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Original Research

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The proper timing to introduce simulation-based education in internal medicine clerkship

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ABSTRACT

Background: Simulation based-education (SBE) is spreading widely among medical schools worldwide. It supports students with safe and effective learning environment, provided being integrated into the curriculum properly to enhance the transfer of skills learnt to real clinical practice. **Aim:** The aim was to evaluate two-time formats for introducing SBE in clinical teaching based on the outcome of clinical training and students' perception. **Methods:** This cross-sectional study included (37) 4th year female students starting internal medicine (IM) clerkship. Students were divided randomly into two groups: Group (A) $n = 18$ had their SBE sessions at the beginning of the IM course for 1 week (first format). Group (B) $n = 19$ had their SBE sessions spaced over the duration of the IM course (second format). Grades of objective structured clinical exam (OSCE), mini clinical cases (MiniCex) and final block were collected. Using self-administered questionnaire, students' perception was collected. **Results:** A highly significant difference between OSCE grades of students in the two groups was observed being higher with Group A ($P < 0.001$). Overall, the outcome of SBE has a predictive impact on MiniCex and final course grades with Group A. 67% of students agree and strongly agree about the usefulness of having SBE sessions during IM clerkship; and 58.3% of them believed that it is better to use the first format for the introduction of SBE sessions. Simulation sessions were perceived by 66.6% of the students to eases the step from the classroom to the real clinical world. **Conclusion:** This study attempts to highlight the importance of the integration of SBE for students starting their IM clerkship in order to provide an easier transition between simulated and clinical learning environment. If intensive SBE sessions were introduced to learners at the beginning of the clerkship, the outcome is better and has a predictive impact on MiniCex and final grades of IM clerkship. Future application of this concept in other departments needs to be evaluated with more emphasis on measuring the outcome of skills laboratory learning process.

KEY WORDS: Basic clinical skills, internal medicine, medical students, simulation sessions, skill laboratory

INTRODUCTION

Clinical training of medical students is an important part of medical curricula, and it is highly relevant to professional practice [1]. Clinical education has been modified in the last few decades in response to the development of educational theories and research, and to changes in medical knowledge and health care requirements [2]. It has been shown that, students enrolled in traditional medical curricula perform basic clinical skills poorly and that medical schools cannot rely on clerkship experiences alone to offer students adequate basic clinical skills training [3,4]. In order to overcome these deficiencies, a mix of teaching strategies including problem-based learning, community-based education and skills laboratories have been introduced for undergraduate training. These shifts in medical curricula were based on contemporary educational theories such as social constructivism, experiential learning and communities of practice [2].

Many medical schools throughout the world have established clinical skills laboratories in order to assist students with simulation-based-education (SBE), and assure the achievement of an adequate level of clinical competence [5,6]. SBE in skills laboratories enables the teaching of procedures in a standardized and structured manner to improve procedural skills performance [7,8]. However, one of the difficulties associated with the shift of students from the pre-clerkship to clerkship education is the application of clinical skills learned directly on patients [9-11]. Although it has been demonstrated that clinical skills performance of medical students improves by SBE, several

studies have indicated that students may encounter problems with the transition of skills learned in the skills laboratory to the hospital setting [7]. At our faculty, despite following problem-based learning strategies and providing SBE with each course in the pre-clinical phase, these efforts may not address the students' more immediate concerns and anxieties about their practical and professional competencies when entering the clerkships [11]. Therefore, as part of clinical phase curriculum, recently we started including clinical skills laboratory sessions during students' training in clerkships. It has been reported that students who practice basic clinical skills in SBE sessions adapt more readily to clinical practice. However, these learners need time and repetition of skills until their performance is improved [12]. These students also need to consolidate their learned clinical skills by practice in a clinical environment [2]. At our clinical education settings, inter and intra-departmental differences in the time format for introducing the SBE sessions have been observed. In a trial to evaluate the usefulness of integrating SBE in clinical clerkship, and to evaluate two time formats for introducing the SBE interventions to fit with learners' needs, we conducted this study on a group of students enrolled in the internal medicine (IM) clerkship.

METHODS

The curriculum at the Faculty of Medicine, King Fahad Medical City is a hybrid problem-based learning curriculum divided into three phases that are extended through 6 years. Phase one (premedical) is the 1st year. Phase two (preclinical) includes 2nd, 3rd, and first semester of 4th year. The rest up to the 6th year are included in phase three (clerkship). Students enrolled in the IM course are normally divided into groups of 18-20 medical students. The students are scheduled for four SBE sessions 3 h each. Training sessions are held in the skills laboratory. Attendance is obligatory and recorded in students' portfolios. Students can practice skills on models, on mannequins and on standardized patients. Other activities for the students in the course of IM include: Didactic lectures delivered by faculties for both groups (average of 6 h/week), seminars presented by students, attendance of daily morning round for 1 h and a bed side teaching session for 3 h over 6 weeks. Student's assessment is divided to: First, the continuous assessment out of (35%) and this includes evaluation of clinical competency, attendance, seminars, and mid-block written exam. Second, the end of the block examination is out of (65%) this includes written exam (25%), and assessment of clinical competencies by running mini clinical cases (MiniCex) (20%) in the hospital and objective structured clinical exam (OSCE) (20%) in the skills laboratory.

Setting

The study was conducted at the Faculty of Medicine at King Fahad Medical City Hospitals, King Saud Bin Abdulaziz University for Health Sciences Riyadh/KSA. Simulation training sessions were held in a well-equipped skills laboratory with maximum simulation to real patient-physician setting. The students can practice essential skills on computer-operated mannequins that simulate symptoms of different health problems with life-like features such as pulse, voice, heart and breathing sounds. Standardized patients were also included when necessary. Debriefing rooms were utilized to conduct reflective discussions following a simulated learning experience. The SBE sessions were conducted by clinical instructors from the IM department (consultant and/or associate consultants). These sessions were structured according to specified objectives.

Ethical Approval

Ethical approval was obtained from Institutional Review Board (IRB) at King Fahad Medical City (IRB Number: 12-097).

Subjects

This study includes 37 female medical students in their second semester of 4th year starting IM clerkship during the academic year 2012-2013. Students were divided randomly into two groups, with no statistically significant difference in the pre-course grade point average (GPA) between both groups ($P > 0.05$). SBE interventions were introduced in two formats. The first format was introduced to the first group of students (A) $n = 18$ in which they had all their SBE sessions at the beginning of the IM course. The second format was introduced to the second group of students (B) $n = 19$ in which they had their SBE sessions spaced over the IM clerkship of 7 weeks. Both groups had similar hours of training and were taught with the same faculty members.

Data Collection

Pre-course GPA, OSCE, MiniCex and final course grades were collected from the registry department. In order to evaluate students' perspectives toward the effectiveness of, and the proper time format for introducing the SBE interventions during the IM course, students were asked to respond a self-administered questionnaire modified from West *et al*., [13] at the end of OSCEs. The questionnaire was pilot tested. Answering the questionnaire was voluntary and anonymous.

Data Analysis

Data were analyzed using the SPSS statistical software version 16 (Chicago, IL, USA). Simple descriptive statistics, *t*-test, and multiple regression analysis were used for data analysis. The degree of statistical significance is denoted by the $P = 0.05$.

RESULTS

This study included 37 female students enrolled in the IM course, and they were randomly divided into two groups (A and B). The grades of pre-block GPA, OSCE, MiniCex and final block obtained by the two groups of students were collected, and a comparison of the mean between the grades was conducted [Table 1]. A highly significant difference can be observed between the grades of OSCE in the two groups being higher with Group A ($P < 0.001$).

In order to demonstrate whether the skills learned during SBE have a predictive impact on clinical performance presented by grades of MiniCex and the final grades of the IM course, linear regression analyses were conducted. When we considered the whole batch of students enrolled in the IM course (37 students), the model could explain 11.4% of the variance, with beta coefficient of (0.296) and $P = 0.041$. Overall, OSCE grades have a predictive impact on MinCex and final grades of the IM course. However, in order to know if changing the time format of delivering skills lab can affect these dependent variables, we performed regression analyses for each group separately [Table 2]. It was demonstrated that, for Group A students OSCE grades variable contribute significantly to the regression on the dependable variable of MiniCex and final course grades ($P < 0.05$). The contrary was reported with Group B ($P > 0.05$).

In order to evaluate students perception on time format for the introduction of SBE interventions, and some other details on the nature and content of the sessions, we used a self-administered questionnaire which consisted of 11 items. From 37 students, only one did not respond to the questionnaire, this makes the response rate 97.3%. Students' responses for the questions were recorded using five-point Likert scale and results were summarized in Table 3. Around two-thirds (67%) of students agreed and strongly agreed about the usefulness of having SBE sessions during IM clerkship. 58.3% of the students agreed and strongly agreed that it is better to take all SBE sessions at the beginning of the clerkship. While 42.8% of the students agreed and strongly agreed that it is better to have SBE interventions spaced over the IM course. SBE was perceived by 66.6% of the students (agreed and strongly agreed) to eases the step from the classroom to the real clinical world.

Table 1: Descriptive statistics of grades for the students in the two groups presented as mean (±SD)

	Group A *n*=18 (100%)	Group B *n*=19 (100%)	*P* value
Pre-block GPA	3.6 (0.82)	3.4 (0.67)	0.46
OSCE	74.5 (10.9)	59.7 (12.3)	<0.001
MiniCex	78.9 (9.8)	76.8 (14.0)	0.614
Final block grade	74.8 (8.0)	70.2 (8.0)	0.090

SD: Standard deviation, GPA: Grade point average, OSCE: Objective structured clinical exam, MiniCex: Mini clinical cases

Table 2: Multiple regression coefficients of OSCE grades with the MiniCex and final block grades

Course	Grades	R square	Beta coefficient	Standard error	Significant
Group A	MiniCex	0.371	0.546	0.178	0.007
	Final block	0.488	0.510	0.133	0.001
Group B	MiniCex	0.040	0.229	0.271	0.410
	Final block	0.030	0.112	0.155	0.479

OSCE: Objective structured clinical exam, MiniCex: Mini clinical cases

DISCUSSION

Learning clinical skills is a complex process comprising different factors [12,14]. Skills laboratories provide a safe environment for teaching medical students psychomotor skills in a structured manner [15]. It is necessary for these students to master basic clinical examination and procedures prior to practicing on patient. Therefore, SBE training sessions has been found to increase patient safety [16]. This study was conducted to evaluate the usefulness of integrating SBE in a clinical clerkship, and to evaluate the proper time format for introducing the SBE interventions to fit with learners' needs during IM clerkship. OSCE was conducted to assess basic clinical skills competencies. The students were assessed for history taking, clinical examination, working a differential diagnosis, laboratory and radiology request and interpretation of results, in addition to, communication skills and doctor-patient relationship. OSCE is considered to be one of the most reliable and valid measures of clinical performance ability currently available [17]. For the two groups of students included in this study, OSCE settings were standardized in terms of stations, evaluation process and grading using a standard checklist. Also, there was no significant difference in the GPA of the two groups of students prior entering the IM course. Results from this study have shown that when SBE interventions were introduced in the first format (prior to students' contact with patients), students gained significantly higher scores in OCSE than those who had the SBE sessions introduced in the second format (spaced over the IM course). This may reflect that introduction of SBE in the first format enabled the students to have a better level of clinical competencies than the latter group indicated by the outcome that was assessed by OSCE. The first group

Table 3: Students views on different characteristics of simulation sessions

Questions	Students *n*=36 (100%) *n* (%)				
	Strongly agree	Agree	Neither	Disagree	Strongly disagree
Simulation sessions were very useful	6 (17)	18 (50)	0 (0.0)	5 (13.9)	7 (19.4)
Better to take all simulation sessions at the beginning of the rotation	14 (38.9)	7 (19.4)	0 (0.0)	6 (16.7)	9 (25.0)
Better to take simulation sessions distributed all over the rotation*	4 (11.4)	11 (31.4)	4 (11.4)	10 (28)	6 (16.7)
Instructors were friendly and helpful*	6 (16.7)	22 (62.9)	1 (2.9)	3 (8.6)	3 (8.6)
Duration and frequency of simulation sessions have to be increased	4 (11.1)	17 (47.2)	7 (19.4)	6 (16.7)	2 (5.6)
Organization of simulation sessions were appropriate	4 (11.1)	16 (44.4)	6 (16.7)	7 (19.4)	6 (16.7)
Skills taught could be transferred to patients*	6 (16.7)	17 (47.2)	5 (14.3)	3 (8.6)	4 (11.4)
Training in clinical skills lab eases the step from the classroom to the real clinical world*	7 (19.4)	17 (47.2)	3 (8.6)	3 (8.6)	5 (13.9)
Objectives of IM rotation were covered by the simulation sessions	0 (0.0)	18 (50.0)	4 (11.1)	7 (19.4)	7 (19.4)
Students were aware of the level of information neededw	0 (0.0)	17 (47.2)	7 (19.4)	5 (13.9)	7 (19.4)
Wide range of clinical skills covered in skills lab	0 (0.0)	15 (41.7)	4 (11.1)	10 (27)	7 (19.4)

IM: Internal medicine, *Only 35 students answered this question

of students had the opportunity to be more focused with longer practice and repetition of all basic clinical skills after finishing the simulation sessions and before the exposure to patients. For developing motor skills learners progress through phases including cognitive (understand how to perform), associative (refining movement to become more consistent in performance), and autonomous (practicing until learners does not need to think about each step)[18]. Progressing through these phases of learning requires deliberate practice, which is an important tool for the development and maintenance of professional expertise [2,19]. It has been reported that, students learning clinical skills in the laboratory need enough time for repetition of practice of these skills and demonstrate their complexity. For learners to progress in skills learning, they also need planning and focusing to refine their performance [19,20]. Furthermore, when the students practice all the basic clinical skills before patients' encounter, they will have more confidence in dealing with real patients overcoming the uncertainty and difficulty of applying the learned clinical skills in practice. Students in the second group perhaps were less confident in dealing with less safe environment than the situation in simulation sessions [21]. This could be because they were learning clinical skills in ESB while being in direct contact with patients. A study on how nursing students learn in a skilled laboratory demonstrated that during clinical training of the students, it is necessary for these students to have time to practice clinical skills before being exposed to patients. Students considered that a feeling of security is a prerequisite for learning process [12].

Our results did not reveal any significant difference between the results of the two groups with regards to MiniCex and overall final grades of the IM course. One might have expected that students from the first group to perform better than students in the second group at least in MiniCex. Students in the second group probably put more effort to improve their performance due to their feeling of lower self-confidence and uncertainty. Widyandana *et al*. reported that when students face clinical problems in reality they will be motivated to reflect more on their own performance indicated by higher level of self-directed learning [22]. This led us to investigate whether there is an impact of the outcome of simulation sessions assessed by OSCE grades on the outcome of MinCex and the outcome of the whole IM course. When we conducted a linear regression test, we found that generally, OSCE grades have an impact on both grades of MinCex and final overall grade of the course. From this, we could demonstrate that for all students, outcome of SBE sessions represented by OSCE grades has a predictive impact on MiniCex and final course grades. This reflects the importance of learning clinical skills SBE, then practice these skills on real patient encounter. In a trial to find the proper format for the introduction of SBE sessions, we conducted a separate regression analyses for each group of students. Results demonstrated a predictive impact of OSCE grades on both MinCex and final IM course grades of students who went through the first format for introducing the SBE interventions. This predictive impact was not shown with the other group of students. This may suggest that students who had the first format of SBE before coming in contact with patients had better clinical performance whether in the MiniCex or as an overall performance in the IM course. Students in the first group had a chance for more deliberate practice for all learned skills more than the other group. It has been reported that the more deliberate practice is performed to learn skills, the more these skills are retained [23]. We need to mention here that, although the IM department have tried to standardize the clinical cases included in the MiniCex according to course objectives, yet it was a difficult task. This could also be one of the reasons why there was no significant difference in the MiniCex grades between the two groups.

We evaluated students' perception about the overall conduct of the SBE sessions in the skills lab and asked about the best format to introduce these sessions during clerkship. Overall, 67% of students found SBE interventions for training on the basic clinical skills during IM clerkship to be very useful. This is consistent with the growing evidence that using SBE results in learners' satisfaction and self-reported increased clinical competence [24]. 58.3% of students in this study believed that it was more useful to take all SBE sessions at the beginning of the clerkship. This perception came in agreement with the difference observed in the outcome of SBE sessions represented by OSCE grades. SBE session was perceived by 66.6% of the students to eases the step from training on manikins to be transferred to real clinical world. About the administration of these simulation sessions, more than half of the students think that the sessions were well organized and that the duration and the frequency of sessions were appropriate. The majority of students perceived that the instructors were friendly and helpful.

This study had a limitation of the low number of students due to the limited capacity of the IM department. Therefore, results of this study are considered preliminary, and we need to conduct a study with a bigger sample size. Furthermore, the design of this study did not allow us to demonstrate how students learn clinical skills. This study can also be conducted in other departments that may need different nature of basic clinical skills such as surgical departments with adding more emphasis on how students learn these skills.

CONCLUSION

In conclusion, results of this study highlighted the importance of integrating SBE interventions with clerkships in order to provide continuity between simulated and clinical learning environment. Overall, it appears that if intensive training of the students for basic clinical skills using SBE sessions is introduced to learners at the beginning of the clerkship, the outcome is better and has a predictive impact on MiniCex and final grades of IM block. Students' preference also agrees with this assumption. Findings of this study may assist curriculum monitoring committee to re-evaluate the time format for the introduction of SBE sessions in different departments. Future application of this concept in other departments needs to be tested with more emphasis on measuring the outcome of skills laboratory learning process.

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