Setup and Utilization of Clinical Simulation Center, Faculty of Medicine, King Abdulaziz University, Saudi Arabia

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Abstract: Background: Faculty of Medicine, King Abdulaziz University is the second largest medical school in Saudi Arabia. In 2006-2007, faculty adopted a new integrated system based curriculum with early clinical experience component in the pre-clerkship years. In response, a multidisciplinary clinical skill and simulation center (CSC) was setup to complement and enhance clinical teaching and promote early student professional training. **Objectives:** to describe the setup, structure and methodology of the CSC as well the progress of the center utilization by the faculty and students along its first three years. **Methods:** This study was a chart review used a data collection sheet that was designed, piloted and subsequently used to collect data regarding various activities carried out at center (booking, session's objectives, availability of models and user's evaluation of CSC services and staff). Data was collected per semester of the three academic years 2007 – 2010 and analyzed using SPSS program. **Results:** This study showed that there was progressive increase in total contact hours, the number and percentage of all types of sessions (registered and walk in) conducted at the CSC over the studied period. The clinical sessions reached 99.99% of the total number of the sessions conducted in 2009-2010. Also, there was significant increase in the number and percentage of model utilization and objectives completeness of the sessions over all the studied period. **Conclusion:** Setting up clinical skills and simulation center as training facility is a worthwhile and rewarding experience to enhance and complement teaching and learning activities of students and faculty alike.

[Abdulaziz Boker. **Setup and Utilization of Clinical Simulation Center, Faculty of Medicine, King Abdulaziz University, Saudi Arabia.** *Life Sci J* 2013;10(1):1079-1085] (ISSN:1097-8135).
http://www.lifesciencesite.com. 167

Key Words: Clinical Skills Center, Patient Simulation Training, set up.

1. Introduction

There is a growing body of evidence that simulation technology provides a safe and effective mechanism to educate and evaluate professional persons in a variety of disciplines and professions like flight simulators for pilots and astronauts and war games [1, 2].

Medical education has placed increased reliance on simulation technology in the last two decades as simulations become an integral part of it at all levels [3-5]. **Issenberg *et al.*,** summarize at least five factors that contribute to the rise of simulations in medical education: (a) problems with clinical teaching; (b) new technologies for diagnosis and management; (c) assessing professional competence; (d) medical errors, patient safety and team training; and (e) the role of deliberate practice [6].

Changes in the delivery of healthcare trigger major shifts in medical education methods. Higher percentages of acutely ill patients and shorter inpatient stays resulted in less opportunity for medical learners to assess patients with a wide variety of diseases and physical findings. Despite increased cost-efficiency in outpatient care, reductions in physician reimbursement and shrinking financial resources constrain the educational time that physicians in training receive in this environment. Consequently, physicians at all educational levels find it increasingly difficult to keep abreast of skills and topics that frequently appear in practice. These problems have a direct effect on clinical skills training [6].

The advent of new technologies in medicine has revolutionized patient diagnosis and care. However, the psychomotor and perceptual skills required for these newer techniques differ from traditional approaches. Simulation technology has been introduced as a method to train and assess individuals in these new techniques. A survey of training program directors stressed the importance of virtual reality and computer-based simulations as technological tools in clinical education [7].

Simulation technology is increasingly being used to assess the first three levels of learning described by **Miller** [8] (knows, knows how and shows how) because of its ability to (a) program and select learner-specific findings, conditions, and scenarios; (b) provide standardized experiences for all examinees; and (c) include outcome measures that yield reliable data [9].

The acquisition of expertise in clinical medicine is governed by a simple set of principles concern the

learner's engagement in deliberate practice of desired educational outcomes. Deliberate practice involves (a) repetitive performance of intended cognitive or psychomotor skills in a focused domain, coupled with (b) rigorous skills assessment, that provides learners with (c) specific, informative feedback, that results in increasingly (d) better skills performance, in a controlled setting [10, 11].

Many Medical Schools around the world are going through various steps to update their curricula. Among these innovations many of these schools are considering and or operating various faculties for skill training.

Faculty of Medicine at King Abdulaziz University is the second largest medical school in Saudi Arabia. It was established at 1968 with current total annual intake of about 400 male and female medical students. The faculty adopted traditional curriculum till the year 2006-2007 when it started integrated system based curriculum with PBL and early clinical experience component in the preclerkiship. As a part of the developmental plan, a large multidisciplinary clinical skill and simulation center was setup at the main teaching hospital to complement and enhance clinical teaching and promote early student professional development training. In this paper we presented the case that even in established medical school, there is room to integrate skills training at designated centers gradually and steadily. The purpose of this article was thus to describe the set up, structure and methodology of the clinical skill center (CSC) and to describe the progress of the center utilization by the faculty of medicine along the first three academic years.

2.Methods

This study was a chart review that used a data collection sheet as a tool. This sheet was designed prior to initial operation of the center, then piloted and subsequently used to collect data regarding various activities carried out at the center. A separate section of the form collects specifics about booking information, session's details, and presence or absence of model and manikins' and user's evaluation of clinical skill center services and staff. Data was collected per each semester of academic years 2007 – 2010 and entered to excel sheet and was analyzed using Statistical Package of Social science (SPSS) version 16.

Steps of CSC setup: The initial step in CSC setup was to get key approval from leaders in the faculty for the project, then relocating all simulators and part task trainers to one central location accessible to all potential users. Our center was allocated at the main teaching hospital unused ward. The ward had seven bedded rooms, three wings each have six double and two single rooms (total eight rooms per wing). In addition, the ward had four store rooms, three variable office spaces and central space for main meeting room and secretarial space.

From day one, the plan was setup to collect information about all activities booked and follow up their completion using a simple data collection sheet. Next, all contents and facilities of the center were collected in one catalogue which was distributed to all departments to notify them about the center. Additional products and catalogues were kept at the center to be viewed by teaching faculty to identify future needed material and to enhance participants teaching experience.

A formal administrative structure of the center was settled. It consisted of two sections; the first included five full time staff for day to day management of the center. The second section was formed of academic supervising committee with eight part time faculty members. This committee overlooked all issues related to the short, intermediate, and long term planning of academic activities of the center. The committee membership had a wide representation from the key clinical departments as well the basic health sciences departments. Such arrangement made it possible to increase the faculty involvement in the project awareness campaign and their ownership for the center.

Subsequent steps were taken to further implement key future plans. These included setting up of library resources of material related to simulation in health care setting, acquiring new material and equipments for the center, and planning to establish a future independent five floor building for health care simulation near the main teaching hospital and basic sciences departments for both male and female medical students and also allow easy access of other participants to this new future site

3.Results:

The result of this study showed that there was progressive increase in the number and percentage of sessions conducted at the CSC over the studied period (2007 to 2010). The number of the sessions conducted at the center during the last studied year (2009-2010) represented about 50% of the total sessions conducted in the three studied years. The total contact hours were increased all over the studied period. (Table 1, Fig.1).

It was found that large percent (43%) of the sessions that had been conducted in 2007-2008 were walk in sessions and this percent has been increased to reach about 52% in the year 2008-2009. On the other hand the registered sessions represented about 64% of the sessions conducted at the center during the

year 2009-2010 (Table 2). There was significant decrease in the number and percentage of walk in sessions in (2008-2009) compared to (2007-2008) while the number and percentage of the registered sessions were significantly increase in 2009-2010 compared to 2007-2008.

Regards the different types of the sessions conducted at the CSC, it was observed that the number of the clinical sessions in 2008-2009 represented two folds of that of 2007-2008. The percentage of clinical sessions was significantly increased over the studied years to reached 99.99% of the total number of the sessions conducted in 2009-2010. On the other hand, numbers of both problem based learning (PBL) and practical sessions had been marked decreased along the studied years. (Table 3)

The number and percentage of model utilized during the conducted sessions at CSC had significantly increased over all the period from 2007 to 2010 (Table 4). Regards the number and percentage of objective code completeness of the sessions conducted at CSC, there was significantly increased in 2009-2010 compared to 2007-2008 and 2008-2009 (Table 4).

Table (1): Number and percentage of the sessions conducted at CSC and total contact hours per term during the years (2007-2010).

Year	Number Of sessions	Percentage from each year	Percentage from total	Total contact hours
2007-2008				
Summer	15	1.8	0.3	561
First term	347	41.0	7.5	10368
Second term	484	57.2	10.5	33988
Total	846	100	18.3	44917
2008-2009				
Summer	26	1.9	0.6	7303
First term	687	49.1	14.9	23622
Second term	685	49.0	14.8	44348
Total	1398	100	30.3	75273
2009-2010				
Summer	0	0	0	0
First term	1323	55.6	28.6	46289
Second term	1056	44.4	22.8	63906
Total	2379	100	51.4	110195
Total (the three years)	4623		100	230385

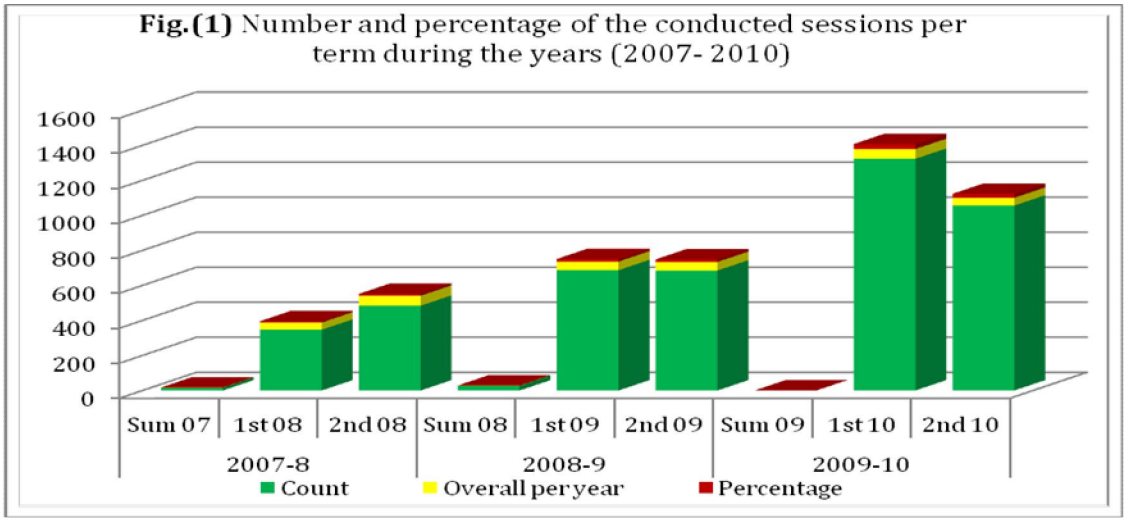

Table (2): Number and percentage of booking information of sessions conducted at CSC per term during the years (2007-2010).

Year	Pre-booked sessions N %	Registered sessions N %	Walk-In sessions N %	Total
2007-2008				
Summer	15 (5.2)	- -	- -	15
First term	91 (31.9)	89 (46.3)	167 (45.2)	347
Second term	179 (62.9)	103 (53.6)	202 (54.8)	484
Total	285 (33.6)	192 (22.7)	369 (43.7)	846
2008-2009				
Summer	8 (3.4)	-	18 (2.5)	26
First term	232 (45.1)	106 (63.8)	349 (48.6)	687
Second term	275 (53.3)	60 (36.2)	350 (48.9)	685
Total	515 (36.8)	166 (11.8)	717 (51.2)	1398
2009-2010				
Summer	-	-	-	-
First term	197 (49.1)	833 (54.9)	293 (63.5)	1373
Second term	204 (50.9)	684 (45.1)	168 (36.5)	1056
Total	401 (16.8)	1517 (63.7)	461 (19.3)	2379
Total (the 3 years)	1201	1875	1547	

Test of significance

(2007-2008) versus (2008-2009) Chi-square = 125.41 P<0.001***
(2007-2008) versus (2009-2010) Chi-square = 195.61 P<0.001***
(2008-2009) versus (2009-2010) Chi-square = 221.41 P<0.001***

Table (3): Number and percentage of different type of sessions conducted in the CSC per term during the years (2007- 2010).

Year	Clinical Session N %	Problem Based Learning (PBL) N %	Practical Session N %	Total
2007-2008				
Summer	8 (1.5)	-	7 (7.8)	15
First term	176 (33.6)	15 (45.4)	26 (28.9)	217
Second term	339 (64.7)	18 (54.5)	57 (63.4)	414
Total	523 (80.9)	33 (5.1)	90 (13.9)	646
2008-2009				
Summer	26 (1.9)	-	-	26
First term	684 (50.1)	-	3 (100)	687
Second term	656 (47.9)	4 (100)	-	660
Total	1369 (99.98)	4 (0.003)	3 (0.002)	1373
2009-2010				
Summer	-	-	-	-
First term	1318 (57.1)	1 (100)	-	1319
Second term	992 (42.9)	-	-	992
Total	2310 (99.99)	1 (0.001)	-	2311
Total (three years)	4194	38	93	4330

Test of significance comparing the clinical sessions:

(2007-2008) versus (2008-2009) Chi-square = 75.3 P<0.001***
(2007-2008) versus (2009-2010) Chi-square = 529.61 P<0.001***
(2008-2009) versus (2009-2010) Chi-square = 9.41 P=0.002**

Table (4): Number and percent of model utilization and objective completeness in sessions conducted in the CSC per term during the years (2007- 2010).

Year	Model utilization		Objectives completeness	
	N	%	N	%
2007-2008				
Summer (n=15)	15	(2.9)	15	(13.8)
First term (n=347)	229	(45.8)	32	(29.7)
Second term (n=484)	257	(51.3)	61	(56.5)
Total (846)	501	(59.2)	108	(12.7)
2008-2009				
Summer (n=26)	20	(2.8)	-	-
First term (n=687)	381	(53.6)	143	(75.6)
Second term (n=685)	310	(43.6)	46	(24.3)
Total (1398)	711	(50.8)	189	(13.9)
2009-2010				
Summer (0)	-	-	-	-
First term (1322)	498	(56.1)	172	(72.8)
Second term (1050)	391	(43.9)	64	(27.2)
Total (n=2372)	889	(37.4)	236	(10)
Total (three years)	2101		533	

Test of significance comparing the model utilization of sessions:

(2007-2008) versus (2008-2009) Chi-square = 14.83 P<0.001***

(2007-2008) versus (2009-2010) Chi-square = 120.13 P<0.001***

(2008-2009) versus (2009-2010) Chi-square = 64.46 P=0.002**

Test of significance comparing the objective completeness of sessions:

(2007-2008) versus (2008-2009) Chi-square = 0.27 P=0.6

(2007-2008) versus (2009-2010) Chi-square = 5.30 P=0.021*

(2008-2009) versus (2009-2010) Chi-square = 11.48 P<0.001***

4.Discussion

Many initiatives have contributed to the rapid expansion of longitudinal pre-clinical doctoring courses, clinical skills centers, and use of standardized patients as specific recommendations for educational reform and outcomes [12-17]. This came in response to an increasing and documented need for standardized curriculum components in which students can learn, practice, and demonstrate competence in basic clinical knowledge and skills [18, 19]. **Lofaso *et al.*** demonstrated that the clinical Skills Lab (CSL) is not designed to replace real clinical patient experiences. It's to provide early exposure, medical knowledge, professionalism and opportunity to practice skills in a patient free environment [20].

As seen in the results reported in this study, there was steadily increase in the use of the facility, which is about 400% increase from year one to year three. Main trends were also observed related to increasing number and percentage of pre-booked or regular sessions in the center which enhances the concept of systematic teaching versus the opportunistic teaching activities (registered) typically seen at classical teaching sites like outpatient and inpatient setting. High utility of the CSC could be attributed to; its central position within the teaching hospital and next to the academic buildings, flexibility of the booking system either registered or walk in sessions and availability of wide range of equipments variety from basic to most advanced simulations that are fully staffed. Adding to that; the active integration of CSC within the curriculum modules for both under-and postgraduate programs as well as the well structured faculty development and enhancement programs aiming to use simulation in education and were conducted through the CSC.

Although there is no evidence, till now, that the high utility of this center has resulted in better performance of the students, yet students were eager to participate in the courses of learning opportunities in the CSC which reflect empirically that it helped them to improve their performance. And this was in concordance with **Issenberg *et al.*** who attributed the increase in the CSC utilization to its success in preparing learners for real patient contact [6]. It allows them to practice and acquire patient care skills in a controlled, safe and forgiving environment. Skill acquisition from practice and feedback also boosts learner self-confidence and perseverance, affective educational outcomes that accompany clinical competence.

The use of the CSC in clinical skill assessment through the objective structured clinical skills examination (OSCE) is a routine at the faculty of medicine, King Abdulaziz University since the center had been set. The clinical skills learning facility was described by **Bradley and Postlethwaite** as an ideal venue to assess the acquisition of clinical skills in an in-vitro environment at 'shows how' level of Miller's hierarchy [21]. The logistics and skill required are very significant and should not be under-estimated**[22].**

One important development, which was initially not anticipated, that a larger number of house officers and senior medical students increased their involvement both in self- directed and peer teaching and learning activities. **Bradley and Postlethwaite** confirmed that students in the clinical skill center can practise the skills at their own pace and they can practice iteratively **[21]**. **Hao *et al.*** explained this when said "Students can be confident that they can do no harm and are not embarrassed by their early failures and are positive in their evaluation of their learning" **[23]**. In the CSC, KAU, the individual and group feedback was provided to the students after an activity or session depending on the session and its objectives. For example with High-fidelity simulation session, it is part of the program is to have briefing and debriefing.

It was noticed that, not only teaching sessions that were organized by those students, but also symposia and workshops. Students from various years arranged and successfully carried out formative examination for their fellow junior students and also carried outreach program for community first aids courses at intermediate and high schools.

During these first three years the CSC hosted many workshops for faculty development to enhance faculty awareness and capabilities to use various simulation tools. This aimed indirectly to enhance student learning and to advance the concepts of early clinical exposures of junior medical student to clinical care and stream line and systemize teaching and learning activities carried out at the faculty. Problem based learning (PBL) training workshops were part of the faculty development program conducted in the CSC. PBL has been used to integrated active learning principles with training and performing skills. It was reported that, the clinical skill learning facility can also be seen to be a medium through which interprofessional learning can be promoted and facilitated in a general learning of generic skills **[24]** or in specific and complex simulations **[25-26].**

The center with the help of the faculty of medicine and university administration also invested in arranging international training courses to implement more advanced application of simulation in the medical school. A group of faculty attended month training at University of Illinois Chicago (UIC) to further establish standardized patient program at the CSC. This program is due to start at the next academic year 2012 – 2013, after installation of needed Audio Visual system designed to record communication and professional skills teaching for all medical students and residents during their first year of contact with patient. These modern clinical skills facility provides high quality audio-visual facilities that can be used to promote analysis and feedback in a variety of settings. Team work in clinical scenarios can be recorded for later discussions. Simultaneous recording to a DVD recorder can allow almost instant replay and rapid fast forward or reverse, as well as providing individual students with a permanent record of their performances **[21].**

Similar initiatives were taken to establish full functional program in order to implement high fidelity simulation training exercises for both medical students (during fifth year rotation in anesthesia and critical care department), and for residents training program, which got established during the academic year 2010 – 2011. The next step will be to integrate high fidelity simulation for the rest of the postgraduate training programs in the faculty.

Conclusion:

Setting up clinical skills center and training facility is a worthwhile and rewarding experience for both students and faculty to enhance and complement teaching and learning activities of students and faculty alike. This project had proved to have many advantages for established medical school, and it is important to consider these issues when planning new medical and other health teaching facilities.

Effect of clinical skill center on improving the performance of the students in clinical exam will be done in a future study. Further researches on program of patient simulation will be conducted after its implementation in the next year.

Acknowledgement:

The author would like to thank Dr. Adnan Mazroaa for his unlimited support for the project and Dr. Abdulmoneim Al Hayani, Vice Dean for Development and Quality at the time for his encouragement and support. The staff and the Academic Supervising Committee of the CSC were the actual people who made this project come to existence.

Declaration of interest:

The author reports no conflict of interest.

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12/29/2012