

REVIEWS

Virtual Patients in Pharmacy Education

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A review of the literature relating to the use of virtual patients in teaching pharmaceutical care to pharmacy students was conducted. Only 7 articles met the inclusion criteria for the review and 4 of the studies were conducted in North America. Few articles identified by the review used virtual patient technology that was true-to-life and/or validated.

Keywords: virtual patient, pharmaceutical care, systematic review

INTRODUCTION

Pharmacists' ability to communicate effectively with patients is paramount in the prevention and management of drug-therapy problems.¹⁻³ The effective delivery of pharmaceutical care interventions requires not only sound clinical knowledge of medication, but also good communication skills to interact with patients and review their medication needs and use. Over a decade ago, the World Health Organization identified the ability to communicate effectively as a skill pharmacists must possess in support of their role,⁴ prompting pharmacy colleges and schools around the world to introduce communication skills as an integral part of the pharmacy curriculum. In contrast, most colleges and schools of Pharmacy in Brazil are yet to implement communication skills in their curricula, despite that the National Guidelines for Undergraduate Education in Pharmacy have included formal training in communication skills as an integral part of the pharmacy curriculum.⁵

In developed countries, recognition of the value of pharmacy in the prevention and management of drug-therapy problems has led to demonstrable efforts made by pharmacy colleges and schools to teach effective communication skills to students. Curriculum changes have incorporated training in communication skills, including the introduction of theoretical-practical disciplines, as well as the establishment of practice laboratories.⁶⁻⁹ Additionally, different methods of teaching communication skills to pharmacy students have been developed, includ-

ing face-to-face, telephone, and e-mail interviews; analysis of audio and video tapes; and simulated patient methods in which actors played the role of patients or actual patients who were coached to present specific scenarios to pharmacists in order to teach and evaluate their patient assessment and interview skills.¹⁰⁻¹⁴

Over the last decade, use of virtual patient technology—from computer-based virtual reality programs to full-size lifelike simulators—emerged as a new method of training health care providers in clinical and communication skills. In pharmacy education, the virtual patient is a simulated patient, typically generated by a computer software program, and used to simulate realistic clinical scenarios.¹⁵ Teaching methods using virtual patient technology in health care education allow students to adopt the role of a health care provider in a safe environment where they can develop clinical and communication skills, such as patient assessment, interview skills, and information provision, without compromising the welfare of an actual patient. This can be achieved through the use of a range of virtual clinical scenarios applied to individual case-based assignments.¹⁶ Typically, students interact with a virtual patient, and during the process of assessment, propose some health care intervention, which is then recorded to complete the case. As computer-generated virtual patients are available on demand, students are able to practice their clinical and communication skills at any time.

An advantage of using virtual patients in the teaching of medication counseling compared to traditional teaching methods is the ability of the virtual patient to emulate the psychological state of the different types of patients that pharmacists encounter in the practice of pharmacy (eg, angry, anxious, ambivalent, passive, assertive, and persuasive).⁷ This not only allows future pharmacists to

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build realistic expectations of pharmacy practice, but also enhances trainees' confidence in their medication-counseling skills, increasing their sense of self-efficacy in dealing with all types of patients.¹⁷

Virtual patient technology also can be used to assess student skills. Hubal and colleagues¹⁴ argue that the use of case studies involving any of the 3 types of patients (real, simulated, virtual) is the optimal way of assessing critical-thinking skills in students, compared to paper-based case studies. At least 94 medical schools in the United States and Canada use virtual simulated patients in their teaching programs, and 26 medical schools in the United States cooperate in resource sharing, standard setting, and other issues relevant to implementing effective simulated-patient programs.¹⁴ In addition, several interactive virtual patients software programs have been developed during the last 10 to 15 years.¹⁶ In pharmacy, the first study in which virtual patient technology was reported was published in the early 1990s.¹⁷ There are only a paucity of published studies in the area.

The standardized nature of virtual patient simulations also increases the validity of assessments, as each scenario is relatively consistent.¹⁵ The use of virtual patient technology allows students to develop their competencies (knowledge, skills, and attitudes) in providing care to patients.¹⁸ Therefore, it is important to use techniques such as virtual patient technology in teaching pharmacotherapy and pharmacist-patient communication skills, as virtual patients allow students to experience true-to-life situations and the knowledge and skills developed through these experiences have the long-term potential to optimize patient care. The aim of the current paper is to review the literature on the use of virtual patient technology in the teaching of pharmaceutical care to pharmacy students.

LITERATURE SEARCH

A search was conducted of the following electronic databases: EBSCO, Embase, Latin American and Caribbean Center on Health Sciences Information (LILACS), Pubmed/Medline, Scientific Electronic Library Online (SciELO), and Scopus. The following combinations of search terms were used: virtual patient and pharmacist, virtual patient and pharmacy, and virtual patient and medication.

To study the literature on the use of virtual patients in pharmacy, we retrieved articles from all 6 databases that met the following criteria: original articles and reviews from experts, published from January 1960 to December 2009 in the English language, where virtual patients were used in the teaching of competencies (skills, knowledge, and attitudes) related to pharmacist-patient interactions. We excluded studies in which the use of virtual patients occurred outside the discipline of pharmacy.

Abstracts resulting from the initial online search were manually screened for relevance and eligibility for full-text retrieval. Articles indexed in 2 or more databases were considered only once.

The following categories of data were extracted from selected articles: (1) setting where virtual patients were used; (2) scenario of the virtual consultation (out-patient, community pharmacy, hospital pharmacy); (3) number of students who used the virtual patient tool; (4) year of the students' degree; (5) student satisfaction with the virtual patient tool; (6) competencies assessed; (7) role of instructors; (8) program development; and (9) limitations.

FINDINGS

The literature search generated 72 articles using the terms virtual patient and pharmacy, 10 articles with the terms virtual patient and pharmacist, and 157 articles with the terms virtual patient and medication. Of these studies, only 7 met the inclusion criteria, and these 7 formed the study sample.

Table 1 shows the distribution of articles by database. All 7 articles selected were indexed in the Scopus database; 5 of them were indexed concurrently in Embase, 4 in LILACS, 3 in Medline, and 2 in the EBSCO database. None of the 7 was found in the SciELO database. Most excluded articles were indexed in the LILACS database.

Of the studies in the final sample, 4 were conducted in North America,¹⁶⁻¹⁹ 2 were conducted in Australia,^{16,20} and 1 in Europe²¹ (Table 2). None of the studies that met the inclusion criteria was conducted in Latin America, Africa, or Asia.

All 7 studies were related to the teaching of pharmacy practice in the educational setting, with 1 study being multidisciplinary,²¹ covering the disciplines of pharmacy, medicine, and dentistry. The study reported by Marriot²⁰ simply described the development and implementation of a computer software program for producing virtual patients, with a later study complementing this initial one by addressing the use and application of the tool by pharmacy students.¹⁵

The majority of virtual patient tools used standardized clinical cases involving chronic illness and reflected true-to-life professional practice scenarios simulating patient care in the community,¹⁷ outpatient setting,¹⁸ and hospital pharmacy.¹⁹ Four of the 7 studies did not state the location of patient care. However, 4 of the 7 articles described the clinical scenarios used.^{15,16,20,21}

Regarding the reported number of students who used the virtual patient tool, sample sizes ranged from 34¹⁹ to

Table 1. Progress Through the Stages of a Literature Search on Virtual Patient Technology

Descriptors	First Search Step	Exclusion of Duplicates and Triplicates	Reading of Titles and Abstracts	Articles Selected ^a
“Virtual patient” and “pharmacy”	89 potentially relevant articles retrieved through databases: EBSCO (4), MEDLINE (4), EMBASE (7), SCOPUS (8), LILACS (66), SCIELO (0)	18 articles excluded	64 articles excluded	7 articles selected
“Virtual patient” and “pharmacist”	10 potentially relevant articles retrieved through databases: EBSCO (0), MEDLINE (1), EMBASE (1), SCOPUS (2), LILACS (6), SCIELO (0)	3 articles excluded	5 articles excluded	2 articles selected
“Virtual patient” and “medication”	164 potentially relevant articles retrieved through databases: EBSCO (1), MEDLINE (3), EMBASE (10), SCOPUS (4), LILACS (146), SCIELO (0)	8 articles excluded	155 articles excluded	1 articles selected

^a Of the 10 articles identified, 3 were eliminated.

212 students.¹⁵ Virtual patients were typically used to teach students through the third year of the pharmacy curriculum.^{15,19}

Evaluation of teaching methods using virtual patient technology was typically conducted by providing participating students with questionnaires to determine their satisfaction with the virtual patient experience, the program’s perceived value, and usability of the virtual patient tools (Appendix 1). Student assessment of the use of virtual patient technology took place in computer laboratories and at universities,¹⁹ via the Web,^{15,17,20,21} e-mail,¹⁸ and within computer programs.^{16,17} In one study, students assessed their patients from their computer at home by logging into the virtual patient database page on the college’s Web site.¹⁷ In addition, the studies assessed students’ competencies in pharmaceutical care interventions and in learning, and their ability to solve clinical cases.^{15-19,21} In all 7 studies, students reported a high degree of satisfaction with the virtual patient exercise and found it to be stimulating, innovative, and highly applicable to the practice of pharmacy.

Five of the reviewed studies used preceptors during the exercise to answer students’ questions regarding the virtual patient environment, including how to access sources of information necessary for solving clinical cases. Preceptors also evaluated student responses and collected feedback.¹⁵⁻¹⁹ The other 2 studies did not include preceptors.^{16,21}

The reviewed studies differed in the reporting of limitations:¹⁸⁻²⁰ some studies did not mention limitations^{16,17} or reported having no limitations.²¹ Hussein and Kawahara reported that dependency on telephones for communication and having too few telephone lines available were limitations.¹⁹ Marriott reported limitations resulting

from the small number of standardized patients and clinical scenarios from which to choose.²⁰

DISCUSSION

Most of the 7 studies reviewed here that involved use of virtual patients were carried out in the United States, reflecting the pioneering of this country in relation to virtual patient methods in the teaching of pharmacy, with studies dating back to the late 1990s.²² Since completion of this literature review in December 2009, additional US studies have been published.²³⁻²⁶ The next step would be for these methods to be disseminated to a greater number of countries and for formal evaluation studies to be conducted, which may assist in the development of essential competencies in pharmacy students.

Virtual patient studies that used chronic disease scenarios may have assisted students in understanding the clinical aspects of risk-management and continuity of care. The health care literature emphasizes the importance of health care students, including pharmacy students, undergoing specific training using a technological approach, such as using virtual patient software programs, to ensure the provision of high quality care to patients with chronic disease.^{21,23,27-31} Therefore, the introduction of virtual patients to pharmacy education can potentially offer an effective method for teaching students, posing a challenge to current pharmacy educators to master and adopt these methods.

The studies demonstrated how using virtual patients impacted the clinical and communication skills of the students in their study samples, but most were not able to generalize their results beyond their sample.^{25,32} There is a need for more studies on the use of virtual patient technology to be conducted using a broader population

Table 2. Characteristics of the Study Sample Related to the Use of Virtual Patient Methods from 1960 to 2009

Reference	Setting/Country	Scenario of the Virtual Consultation (outpatient, community pharmacy, hospital pharmacy)	No. of Students	Year of Candidature
Fuhrman Jr. et al, 2001 ¹⁷	College of Pharmacy, University of South Carolina – EUA	Community pharmacy	57	First year
Hussein and Kawahara, 2006 ¹⁹	School of Pharmacy, Loma Linda University – EUA	Each virtual visit represented a hospital day or a clinic visit	34	Third-year
Marriot, 2007 ²⁰	Monash University, Australia	Scenarios on typical disease states that affect patients at a range of ages: respiratory and dermatological conditions	-	-
Marriot, 2007 ¹⁵	Monash University, Australia	Scenarios on typical disease states that affect patients at a range of ages: respiratory and dermatological conditions	212	Students in the third or fourth year of the Bachelor of Pharmacy course
Orr, 2007 ¹⁸	University of Rhode Island, College of Pharmacy – EUA	Ambulatory or community	81	Third-year PharmD students
Villaume, Berger e Barker, 2006 ¹⁶	Harrison School of Pharmacy, Auburn University – EUA	Scenarios: arthritis, asthma, type 2 diabetes, gastroesophageal reflux disease, hypertension, and osteoporosis	125	First-year PharmD students
Zary et al, 2006 ²¹	Karolinska Institutet and Uppsala University in Sweden	Diagnosis: kidney failure, myocardial infarction, pulmonary edema and diabetes type I	90	High educational level (a few months from graduation)

of pharmacy students to validate its use as an effective teaching tool.

In the 7 studies reviewed, virtual patients were used in the teaching pharmaceutical care from the first year of an undergraduate pharmacy degree program to the third year of a doctor of pharmacy degree program.¹⁵⁻²¹ The use of computer technology in pharmacy education is broad and used in disciplines other than pharmacy practice, such as pharmacokinetics, dispensing, calculations, and clinical therapeutics.^{28-31,33} Similarly, the use of virtual patients can be broadened to encompass all aspects of pharmacy training, becoming an essential tool in pharmacy education and an integral part of student assessment.

With the worldwide increase in the adoption of pharmaceutical care practices, satisfaction with virtual patient methods in the area is an important performance indicator of educational program effectiveness. Therefore, assessment of student satisfaction with the use of virtual patients is necessary to identify its strengths and weaknesses and to improve virtual patient teaching methods.³⁴ Students in

the 7 studies found that virtual patients were an interactive and dynamic tool that assisted them in understanding disease states and managing drug therapy regimens, and that allowed them to apply what they had learned in classroom lectures to realistic situations.¹⁵⁻²¹ These findings corroborate those of Benedict and colleagues, who reported that the simulations in which virtual patients were used strongly supported by students and were effective teaching tools when used to supplement more traditional instructional formats (eg, lectures).³⁴ Therefore, in designing future studies, researchers should consider the assessment of student satisfaction with virtual patient tools as a measurement that will lead to the expanded use of virtual patients in the teaching of pharmaceutical care.

This review found that there is a paucity of studies involving virtual patients, suggesting an under use of these methods in pharmaceutical education. Health care education is going through fundamental changes in relation to students' skills and approaches to learning. In schools of medicine, virtual educational tools have been

widely used and are considered important resources for teaching clinical skills³¹ (diagnostic and treatment) and communication skills.^{35,36} This training method is also commonly implemented in other health care professions education, including nursing³⁷ and dentistry.³⁸ Our findings suggest that pharmacy as a discipline may be lagging behind other health care disciplines in the use of virtual patient technology for teaching students clinical and communication skills. Pharmacy educators do not appear to be capitalizing on the congruence between computerized virtual patient approaches to teaching and the level of comfort graduate students have with virtual technology.

Semeraro and colleagues³⁹ emphasized the importance of preceptors in familiarizing students with the use of virtual patient scenarios to practice and improve their clinical knowledge and communication skills. Some of the studies reported that preceptors assisted students in the patient decision-making process within the virtual clinical scenario.¹⁹ In addition, preceptors provided feedback on students' performance during virtual counseling sessions and the strengths and weaknesses of using virtual patient technology to teach students.^{15,18} However, none of the studies in the review assessed whether the preceptors' input had any influence on how well students performed in the virtual scenarios. Future studies should assess whether preceptors influence student outcomes when using virtual patient technology.

Two reviews found that there is a number of technologies that can be used in the teaching of clinical competencies, including telephone, e-mail, analysis of audio and video tapes, and Web pages, as well as computer software.^{10,11} Advantages of Internet-based virtual patient programs include their portability and realism.¹⁹ Limitations of virtual patient programs in pharmacy include the limited number of computer animations and interactions scenarios available.^{18,20} More sophisticated graphics and multimedia (sound, animation, text, and avatars of patients) need to be created to enhance human interactions with virtual patients and learning.

Despite the many advantages of using virtual patient technology in pharmacy education, a significant limitation identified in this review was the lack of virtual patients seeming true to life and the inability of virtual patients to provide additional unscripted information in response to students' questions.¹⁵⁻²¹ Also, some pharmacy students did not focus on their verbal communication skills when interacting with virtual patients. Also, using virtual patients in patient encounters did not afford students practice in interpreting patients' nonverbal communication.¹⁸ Moreover, the 7 studies did not assess the reliability of knowledge and skills acquired through use of virtual patient technology. Pharmacy educators must remember

that virtual patient technology has yet to be validated as an effective learning tool for teaching pharmaceutical care.

This review is not without limitations. Only the keywords virtual patient, pharmacist, pharmacy, and medication were used. The use of other relevant key terms, such as pharmaceutical education and pharmaceutical teaching, did not lead to different results. Investigators did not search the International Pharmaceutical Abstracts (IPA) and Education Resources Information Center (ERIC) databases, which index specific journals that are not included in any other database. Consequently, some studies that would have met inclusion criteria may have been left out of the review.

CONCLUSION

Virtual patient technology has the potential to be an innovative and effective educational tool in pharmacy education, particularly for optimizing the teaching of pharmaceutical care. There are few published articles in the area and few validated virtual patient tools. Also, there are few virtual patient scenarios involving chronic diseases; lack of variability in the level of complexity of virtual patient scenarios; and lack of understanding of the influence preceptors have on students' learning from virtual patient technology.

More resources need to be invested in the development of realistic, virtual patient technology specifically for teaching pharmacy at the graduate and undergraduate levels. Also, the technology needs to be tested in various countries to allow for internal and external validation of the programs as effective teaching tools.

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Appendix 1. Characteristics of the Virtual Tools and Student Performance Were Analyzed From 1960 to 2009

Reference	Satisfaction with the VP	Competences Assessed	Role of Instructors	Program Development	Limitations
Fuhrman Jr. et al., 2001 ²²	Most of the students rated their experience as excellent or as good and that the knowledge acquired while participating in the project would be beneficial in the future.	Students were graded on their response with regards to, accurateness, thoroughness and timeliness of their answer.	Evaluate and critique student's answers. Available to students either in the computer laboratory or via e-mail to assist students with technical (computer) or patient care problems	College's web page. Most of the students reported using the Pharmacy Computer Laboratory, Integrated Pharmacy Practice Laboratory, or their home computers.	Data not provided.
Hussein e Kawahara, 2006 ²⁴	Most of the students agreed that the teaching approach used in the Pharmaceutical Care Laboratory course was significantly different from other teaching approaches that they had encountered;	Collect patient data; critically evaluate data, identify drug-related problems; and make recommendations to optimize therapy. End of the course was developed a final examination about the knowledge gained.	Help each group with their patient assessment and decision-making processes.	The "VR-TTS" system was develop a computer program tailored to administering a pharmaceutical care laboratory. The software communicates any text to the user over the telephone.	Dependency on a telephone, and the number of telephone lines available.
Marriot, 2007 ²⁵	Data not provided.	Data not provided.	Data not provided.	The program has provided a flexible database of standardised virtual patients for undergraduate pharmacy students. Clinical scenarios can be added according to pre-determined criteria.	Only able to provide information from a database of standardized patients and randomly allocate clinical scenarios according to pre-set criteria.
Marriot, 2007 ²⁰	Students reported that they felt the assignment was relevant to the subject being assessed and improved their learning.	Pharmacy students choose their own individual "virtual" patient using a purpose-designed computer program and respond to a clinical scenario. The student's response to the clinical scenario was assessed according a guide	To evaluate the student's response to the clinical scenario in an oral presentation of their case to two independent tutors and an allocated group of 10–12 peers. Tutors and peers can provide feedback to the student both during and after the presentation.	Data not provided.	Data not provided.

(Continued)

Appendix 1. (Continued)

Reference	Satisfaction with the VP	Competences Assessed	Role of Instructors	Program Development	Limitations
Orr 2007 ²³	Students felt significantly more confident in their self-care competencies at the end of the semester than at the beginning, moreover they agreed that the overall experience was valuable and improved their current self-care skills.	Within the assessment forms, students were graded on gathering all pertinent patient information, use of open- and closed-ended questions, providing clear nonprescription and non-pharmacological education, and communicating with the patient.	Instructor evaluation of responses.	For the virtual patients recruited for e-mail, a packet of information (instruction on the activity, personal virtual patient profile, and a calendar to track interactions) was disseminated to them, as well as oral instructions from the course coordinator	Not focusing on verbal communication skills and were unable to interpret the nonverbal communication. An additional limitation of Could not be of assessment of actual virtual patients on their satisfaction and perception of student learning
Villaume, Berger e Barker, 2006 ²¹	The project took too much time because of the complexities of the computer procedures resulting from the Virtual Patient being a prototype (attention from writing the script.	Students were required to write a script for a working prototype of the Auburn University Virtual Patient.	1 of the authors was available most class days for consultation in his office. Extensive consultation was also provided with regard to the content of the scripts.	The Auburn University Virtual Patient (AUVP) developed a program to practice using motivational interviewing principles and strategies in patient counseling.	Data not provided.
Zary et al., 2006 ²⁶	Most of the students reported that had no problems learning to use the Web-SP system, the cases engaging, learned from using and found Web-SP fun to use.	The students are free to follow their own path of inquiry through the case, and may select, physical examinations and laboratory tests. The students get detailed feedback on their achievements at the end of each case.	Data not provided.	Web-SP was successfully implemented at several universities by taking into account key factors such as cost, access, security, scalability and flexibility.	There are no inherent limitations in the system which means that Web-SP easily can support campus-wide implementations.