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SIMULATIONS USED IN PHARMACEUTICAL EDUCATION

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ABSTRACT

The use of simulation and related technology in healthcare education will continue to increase in the coming years and there is a collective role for this technique within pharmacy curricula. It is anticipated that increasing the amount of simulation in pharmacy curricula will have a positive impact on education and training of pharmacy students, and ultimately produce positive benefits for patients and the healthcare team. Simulation-based education (SBE) is a fundamental teaching method that complements traditional teaching modalities. SBE has improved students' knowledge, understanding, and numerous essential skills within undergraduate pharmacy education, similar to traditional teaching methods. However, SBE has become crucial for developing students' teamwork, decision-making, and communication skills. Even though the Accreditation Council for Pharmacy Education (ACPE) has acknowledged the benefit of SBE in interprofessional education (IPE) and the introductory pharmacy practice experience (IPPE). The apparent objective of introducing simulation techniques into the training program for pharmacy students is to advance the education and training of pharmacists with the ultimate objective of improving patient care and safety. Simulation experiences could never substitute experiences in real clinical settings, but has a great potential to complement clinical education as well as to use as a provision to develop skills required for a competent pharmacist. In addition to the development of technical skills such as procedural and clinical skills, simulation techniques have been used in pharmacy education in addressing general cognitive and social skills, notably in communication, decision-making, ethical issues, prioritization and teamwork. Pharmacy programs which aim to provide an opportunity for theoretical knowledge to be applied to a real clinical setting, simulated learning environments could enable a more systematic approach to both the training of clinical skills. Simulation provides a consistent, predictable experience to basic sciences, dispensing and medication supply. Ideally, it was recognized that simulation training should be integrated across all levels of pharmacy education and training

KEYWORDS: Patient simulation, pharmacy, education, simulation-based education.

INTRODUCTION

Pharmacy education continues to evolve, thus demanding innovative active learning to enhance pharmacotherapeutic knowledge and clinical skills. Simulation-based pharmacy education enhances students' fundamental knowledge, improves learner confidence, enhances clinical performance, stimulates critical thinking, and decreases medication administration errors. Given educators 'increasing and innovative use of simulation throughout pharmacy and interprofessional curricula, a supplement issue that reviews the status of simulation in pharmacy education and relevant issues surrounding it seemed merited. As technology continues to advance, methods of knowledge delivery will need to adjust rapidly. The Pharmacy Simulation will explore the role of simulation education in the development of clinical skills, enhancement of critical thinking skills, and performance of critical assessment in pharmacy students; review opportunities to improve patient safety; and discuss simulation's use in introductory pharmacy practice experiences (IPPEs). With the integration of simulation methods into pharmacy education, the Accreditation Council on Pharmacy Education (ACPE) has approved the use of simulation in IPPEs for up to 20% or 60 hours of the total 300 hour experiential education requirement.[1] Use of high-fidelity human patient simulation is an example of an acceptable method of simulating patient care activities. A critical element in the use of simulation as a component of IPPEs is that the educational encounter connects the pharmacy or patient care activity to a high-fidelity human patient simulator. Both medical and nursing educators also recognize the completion of simulated patient care exercises as acceptable experience within their professional curriculums and have provided guidance in the effective use of simulation in education.[2-4] Several pharmacy programs use high-

fidelity human patient simulation at various points in their curricula while others have integrated it successfully throughout the curriculum. High-fidelity human patient simulation in this supplement refers to the use of simulators with programmable physiologic responses to disease states, interventions, and medications. These simulators can speak, breathe, have realistic heart, lung, and bowel sounds, display hemodynamic parameters in real time, seize, sweat, display cyanosis, and other physiologic responses at various levels depending on the model used.[3] The role of patient care pharmacists is primarily focused on optimising therapeutic outcomes, particularly from pharmacotherapy perspective. Pharmacists are professionally obliged to secure safe, effective and responsible use of medicines by patients, prescribers and populations.[5] The essential role of pharmacy education is to produce competent, ethical, empathic and work-ready graduates. Thus, educators and policy makers must view pharmacy education from the standpoint of fitness for purpose for current as well as evolving, anticipated or aspirational roles and responsibilities.[5]

The goals of clinical education and training can be achieved in real patient care settings, via simulation or a combination of the two. As authentic and rich learning environments, patient care settings provide situated learning, but less control is possible over content than that in a classroom: opportunistic learning can be a limitation, particularly for novices. Other key characteristics of patient care settings that may negatively impact learning are their 'messy' nature, competing demands on clinician-teachers and risks associated with entrusting professional activity to students. Simulation has been defined as '(an) event or situation made to resemble clinical practice as closely as possible'.[6] Simulation-based instruction (SBI) is used in pharmacy education.[7-9] For example, pharmacy education in the United States has employed simulation-based learning for more than a decade.[9,10] This has included the use of standardised patients, role-play and skills assessment. Simulation is attractive for its potential for applying a control over learning environment, content complexity, teacher time, costs and risk. Simulations offer progressive, scaffolded learning in safe, convenient, comfortable, yet convincing learning environments.[11] Depending on the simulation, there is a low or controlled risk to patients, while enabling the improvement of skills that will help protect patients.[12]

Definition and types of simulation

"Simulation" is a technique, not a technology, to substitute or strengthen real experiences with guided experiences that evoke or replicate substantial characteristics of the real world in a fully interactive fashion. Gaba, stresses that simulation should be interpreted as a strategy– not a technology–to the mirror, anticipate, or amplify real situations with guided experiences in a fully interactive way.[13] Ross J. Scalese et al. clarify aims of "medical simulations" as an imitation of real patients, anatomic regions, or clinical tasks, and/or mirroring the real-life circumstances in which medical services are rendered. While "simulators", refers to particular simulation devices, which can take many forms and span the range from low to high fidelity, and from devices for individual users to simulations for groups of trainees.[14] Simulation in health care education varies in the level of technology used and in which skills features are highlighted. Standardized patients are one of the most regularly used methods of simulation by all health disciplines including pharmacy. Simulation-based training is a technique or strategy of training that comprises the use of several scientific, theory-based approaches to training, and includes information, demonstration, and practicebased methods.[15] Simulation learning serves as a bridge between classroom learning and real-life clinical experience. Simulation-based training can provide opportunities for students to develop prerequisite competencies through practice in a simulated environment that is representative of the real setting. Students receive constructive feedback related to specific events that occur during simulated training that can support them to develop reflective responses for further development in their understanding and skills. Hence, students are free to build on their current knowledge base and develop important clinical skills before they work with real patients. The healthcare community can gain significantly from using simulation-based training to reduce errors and improve patient safety when it is designed and delivered appropriately.[15] Evidence from different studies indicates that simulation is noninferior to other educational methodologies.[16] Technologyenhanced simulation is associated with a small but statistically significant benefit for outcomes of knowledge and skills. Both virtual patients and technology-enhanced simulation in comparison with no intervention are consistently associated with statistically significant benefits in the areas of knowledge, skills, and behaviors (in the context of actual patient care).[17] For direct patient effects (e. g., major complications, mortality, or length of stay), the benefits are smaller but still significant.[18] As per the findings from various studies, technology-enhanced simulation confirmed theory-based predictions that feedback, repetition, the range of difficulty, cognitive interactivity, clinical variation, distributed practice, individualized training, and longer training time significantly improve skill outcomes.[17]

Types of simulation technology used in health care education

1. High-fidelity patient simulator or mannequin: able to mimic human actions and physiology and respond to physiologic and pharmacologic interventions.
2. Task trainer: designed to help learners practice, specific skills and do not have the extensive programming capabilities of highfidelity models. It can be considered as low-fidelity simulators or

moderate-fidelity simulators depending on the sophistication of the model.
3. Standardized patients: live people who are coached to portray patients, usually referred as simulated patients.
4. Virtual reality simulators: in which a computer display simulates the physical world and user interactions are with the computer within that simulated (virtual) world.
5. Full environment simulations: it involves the incorporation of high-fidelity mannequins, standardized patients, healthcare professionals, and ancillary equipment to recreate a real-life clinical environment.[19,20]

Simulation tools could potentially be used to deliver education and training within pharmacy school curricula

Clinical skills development - Demonstration of knowledge that incorporates an understanding of important drug principles, Use of evidence to support recommendations , demonstrate good communication skills, able to assess patients' response & monitor the outcomes of drug treatment. High and low tech high-fidelity simulators, virtual soft-wares, virtual reality models, simulated patients, case-based scenarios and role-play, electronic medical record, video and teleconferencing facilities. Professionalism and ethics - Comply with legal requirements, demonstrate personal and professional integrity, behave in a professional and ethical manner, maintain professional practice and Case-based scenarios using role-plays. Interpersonal relationships - Apply communication skills, participate in negotiations, address problems, manage conflict, apply assertiveness skills Role plays through simulated patients, use of interactive mannequins and virtual reality programs, case-based scenarios, written and telecommunication, video and teleconferencing. Dispensing skills - Use of communications and interpersonal skills, systematic approach to screening prescriptions, ensure safe and effective drug use, provide appropriate information and advice, supply prescribed medicines and Mock pharmacy-computers, label printers, medicines and medicinal devices, barcode scanners, dispensing software. Using counseling tools such as fact cards, cmi leaflets, and placebo medication devices. Electronic prescription, simulated patient/prescriber, tele-conversation, role play. Optimal use of Medicines - Participate in therapeutic decision making, provide ongoing pharmaceutical management, promote rational drug use Simulated patients, virtual reality models, and interactive mannequins. Drug information Able to retrieve information, evaluate and synthesis information and disseminate information in a manner that supports decision-making. Us communication skills to respond to medicines information query Simulated cases, role play, tele-conversation.[19 – 44]

Simulation in pharmacy practices education

Simulation in pharmacy education improves students' essential knowledge, develops learner confidence, enhances clinical performance, stimulates critical thinking, and decreases medication errors.[15] Many pharmacy colleges and schools have integrated simulation as part of their curricula. We have listed some of the renowned simulation tools may applicable to some of the functional areas in pharmacy practice curricula. The list has been generated on the basis of available evidence as well as from our perception, considering the experience in conducting a simulation in pharmacy practice education.[19 - 44] When it comes to pharmacy practice training, standardized patients including case-based scenarios, role playing, considered the most common methods of simulation ubiquitously.[29] The use of high and low tech high-fidelity simulators in pharmacy curricula was restricted to some specific areas, but virtual reality simulators can contribute in many ways in the different functional areas. Computerbased programs and simulations were involved such as "Second Life" and a program using a 'talking head' which were used to assist with the delivery of some material in pharmacy practice and communications.[4,27] Simulations have an important role in the competency assessment, which will incorporate assessment of clinical skills and competencies necessary for advancement in the pharmacy education.[31,32] According to the report concerning to the use of SLPs within the pharmacy schools located in Australia.[4] and considering other best available simulated approaches in different schools, established that SLPs could be used to assist with the delivery of many elements in the core pharmacy curricula. Students can review prescriptions to assess it for safety and appropriateness. Telecommunication with simulated prescriber for clarification and discussion if there are concerns with prescriptions. Students are expected to pack, label and prepare the medication for dispensing if the prescription is deemed to be safe and appropriate. Debriefing is provided at the end of the exercise. Students can analyse computer aided simulated prescription to identify and describe omissions and commission errors as well other clinical issues. Provide an opportunity to respond in a systematic way to the problems. Feedback is provided at the end of the exercise.

How to implement?

Simulation in pharmacy practice can be implemented in the Bachelor of Pharmacy practice courses in India which is an emerging field. The aim of this program was to produce competent pharmacy graduates who are experts, professionals and leaders who are agents of change with the ability to communicate well, solve problems, work cooperatively, as well as being endowed with positive attitude and an ability to reflect and recognise their responsibility as servants of society who endeavour to contribute to the well-being of all in their community. This four-year, eight-semester undergraduate pharmacy programme is an integrated

program consisting of lecture, practical, tutorial, workshop, computer aided learning, problem-based learning, experiential learning through clinical placements and simulated learning environments. The use simulation in this course is a form of experiential learning. The main focus of simulation training is to allow students to practice application of pharmacy knowledge and skills in a safe, consistent and simulated environment. The sessions are expected to develop communication skills, problem-solving skills, critical thinking and enhance professional development; as well as technical skills such as dispensing skills. The development of extemporaneous/compounding and dispensing techniques using simulation in pharmacy education is not an uncommon. In India, the training can be extended to include interaction with prescriber with the mimic real setting. Table 4 provides an example of simulation in dispensing practical. Pharmacy Skills Development (PSD) sessions can be the main component of simulation training sessions within the course. The course can introduce PSD sessions at Year 1 or Semester 2.

Simulation Implemented in pharmaceutical curriculum

Standardized Patients (SPs)

SPs refer to well-trained specialists who portray the case of a real-life patient in a consistent and replicable performance to different students and provide responses that vary based on the students' performance. The SP portrayal should involve all aspects of the presented patient case, including but not limited to medical history, signs and symptoms, physical findings, emotional and personal characteristics, and body language. SPs may also assess students and provide feedback on their performance.[45] Utilizing SPs in pharmacy education has been widely reported in the literature as an effective complementary teaching modality to advance clinical pharmacy education. Many learning outcomes can be achieved using this modality, ranging from advancing patient interviewing and history-taking skills to the optimal implementation and monitoring of a pharmacotherapy plan. The SP modality can be utilized in various courses throughout the pharmacy curriculum and at various student levels, especially when the learning objectives are aimed to boost students' confidence and develop the students' professional skills, such as patient interviews and communication skills, clinical knowledge, and practice, cultural and emotional competence, and team-based skills. Courses that focus on pharmacotherapy, immunization, medication therapy management, and psychiatry are some examples where SP could be utilized. In addition, the standardization in the SP modality makes it an excellent modality to use in high-stake assessments where the responses to students are standardized among all participating students.[46]

Role-Play (RP)

Role-play (RP) is a well-known learning practice in which students perform various roles in a simulation of real-life situations. During role-play, a peer student (co-learner) may impersonate a patient, caregiver, or health care provider within a clinical scenario. If the role is played with an individual who is trained to act as a patient or a family member, this can fall under an SP, as discussed earlier in this review. This allows students to practice realistic experiences while remaining in a controlled environment.[47] Many pharmacy programs have reported successfully using RP to teach a wide range of skills in several core or elective courses and laboratories. Moreover, it can be used in all levels of the pharmacy curriculum, including APPE. Despite the variations in the application method, several researchers have reported positive outcomes regarding students' communication skills, motivational interviewing skills medication reconciliation, patient presentation skills, patient and self-care, and patient counseling. Furthermore, students have reported increased confidence, knowledge, and engagement. All of these outcomes have been assessed using various methods, such as rubrics, checklists, immediate feedback, and exams.[48]

Manikin-Based Simulation (MBS)

Manikins are classified according to their levels of physiologic function; the simulation replicates real life with low-fidelity, medium-fidelity, and high-fidelity mannequins. Low fidelity refers to part-task trainers, static mannequins, or dolls.Medium fidelity utilizes manikins or task trainers with limited physiological functions.In contrast, high-fidelity mannequin simulators present a full-body mannequin that physiologically reacts like a "real" patient and has a voice based on computer programs. Manikin-based simulations (MBSs) combined with other simulation types, such as SPs or RP, have been widely implemented in the pharmacy curriculum, especially in experiential training.[49] Several pharmacy schools have utilized and assessed MBSs in pharmacy curriculum in core and elective pharmacotherapy courses, pharmacotherapy practice laboratories,and certification programs, in addition to mannequin-based simulator integration in IPPE and APPE. Overall, MBSs have more frequently been used for advanced level pharmacy students. This is expected, as pharmacotherapy courses and parallel laboratories are usually delivered at high pharmacy student levels. Moreover, many elective and certificate programs were built on preexisting knowledge from fundamental courses offered early in the pharmacy curriculum.[50]

Hybrid Simulation

This describes the use of two or more simulation modalities in the same scenario to enhance the reality of the experience. Primarily, this involves the use of MBS with supporting techniques to mimic real-life scenarios. These supporting methods include RP (involving another member of the health team or a caregiver), SPs, or CBS. Even though each of the mentioned simulation modalities has its advantages and disadvantages, the choice of the best SBE fit within the course depends on

the desired learning outcomes. Numerous previous experiences in pharmacy education have involved the use of MBS with RP or SP. Using hybrid SBE methods may be the best way to achieve the intended student learning outcomes. Hybrid simulation has proven to help students improve their knowledge, understanding, communication, and psychomotor skills. However, its implementation may require extra resources, time, and workforce members. Previous reports have indicated the use of hybrid simulation in advanced pharmacy levels, including APPE. Various assessment methods have been used to evaluate student achievement, including summative and formative assessments, depending on the simulation modalities used and the intended learning outcome of the scenario.[50]

Future Recommendations About Patients- Simulation Implementation in the Pharmacy Curriculum

- Further studies are needed to assess the use of MBS within the pharmacy curriculum in non-acute care settings.
- Cost-effectiveness studies about patient simulation implementation within the pharmacy curriculum are needed given the high cost of some simulation methods.
- The integration of RP, SP, SG, and CBS should be explored for advanced pharmacotherapy courses, disease management, and care implementation within pharmacy school curricula.

CONCLUSION

Despite the lack of best evidence support simulation in pharmacy education, simulation techniques are being used in many colleges and schools of pharmacy as a complementary tool for teaching and learning activities. Even though simulated patients are being used as the leading simulation techniques in different schools, other technology-oriented approaches could be considered after identifying appropriate areas to integrate into pharmacy curriculum. With the limited placements opportunity, there is a need to enhance these learning opportunities to accommodate the requirements of the profession to produce a graduate with the core skills of a pharmacist.

Similar to traditional teaching methods, SBE has improved students' knowledge, understanding, and numerous essential skills within undergraduate pharmacy education. This review highlights various modalities of simulation and their incorporation into pharmacy curricula. It can help pharmacy educators identify the best type and placement of integrating patient simulation within the pharmacy curriculum to achieve the intended student learning outcomes. The SBE method is crucial for developing skills (eg, teamwork, decision making, and communication) that are difficult to achieve by conventional methods. Even though the ACPE acknowledged SBE benefits in IPE and IPPE, this article provides evidence that they are effective within all pharmacy curricula. Combining multiple simulation techniques may be the best way to achieve the desired student learning outcomes. Some gaps in the literature involving the use of SBE in pharmacy education have been identified and need to be further investigated in future studies.

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