based seminar	3 months	The students appreciated the OSCE experience and encouraged it to be put in the pharmacy curriculum.
6	(Cláudio et al., 2016) [29]	Mixed-methods	52	Undergraduate Pharmacy Students	No control	Virtual Human Simulation	1. The researchers assessed a pharmacy student's interactive	Unspecified	1. The education of pharmacy is well achieved through virtual humans, which are interactive applications.

							virtual human simulation. 2. Obtained the feedback of students and experts regarding its effectiveness and usability.		2. Realism, scenario variety, and user experience also require improvement in the future.

3.3 Risk of Bias Assessment

The assessment of risk of bias is necessary to assess the quality and reliability of the methodology of included studies. In the case of RCTs, RoB 2 was utilized, which evaluated the possibility of bias due to randomization, variations of planned interventions, loss of data, measures of outcomes, and selective reporting, with judgments as low risk of bias, some concerns, and high risk. In non-randomized or quasi-experimental studies, the ROBINS-I tool has evaluated seven domains, such as confounding, participant selection, intervention classification, adherence, missing data, outcome measurement, and reporting. Each study was evaluated by two reviewers, and disagreements over the evaluations were resolved by discussion or by a third reviewer. Traffic light plots were created using the Robvis tool.

3.3.1. Randomized controlled studies

The traffic-light plot in Figure 2 demonstrates the risk of bias assessment of Farahani et al. (2021) based on the Cochrane ROB 2 tool. The research showed minimal risk of bias in the majority of areas, such as the randomization process (D1), bias, deviations from the intended interventions (D2), missing outcome data (D3), and selection of the reported result (D5). But there were issues noted in outcome measurement (D4), mainly because assessor blinding was not applied in evaluating the OSCEs, which could result in subjective influence.

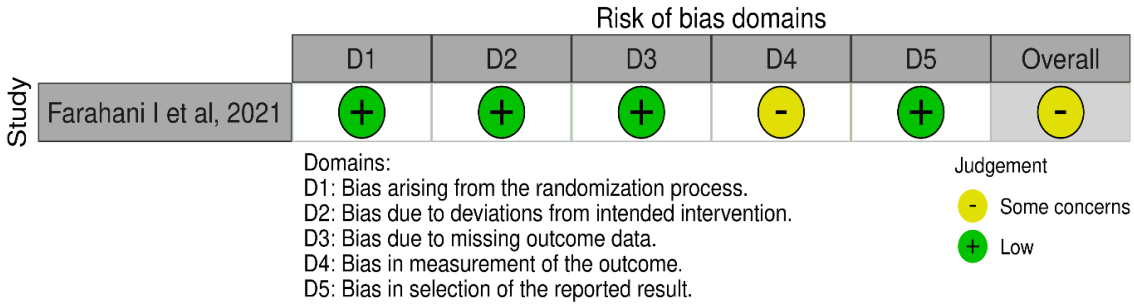


Figure 2. Traffic-light plot to show the domain-specific risk of bias judgments of the randomized controlled trials evaluated with the Cochrane ROB 2 tool.

Figure 3 further supports these findings, showing that 80% of domains were rated low risk and 20% (one domain) raised concerns. No fields were considered high-risk. Overall, the study was discussed as having good methodological quality, with minor limitations due to the subjectivity of outcome measurement, which was rated as a source of some concern for risk of bias.

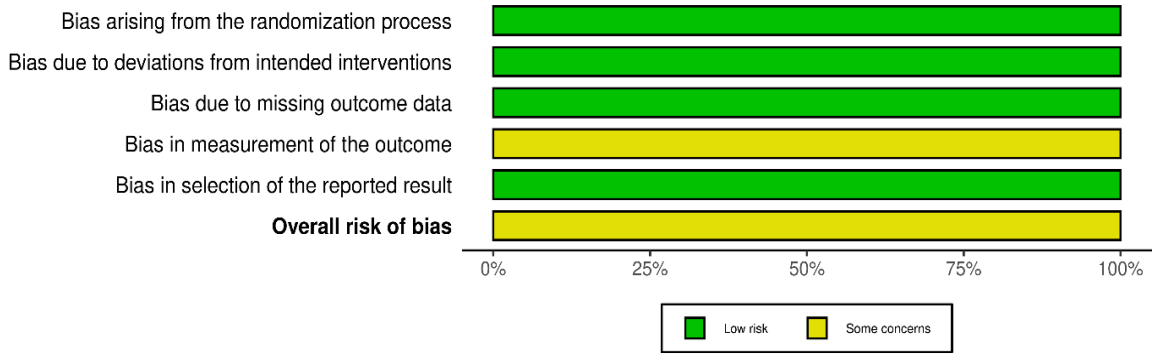


Figure 3. Summary plot providing an overview of the risk-of-bias judgments across all domains in randomized controlled trials.

3.3.2 Non-randomized studies

In Figure 4, the domain-wise ROBINS-I evaluation of the five non-randomized studies (Hastings et al., 2010; Brata et al., 2021; Rude et al., 2023; Ponnusankar et al., 2024; and Cláudio et al., 2016) is presented. The vast majority of domains, participant selection (D2), intervention classification (D3), deviations of intended interventions (D4), lost data (D5), and selection of reported results (D7) were considered low risk (green), which implied coherent and transparent study practices.

The major methodological issue was confounding (D1). The studies by Rude et al. (2023) and Cláudio et al. (2016) showed a serious risk (red) because of confounding by unmeasured factors and the absence of baseline comparability. The other studies by Hastings et al. (2010), Brata et al. (2021), and Ponnusankar et al. (2024) were considered to be of moderate risk (yellow) of confounding. In addition, there were moderate concerns about outcome measurement (D6) because of subjective or unblinded measurements.

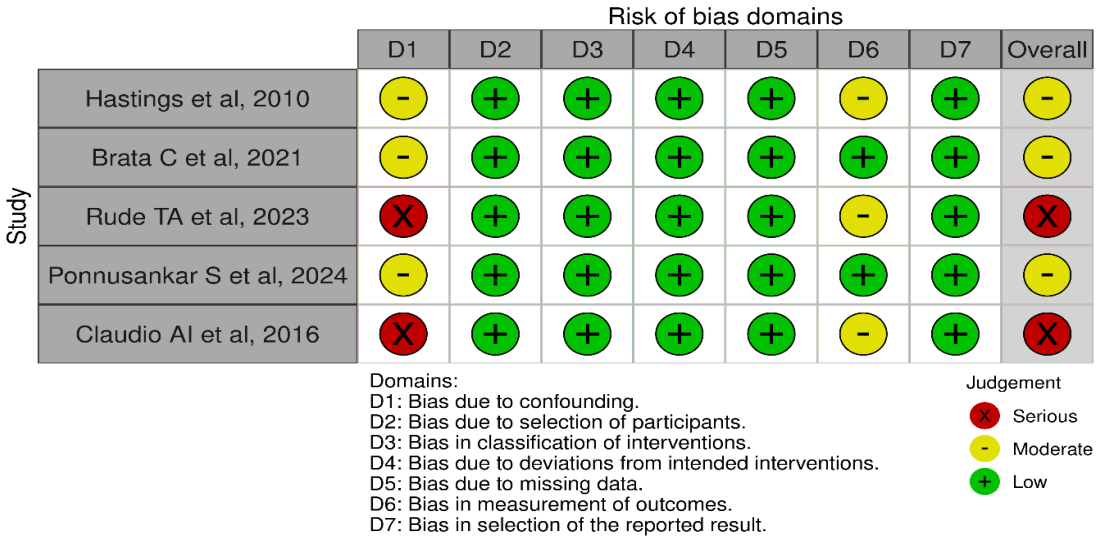


Figure 4. Traffic-light plot to show the domain-specific risk of bias judgments of the non-randomized controlled trials evaluated with the Cochrane ROBINS-I tool.

In Figure 5, the summary plot indicates that approximately 70-75% of the judgments in all domains of ROBINS-I were low risk, indicating high methodological control. Moderate risks were around 20-25%, mostly related to confounding and subjective outcome measures, indicating partial control over external factors. Only a small percentage showed a serious risk, which was mostly explained by two studies that failed to adequately control for confounding.

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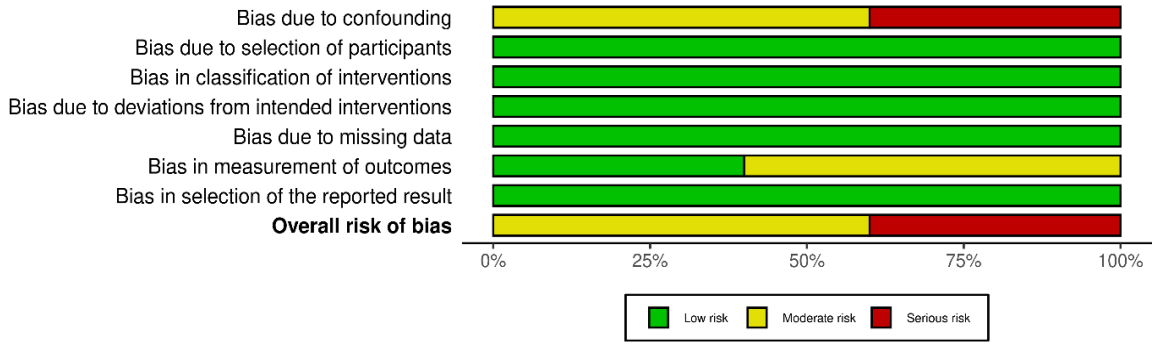


Figure 5. Summary plot providing an overview of the risk-of-bias judgments across all domains in non-randomized controlled trials.

On the whole, the general plot of the summary indicates that the majority of the studies included in the synthesis had acceptable internal validity and only some methodological shortcomings, which allow a moderate level of confidence in the synthesized results.

3.4 Critical appraisal of individual studies

Simulation interventions consistently improved communication skills and confidence, while evidence for improvements in clinical reasoning and patient safety competencies was more variable. The RCT provided high-quality evidence showing that OSCE-based learning provides significantly greater competence and confidence than traditional teaching. Although methodologically weak, other studies supported these findings by showing significant gains in counselling quality and self-efficacy following simulation-based training.

The improvement in performance of all studies registered significant improvements in counselling performance, such as better skills in collecting patients' information, assessing red-flag symptoms, and offering safe and accurate guidance. Clinical empathy, active listening, and structured questioning methods were also developed during simulation. The use of virtual and standardized patient interaction encouraged confidence and reflective learning since there was no risk to real patients, and the environment was safe. Other studies, however, reported variability in knowledge retention, by saying that gains can fade away as time goes on unless reinforced. Moreover, the lack of comparability among studies was caused by heterogeneity of simulation methods and outcome measures.

Overall, critical appraisal demonstrates that simulation-based education can be of considerable pedagogical value, but future research must have more rigorous designs, standardized tests, and follow-ups in the long run to ensure the benefits of learning in the long term.

3.5 Synthesis of Findings

The results of the studies were primarily mapped to the "shows how" (simulated performance) and "knows how" (applied knowledge) levels of Miller's pyramid (Miller, 1990), and there was no evidence of studies at the "does" level (authentic practice performance), indicating a need for longitudinal follow-up, which was not addressed in any of the studies. Evidence was strongest at Level 1 (satisfaction) and Level 2 (knowledge/skill acquisition) of Kirkpatrick's framework (Kirkpatrick and Kirkpatrick, 2006) and less at Level 3 (behaviour change) and none at Level 4 (patient outcomes). Using the Dreyfus model (Dreyfus and Dreyfus, 1980), most students moved from novice to competent using simulation, and to proficient or expert levels, they needed sustained and authentic clinical experiences in addition to simulation. Therefore, none of the modalities was thought to ensure mastery of patient safety competencies; the role of simulation is to help move towards competence, not mastery.

There were some differences in modality. Virtual human and digital pharmacy platforms had the most impact on early communication skill development, particularly for first-year students, which was similar to the results of virtual patient meta-analyses (Kononowicz et al., 2019; Kyaw et al., 2019; McGaghie et al., 2010) but was restricted in its ability to measure subtle clinical reasoning. Standardised patient encounters and OSCEs (Brata et al., 2021; Farahani et al., 2021; Hastings et al., 2010) were more difficult to use to measure clinical performance and competence in triage (Harden et al., 1975), and were not blinded,

but were subject to assessor subjectivity. The pedagogical features, strengths, and challenges of each modality are summarized in Table 3.

The findings corroborate a model of the curriculum in which early years are used for establishing communication frameworks and confidence, and later years for assessment through OSCEs for clinical reasoning and patient safety competency development, as recommended by FIP (2020), ACPE (2015), and CBE frameworks (Medina et al., 2013). Guided reflection, standardised rubrics, and structured feedback are encouraged as supporting elements in all modalities.

Table 3. Comparison of Patient Simulation Modalities in Self-Medication Education

Modality	Strengths	Limitations	Optimal Curricular Use
Standardised Patient	Authentic interaction, behavioural assessment, structured feedback	Resource-intensive, SP variability, limited scalability	Mid-to-advanced year communication and counselling competency assessment
Objective Structured Clinical Examinations	Objective and standardised; assesses clinical reasoning and patient safety, comparable across cohorts	Logistically demanding; requires trained assessors	Advanced-year clinical reasoning, triage, and comprehensive competency assessment
Virtual Human Simulation	Scalable, consistent scenarios, low risk, accessible for self-directed practice	Lower interpersonal fidelity; limited sensitivity to nuanced clinical reasoning	Early-year introductory training and communication skill development
Digital Pharmacy Simulation (e.g., MyDispense)	Accessible, repeatable, immediate automated feedback, low resource requirements	Limited replication of interpersonal dynamics, constrained empathy assessment	OTC product knowledge, decision-making, and referral criteria practice

3.6 Discussion

This systematic review pooled six articles that tested simulation-based learning to enhance the competence of pharmacy students in self-medication request management. Simulation was associated with improvements in communication skills, confidence, and consultation performance across diverse educational settings in counselling with patients who require non-prescription medicines. The study by Farahani et al. (2021) was the only randomized controlled trial, demonstrating that OSCE-based training produced significantly greater gains in counselling skills, self-confidence, and self-perceived proficiency than product characteristics-based instruction, with both groups showing comparable improvements in communication skills. Non-randomized studies had methodological disadvantages, but they demonstrated moderate-level evidence of improvement. Overall, simulation serves as a successful means of bridging the gap between theoretical training and counselling competence in practice.

3.6.1. Comparison with Previous Literature

The current results are consistent with the existing evidence supporting the educational value of simulation-based learning in the health professions. Simulation reviews by Cook et al. (2011) and Kononowicz et al. (2019) confirmed that simulation improves clinical competence, communication, and confidence across disciplines, which are reflected in pharmacy education (Seybert, 2011). The observed improvements in counselling and decision-making are in line with Kolb's experiential learning theory, which emphasizes active engagement, reflection, and application as important elements in skill acquisition (Kolb, 1984). But as with previous meta-analyses (Cook et al., 2011; Lebo and Brown, 2024), the studies included in this systematic review did not often evaluate long-term retention or the transfer of behavioural training to clinical practice, which is a frequent limitation in simulation studies.

The results indicate that communication and structured consultation behaviours are more likely to be affected by simulation-based learning than higher-order clinical judgement. But available research does not prove that communication enhancements lead to correct triage or referral decisions. Students need to combine the information gathered during the history-taking process

with an understanding of contraindications, nature of symptoms, symptom severity, symptom duration, patient individual risk factors, and limits of self-care to identify red flags. These decisions might also need more than further communication practice.

Variations in clinical judgement and referral outcomes may also be related to differences in scenario complexity, assessment criteria, educational level, and amount of feedback. In addition, assessment tools that measure questioning or counselling behaviours may not adequately capture the appropriateness of the final recommendation or referral decision. The interpretations of these possible explanations should be viewed as tentative due to the fact that most of the studies in this review were conducted in different samples and measured different constructs.

Referrals should be reported independently from communications in future research. They should rely on clear criteria to differentiate between appropriate self-care guidelines, recommendations for further assessment, and referrals for urgent and/or non-urgent medical review. This would be useful to establish if simulation-based education enhances the safety and appropriateness of decisions, rather than communication performance.

3.6.2. Strengths and Limitations

One of the strengths of this review is that it follows PRISMA 2020 guidelines and prospective registration in PROSPERO, thereby maintaining transparency in the methods. Reliability was improved with dual independent screening and bias evaluation with ROB-2 and ROBINS-I. The search of several databases and the involvement of independent reviewers minimized selection bias and enhanced the trustworthiness of the review. Nevertheless, the number of available studies is small, which restricts the external validity of the findings.

Generalizability of the findings is limited due to the limited number of studies included. The studies included in this report are from six countries, so it is important to note that geographical diversity does not mean that the results of these studies are applicable to other educational systems, regulatory environments, curricula, or health care settings. Baseline scores and achievement of simulation-based learning can be affected by variation in student educational levels, clinical experience, simulation materials, and expectations regarding the role of the pharmacist. Furthermore, the small evidence base limits the extent to which the relative effects of different simulation modalities or educational approaches can be examined. The results should thus be considered to be evidence from a growing and evolving literature rather than as firm estimates that can be applied to all pharmacy students or pedagogical environments. Studies with larger, multi-centre samples using comparable outcomes would be helpful to explore transferability across contexts.

While simulation has been widely studied in pharmacy education, relatively few investigations have specifically evaluated competency development in self-medication consultations. The majority of the studies used non-randomized designs and subjective assessment procedures, which makes the risk of bias moderate to high. A significant diversity in simulation format, outcome measures, and schemes did not allow direct comparison and meta-analysis. Moreover, little evidence is available on long-term retention of the skills and how experience with simulations can be transferred to actual clinical practice. Overall confidence in the evidence is moderate because most studies were non-randomized, employed relatively small sample sizes, and relied on subjective outcome measures. There could also be publication bias, where studies that report good results are likely to be published (Cook et al., 2011; McGaghie et al., 2010).

3.6.3. Literature Implications for Education, Practice, and Research

The introduction of structured simulation into pharmacy education programs meets international competency-based education models, including the ACPE (2015) and the Global Competency Framework of the FIP (2020). Simulation offers realistic chances to students to engage in communication, empathy, and patient-safety skills that are needed in safe self-medication counselling. The integration of structured feedback and reflection elements into the simulation sessions can support the depth of the learning process and facilitate the development of the profession. Practically, trained graduates using simulations are better placed to provide efficient patient-centred consultations that may minimize medication errors and enhance self-care outcomes. To guarantee higher consistency and objectivity in the assessment of performance, the implementation of standardized rubrics for evaluation, like global rating scales (Harden et al., 1975), is essential.

The results indicate that simulation could be viewed as a longitudinal aspect of the Pharmacy Education curriculum and not as a standalone learning experience. This can be approached incrementally; the complexity of scenarios and assessment expectations can be ramped up as students gain foundational knowledge and consultation skills.

At an introductory level, virtual or digital simulations may be used to introduce students to a structured history, information collection, and initial communication. Facilitated practice with standardised patients can then provide opportunities to integrate these skills in more interactive consultations. In more advanced stages, more complex cases may be integrated into OSCEs or other structured performance assessments and include contraindications, special populations, red-flag symptoms, and referrals.

Incorporating explicit learning outcomes, assessment criteria for each scenario, trained facilitators and assessors, structured feedback, and opportunities to reflect and repeat the practice should be part of curricular implementation. Formative simulations/training exercises that assist learning should be separated from summative assessments used for making competency decisions. In situations where resources are scarce, digital interactions can be used to reinforce preparatory practice, and selected standardised patients could be used to develop skills that demand direct observation of interpersonal interaction and clinical judgment.

These recommendations are a suggested curricular application of the evidence reviewed. The limited number and heterogeneity of included studies mean that the optimal sequence, frequency, duration, and resource requirements of simulation activities have not yet been established.

4. CONCLUSION

This systematic review shows that Simulation-based education appears effective in improving self-medication counselling competency in pharmacy students, as reflected by the consistent improvements in communication skills and structured consultation. The gains in higher-order skills, red flag recognition, and contraindication recognition/referral decision-making were more modality-specific and less consistent. No simulation modality guarantees mastery of patient-safety competencies; however, simulation can facilitate progression toward competency. A staged model in the curricular framework is recommended, as per FIP (2020), ACPE (2015), and CBE frameworks, namely with virtual or digital simulations and then a structured OSCE-based assessment. Further research is required in the form of multicentre RCTs, standardization of competency frameworks, validation, long-term studies of authentic practice transfer, and assessment of new technologies of virtual patients and immersive simulation with Artificial Intelligence (Kyaw et al., 2019).

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AUTHOR CONTRIBUTIONS

Bhavya L K: Conceptualization, protocol design, search strategy development, conducting the database searches, screening the studies, data extraction, performing the risk of bias assessment, and carrying out the data synthesis and manuscript drafting.

Savitha R S: Screening, data extraction, and verification of the synthesized findings, and contributed to the critical review and editing of the manuscript. All authors read and approved the final manuscript.

Ponnusankar S: Supervision, methodological guidance, and contributed to the refinement of the review protocol, interpretation of findings, and critical revision of the manuscript.

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