Mannequin-Simulator as a New Teaching and Learning Method in Performance-Based Pharmacotherapy

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ABSTRACT

Introduction: Active learning approach is deemed to be important for performance-based education. **Aims:** Objectives of this study were to report experience in employing a mannequin-based case assessment of pharmacotherapy for pharmacy students and to seek students' opinion on the usefulness of this approach. **Methods:** Students were exposed to a standardised heart failure case using mannequin-simulator and were asked to evaluate the medication prescribed and to manage any drug related problems. Performance grade of the students was evaluated based on participation and a written report. A cross-sectional survey was utilised to identify the students' perception on the simulation experience. The survey consisted of six statements related to the simulation and three statements related to the clinical pharmacy and pharmacotherapy. **Results:** A total of 81 students completed the survey. The median grade for the cohort was seven out of ten marks. Before exposure to the session, 86.4% of the students agreed that clinical pharmacy is interesting, only 29.6% of the students agreed that pharmacotherapy is easy to learn and 60.5% of the cohort agreed they are confident to provide clinical pharmacy services. After exposure to the session, 82.7% of the students agreed that the session has enhanced their interest in pharmacotherapy, 91% of the cohort agreed that this simulation provided an opportunity to utilise their theoretical knowledge, 79% of the students stated the experience has developed their skills to solve pharmacotherapy related problems. Up to 76.5% of the cohort enjoyed the simulation session. **Conclusion:** The students value mannequin-based pharmacotherapy teaching and learning as effective and interesting.

Keywords: Simulation-based, active learning, pharmacotherapy, performance-based.

INTRODUCTION

The scope of pharmacy profession is expanding from pharmaceutical product orientation to clinically oriented pharmacy practice which includes direct patient care. Clinically oriented pharmacy practice include advanced drug-control process, development of physical and human resources, clinical pharmacy skills, and the training of pharmacy practitioners.[1] Pharmacy curriculum should provide experiential practice learning whereby the knowledge and skills learned in the classroom can be applied in a real clinical setting.[2]

In Malaysia, the Pharmacy Board and the Qualification Agency encourage a shift in pharmacy education from traditional lectures to experiential and competency-based learning.[3] Both bodies are responsible to regulate the standard of academic programme and competencies required by the pharmacists. The Pharmacy Board of Malaysia guideline stated that "There must be a variety of teaching-learning methods that are enjoyable, which will enable students to develop the range of intellectual and practical skills as well as positive attitudes".[3] One of the ways to achieve this objective could be a simulation-based training as part of the teaching approach. Previous study has suggested that the mannequin-simulator-based learning offers a realistic clinical training experience for the application of knowledge and interpersonal

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teamwork skills.[2] This method reduces the exposure of uncomfortable environment to the students. The simulator facility allows a safe environment for repeat training to achieve the expected competence without early direct patient's involvement.[4] Clinical situations can also be simulated repeatedly to allow standardised training and assessment for all students. In addition, uncommon scenario such as side effects or adverse reactions of drugs can be simulated for the students to experience. Through this method, performance-based simulation assessment could be used to evaluate the cognitive and practical skills of students.[5]

For the past 15 years, the pharmacy student's theoretical knowledge has been assessed through small group discussion on real clinical cases in Universiti Kebangsaan Malaysia (UKM), These students were exposed to the written problem-based learning prior to the real clinical case exposure. Nevertheless, only limited issues can be highlighted because drug related problem is minimum in the current teaching facility. In our Faculty of Pharmacy, patient simulation was introduced into clinical pharmacy courses in June 2009. The pharmacy courses include Basic Clinical Pharmacy (NFNF3083), Clinical Pharmacy and Therapeutics I (NFNF4024) and Clinical Pharmacy and Therapeutics II (NFNF4044). The pharmacodynamic of selected medications can be demonstrated in an almost realistic situation, and in a controlled environment. We believe that students' interest levels and performance may be further increased by active interaction in a simulated clinical environment. Therefore, this patient simulation was introduced in the middle of each semester to strengthen their theoretical knowledge gained throughout the semester and to provide the students with a unique learning experience. We believed that this teaching and learning approach was the first of it kinds in the Asian region for pharmacy students.

The aims of this article are to report our experience employing a mannequin simulation-based case assessment for pharmacotherapeutic education of pharmacy students and to seek students' opinion on the usefulness of this teaching and learning approach.

MATERIALS AND METHODS

Prior to this simulation session, the students have completed three courses related to clinical pharmacy; Basic Clinical Pharmacy, Hospital Clinical Pharmacy Practice, and Clinical Pharmacokinetics, and all theoretical lectures related to pharmacotherapeutics. All students have also completed the basic medical science courses, which comprise anatomy and physiology, biochemistry, immunology, basic pathology, microbiology and pharmacology. These courses familiarised the students with the basic understanding of pharmacotherapeutic concepts.

Forth year students of academic session 2010–2011 were chosen for this internal audit. Clinical Pharmacy and Therapeutics I and II are compulsory courses in the final semester of the fourth year curriculum of Bachelor of Pharmacy with honours in Universiti Kebangsaan Malaysia. The course sampled for this purpose was the Clinical Pharmacy and Therapeutics I (NFNF4024), which mainly covers the cardiovascular pharmacotherapy. This course incorporates theoretical lecture, patient simulation followed by real clinical experience. The patient simulation was performed at the Clinical Pharmacy Simulation (CliPS) laboratory, where students were required to dress professionally with laboratory coats and were allowed to bring any relevant drug information resources if deemed necessary.

A standardised case was designed with known past medication history and patient was suffering of acute exacerbation of congestive heart failure with poor control of hypertension. The case included all subjective and objective information, similar to the real clinical practice. Laboratory and other clinical data were available for students. A list of medications that were taken by the patient was also available as a printed prescription. No further information was given to the students prior to the scheduled patient simulation experience. Each student group, comprised an average of four students, was scheduled for a one-hour simulation session within eight weeks of rotation. One facilitator was scheduled to control the simulator and to advise each group. The group was guided to the simulation room and oriented to the mannequin in the room. The mannequin was controlled by a computerised unit, SimMan® (Laerdal Medical, New York, USA), and had a palpable pulse, blood pressure, audible heart, lungs, abdominal and breathing sounds.

The students were asked to assess the patient conditions, determine drug-related problems and suggest suitable pharmacotherapy management. After a five-minute briefing by the facilitator who is a clinical pharmacy lecturer, the students were left alone for 30 minutes with the patient to enhance their sense of independence and responsibility. After half an hour and at the end of the session, the facilitator approached the students again to discuss any significant findings and problems related to the simulator. This provided immediate feedback to the students and created an open environment for enquiries related to the case.

As this was the students' first exposure to the simulator, printed instructional tasks were used as a tool to trigger the students' thinking process. This tool acted as

a framework for minimum competency throughout the simulation and was used as the basis for assessing the performance consistently between students. The ability of the student to fulfill these tasks was assessed through discussion and a short written report.

At the end of the simulation session, each group was responsible to produce a written report for the patient simulation. Students who completed the survey returned the form in a reply box to the researcher. The survey was part of an internal audit to evaluate the performance of the CliPS laboratory and acceptance of the students on the simulation session. Thus, ethical approval was regarded as unnecessary. This cross-sectional survey consisted of six statements related to the simulation learning experience which were adopted from a study by Seybert et al. and additional three statements related to clinical pharmacy and pharmacotherapy in general.[4] The level of agreement for each statement was signified using the Likert scale on which 1 was regarded as strongly disagree to 5 as strongly agree.[6]

Students were given a group grade for the simulation session, which was a part of the overall final grade assessment for the course. This patient simulation session contributed to 10% of the students' overall grade. Another 90% of the assessment came from the written examination, clinical case portfolio and clinical case presentation. A maximum of ten marks were given for the simulation session; two marks for participation and group work, and eight marks were based on the critical thinking skills and the written report prepared by each group. Students were considered to achieve the minimal competency level when they score a mark of more than six.

RESULTS

Overall, 90 students completed the simulation session and submitted the group written report. A total of 81 students (90%) completed the post-simulation survey instrument. The average age of the students was 22.1 ± 0.4 years (mean ± s.d.) and 27.2% of them were male. The median grade of the simulation session for the cohort was seven out of ten marks. All students were given the full marks of two for active participation and group work.

Before exposure to the simulation session, 86.4% of the students agreed that clinical pharmacy is an interesting area of pharmacy, only 29.6% of the students agreed pharmacotherapy is easy to learn and 60.5% of the cohort agreed they are confident to provide a minimum level of services related to clinical pharmacy. After exposure to the simulation session, 82.7% of the students agreed that this experience strongly stimulated their interest in internal medicine pharmacotherapy. Ninety one percent of the cohort agreed that this simulation session provided them with an opportunity to utilise theoretical knowledge learned earlier. A total of 79% of the students stated that the experience enhanced them to develop skills to solve pharmacotherapy related problems. Up to 76.5% of the cohort enjoyed the pharmacotherapy simulation session. Majority (95.1%) of the students agreed that simulation session should be largely incorporated into the pharmacy curriculum. Most of the students (92.6%) agreed that the presence of facilitator is helpful in the simulation process. Table 1 and 2 summarise the students' response to each question on the survey instrument.

DISCUSSION

Part of successful knowledge dissemination depends on the teaching and learning techniques. Therefore, performance-based teaching techniques have been introduced in heath care education for decades. Accordingly, the assessment methods of these teaching techniques and their psychometric characteristics have been established and extensively evaluated.[7] These teaching and assessment methods include written clinical simulations, computer-based clinical simulations, oral examinations, standardised patients and mannequin-based patient simulator. These techniques rapidly evolve with the fast development in electronic and computer technologies. As such, traditional methods of teaching like didactic lecture are becoming less popular. More high education institutions prefer to deliver the information through student-centred approaches or performance-based teaching. These methods of teaching are believed to improve student motivation and self learning strategy. Thus, these will directly increase the success of knowledge delivery. A simulator-based learning has been recognised as a valuable educational tool in medical

Table 1: Student's Opinion on the Education and Practice of Clinical Pharmacy Prior to the Simulation Session

No.	Question	% of Students versus Score of Agreement (1 = strongly disagree to 5 = strongly agree)				
		1	2	3	4	5
1.	Clinical Pharmacy is an interesting area of pharmacy.	1.2	0.0	17.3	38.3	48.2
2.	Pharmacotherapy course is easy to understand.	1.2	9.9	59.3	29.6	0.0
3.	I believed I will be able to provide clinical pharmacy service at least at a minimum requirement.	0.0	2.5	37.0	50.6	9.9

Table 2: Student's Opinion on the Clinical Pharmacy Simulation Session

No.	Question	% of Students versus Score of Agreement (1 = strongly disagree to 5 = strongly agree)				
		1	2	3	4	5
1.	The patient simulation stimulated my interest in internal medicine pharmacotherapy.	0.0	0.0	17.3	55.5	27.2
2.	The patient simulation allowed me to use the knowledge that I have learned in this course	0.0	0.0	9.9	55.5	34.6
3.	The experience has helped develop my ability to solve pharmacotherapy problems.	0.0	1.2	19.8	46.9	32.1
4.	I have enjoyed this patient simulation.	2.5	0.0	21.0	42.0	34.5
5.	This patient simulation should be further incorporated into the pharmacy curriculum.	0.0	0.0	4.9	32.1	63.0
6.	The facilitator was helpful in my learning experience.	0.0	1.2	6.2	51.9	40.7

undergraduate education.[8] Simulation-based learning gives an opportunity to students to apply their theoretical knowledge in an almost realistic setting.

Previously, the Faculty of Pharmacy UKM only adopted didactic lectures, laboratory practicals, tutorials, problem-based learning sessions and ward attachments as the methods of teaching and learning. The weaknesses of the latter method include sudden frightening exposure to the clinical environment, drug related problems are commonly learnt as theory and a very minimal hands-on experiences. We believed that all these weaknesses would compromise the competency and confidence of pharmacists produced.

Although most of the students agreed that clinical pharmacy is an interesting area of pharmacy, more than half of the students thought that pharmacotherapy is difficult to learn. This negative perception may influence the student interest in exploring further knowledge regarding pharmacotherapy or clinical pharmacy. Thus, the simulation laboratory was established to provide students with experiential learning and to enhance their interest and self-efficacy in pharmacotherapy. This is hoped to improve student motivation to learn the pharmacotherapy management. Self-efficacy is defined as "an individual's judgments of his or her capabilities to perform given actions".[9] The students' motivation may be enhanced if the students become aware that they are making progress in learning. This realisation can be demonstrated in the simulation learning process. The students' may also identify their lacking in theoretical knowledge while carrying out the simulation task. This may help the students to identify areas of weaknesses for them to focus in pharmacotherapy and to continue working to improve and become more skillful. Accordingly, the students will maintain a sense of self-efficacy for performing well.[10]

The students believed that the simulation session has improved their understanding on the theoretical part of the pharmacotherapy. The majority of students also felt that their interest in internal medicine pharmacotherapy has been enhanced. Comparable with previous study, 90% of students felt that mannequin-simulation based learning represented better clinical patient care experience.[2] The perception that they comprehend their study material enhances self-efficacy and motivation.[10] The student involvement in the simulation experience requires quantity and quality of physical and psychological energy. According to the education theory, the greater the students' involvement in their study, the greater will be the amount of student learning and personal development.[11] Through our observation and the assessment of written report, the simulation session not only enhanced the students' knowledge regarding pharmacotherapy but also developed their imperative generic skills that are required to be competent pharmacists. These generic skills include interpersonal communication, appropriate response to specific clinical problems, time management, team work and ethical practice. The development of skills in solving clinical problems and team work was similarly observed by previous study.[2]

CONCLUSION

This article has demonstrated the usefulness of mannequin-based simulation learning in pharmacotherapy for pharmacy students. The students value simulation-based learning as effective and interesting. The patient simulator is a valuable educational tool in pharmacy undergraduate education.

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