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Gender-based perception of undergraduate medical students at King Abdulaziz University toward use of simulation-based learning in pediatrics

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ABSTRACT

Background: The use of simulation in pediatric clinical teaching has been adopted in many postgraduate curricula, while there is limited data on its impact on medical student satisfaction in the undergraduate pediatric clerkship.
Objectives: This study aimed to assess the perception of undergraduate medical students at King Abdulaziz University (KAU) toward the simulation-based learning (SBL) in pediatrics clerkship and if the gender affected their perception.
Subjects and methods: A comparative cross-sectional study was conducted during the academic year 2017/2018 at the clinical skills and simulation center, KAU Hospital using a self-administered questionnaire distributed to 390 fifth-year medical students enrolled in the pediatric rotation. Students were requested to assess a simulation-based session on managing a child with status epileptics. The data were analyzed using the Statistical Package of Social Science Version 16.
Results: Although most of the students attended the simulation-based session were satisfied with the orientation about the simulation environment, the female students were significantly (p = 0.005), more satisfied than the males. On the other hand, both males and females were satisfied with the simulation environment, technology, and the clarity of session objectives with no significant difference between them. The simulation session was significantly (p = 0.006) more helpful to female students in applying the knowledge and skills they need for clinical practice more than the male students.
Conclusion: Face validity of SBL in pediatrics by undergraduate female medical students was evidenced in this study compared to male students.

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KEYWORDS

Gender; perception; medical; students; undergraduates; simulation; learning; pediatric; clerkship

Introduction

Simulation was defined as "an instructional process that substitutes real patient encounters with artificial models, live actors, or virtual reality patients" [1]. Simulation-based learning (SBL) has been proven to be a cost-effective, easily accessible, and promising educational method in modern education [2]. Simulation allows deliberated practice and guided reflection and provides safe environment for teaching and practicing technical skills [3]. Cook et al. found that simulation training was associated with higher learning outcomes when compared with other instructional modalities [4].

The use of simulation in clinical teaching has been adopted in many undergraduate and postgraduate curricula for many reasons including: "the changes in healthcare delivery, the lack of objectivity of clinical examinations, limited clinical placement positions, and the potential of simulation to improve clinical learning" [5].

Simulation can take many different forms, including role-playing, the use of standardized patients, part-task-trainers, computer patients, or electronic patients [1]. Mannequin-based simulation can also be used in skills laboratory, although the more complex recreations of clinical tasks require fully equipped simulation centers

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or the ability to bring the simulator into an actual work setting [6]. In the past decades, there was a significant focus on realistic pediatric simulators (specific task-trainers and patient mannequins) and an increasing number of studies evaluating the effectiveness of simulation in pediatrics as an educational tool [7].

Two previous Saudi studies were found to report the usage of simulators for teaching laparoscopic surgery skills [8] and local anesthetic approaches [9], and they showed that a significant enhancement of both the cognitive and psychomotor students' skills was achieved by simulation. Not only that, simulation techniques have been widely and successfully used in other specialties such as pediatrics, emergency medicine, intensive care medicine, obstetrics, anesthesia, radiology, and allied medical sciences [3].

Medical simulation is being used with increasing frequency in postgraduate medical education due to its efficacy in helping learners achieve skill competency [10]. Simulation is of special interest in pediatric emergencies, due to the limited exposure of students to critically ill patients and the life-saving skills needed to manage them [11]. Simulation has been used in several situations of pediatric acute care training, including resuscitation, trauma management, airway management, procedural skills, crisis resource management/team training, and disaster/mass casualty training [11].

The existing limited data on the impact of simulation on medical students during their pediatric clerkship suggest high student satisfaction [12]. Nevertheless, no studies have investigated if there is a gender-based difference in students' satisfaction with simulation in pediatrics. Therefore, this study aimed to assess the perception of undergraduate medical students at King Abdulaziz University (KAU) toward SBL in pediatrics clerkship and if the gender affects their perception.

Subjects and Methods

After being ethically approved by the biomedical research ethics committee at the Faculty of Medicine, KAU, Jeddah, Saudi Arabia, this comparative cross-sectional study was conducted during the academic year 2017/2018 at the clinical skills and simulation center (CSSC) at the KAU Hospital.

A standardized self-administered questionnaire designed to evaluated simulation-based sessions conducted at the CSSC was utilized in this study. It was distributed to 390 fifth-year medical students enrolled in the pediatric rotation and attended the simulation session. The questionnaire was anonymous and included an introductory section with questions asking about the information of the session, the course, and the student. The questionnaire also included three sections aimed to assess students' perception of CSSC facilities as well as the students' perception of simulation experience before, during, and after the session. A seven-point Likert scale was utilized to grade students' responses ranged from strongly disagree to strongly agree.

A simulation session on managing a child with status epileptics was designed to be conducted at the CSSC for the fifth-year medical students. The session was aiming to enable the students to perform some psychomotor technical skills such as applying the cardiac monitor and pulse oximeter, inserting a vascular access (intravascular and intradermal), and applying an oxygen mask to a child with status epilepticus. In addition, a set of non-technical skills was also intended such as demonstrating the signs, symptoms, and management of a child presenting with status epilepticus.

Statistical Analysis

The data were collected and entered to the computer. Statistical analysis was done using the Statistical Package of Social Science Version 16 (Chicago, IL, USA), IL 60606-6307. The quantitative data were presented in the form of mean and standard deviation (SD). Student *t*-test was used for the quantitative data. The reliability analysis was done using Cronbach's alpha. Significance was considered at a *p*-value less than 0.05.

Results

The total number of students participated in this study was 256 (125 male and 131 female students) out of 390 and the response rate was 65.6%. Reliability analysis of the study tool was done using Cronbach's alpha. It was found that the Cronbach's alpha of the whole questionnaire is 0.97 and that of the four parts of the questionnaire was ranged from 0.82 to 0.91 which indicating high internal consistency of the questionnaire (see Fig. 1).

Students' perception about CSSC facilities was assessed in this study. It was observed that the students were very satisfied with the learning environment in the CSSC and considered it effective (6.47 ± 0.82), and they reported that all the required teaching aids were available (6.42 ± 1.07) at the CSSC and the space provided in the classrooms

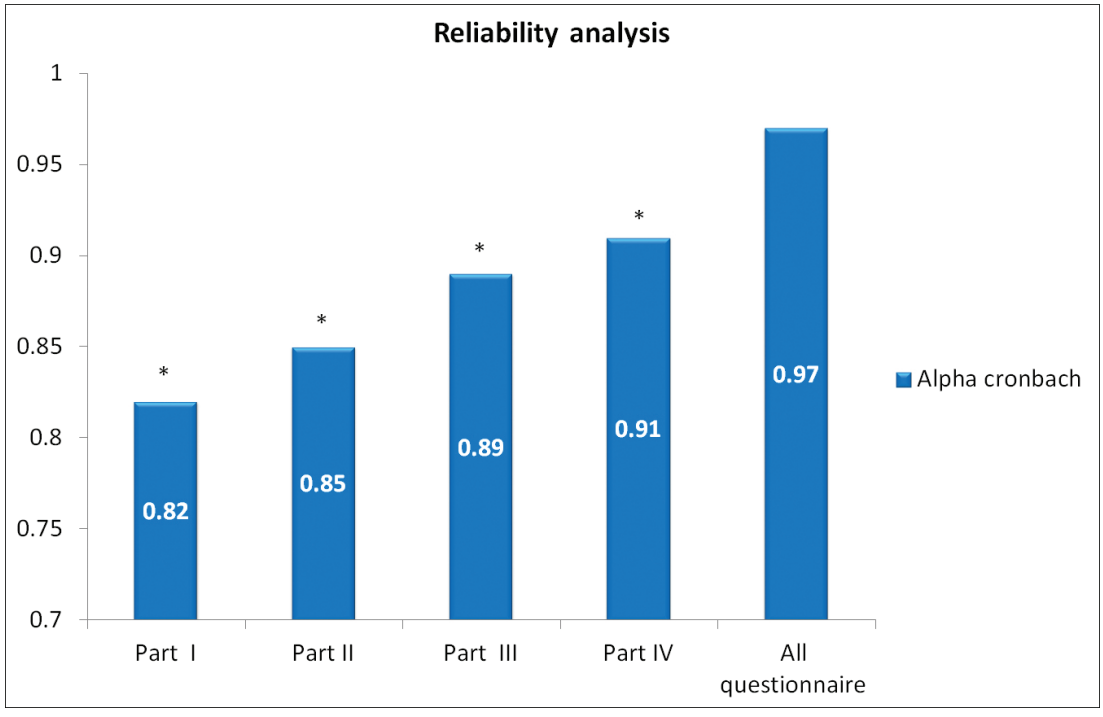

Figure 1. Reliability analysis of the tool used in data collected using Cronbach's alpha. * significance is considered at $p < 0.05$.

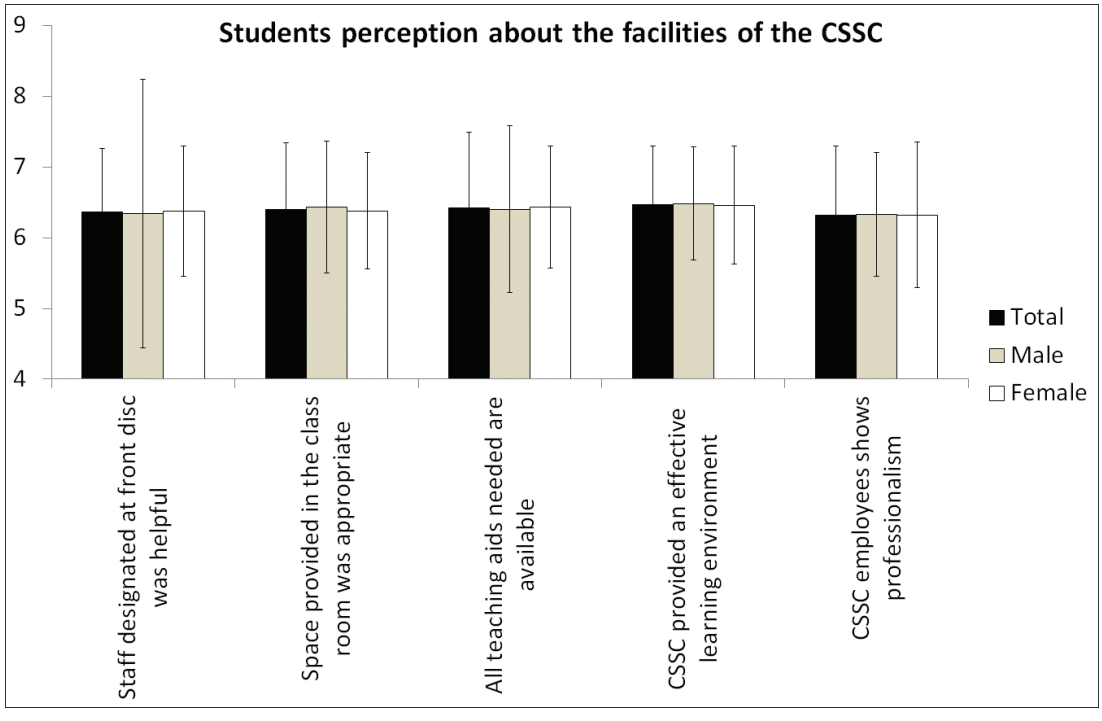

Figure 2. Students' perception about the facilities of the CSSC. No significant changes were detected between male and female.

was appropriate (6.40 ± 0.94). They stated that the staff designated the CSSC front disc was helpful (6.36 ± 0.91) and the employees were professional (6.32 ± 0.97). There was no significant difference in responses between males and females (Fig. 2).

When students' perception about the pre-simulation session was assessed, it was found that all the students were satisfied with the orientation about the simulation environment performed during the session. Interestingly, the female students were

Table 1. Students perception about the pre-simulation session.

Variables	Male Mean ± SD *N* = 125	Female Mean ± SD *N* = 131	Test of significance	All students *N* = 256
Orientation about simulation environment was appropriate	6.03 ± 1.19	6.42 ± 0.98	*T* = 2.82 *p* = 0.005	6.26 ± 1.08
The simulation objectives were clearly stated	6.22 ± 1.01	6.29 ± 1.1	*T* = 0.47 *p* = 0.63	6.26 ± 1.06

Significance is considered at $p < 0.05$

significantly ($p = 0.005$) more satisfied than the male regarding this orientation. Although the female students were also more satisfied than the males with the clarity of the simulation session objectives, there was no significant difference between them (Table 1).

The most satisfying issue for all the students during the simulation session was the appropriateness of the simulation environment (6.38 ± 0.81) and technology (6.38 ± 0.81) with no significant difference between the male and female students. The female students believed that the simulation session significantly ($p = 0.006$) helped them to apply the knowledge and skills they required for clinical practice more than the male students. The females were more satisfied than males regarding the chance to practice, the instructor competency, the objectives, and equipment's utilized during the simulation session, although the difference between males and females was not statistically significant (Table 2).

When it came to the students' perception about the post-simulation session, it was observed that all the students were very satisfied with the program organization (6.44 ± 0.85) with no significant difference between males and females. On the other hand, there was significantly high satisfaction among the female students with the impact of debriefing on their ability to recognize the appropriate intervention ($p = 0.002$) and to share their ideas and thoughts about different situations ($p = 0.002$), and they stated that they would recommend attending such session to their colleagues ($p = 0.024$) (Table 3).

Discussion

Simulation is a process that replicates patient care scenarios in an environment close to reality [13]. Plenty of evidence exists about the ability of simulation-based educational interventions to increase the retention of knowledge for airway management and procedural skills. Simulation-based training, by enhancing provider skills, can subsequently decrease medical errors and increase patient safety [11]. Simulation has tremendous potential as a teaching and assessment tool for pediatric acute care providers. Advances in simulation education continue to emerge for pediatric medicine [7]. To the best of our knowledge, the gender-based difference in medical students' perception toward SBL in

Table 2. Students perception about the simulation session.

Variables	Male Mean ± SD *N* = 125	Female Mean ± SD *N* = 131	Test of significance	All students *N* = 256
I have the chance to practice actively during simulation	6.21 ± 1.09	6.35 ± 0.97	*T* = 1.015 *P* = 0.51	6.29 ± 1.02
The instructor shows competency in simulation	6.23 ± 0.99	6.44 ± 0.86	*T* = 1.79 *P* = 0.074	6.36 ± 0.92
The session objectives have been maintained	6.18 ± 0.93	6.38 ± 1.01	*T* = 1.67 *P* = 0.09	6.30 ± 0.98
The sessions helped me apply knowledge and skills I need for clinical practice	5.96 ± 1.17	6.40 ± 0.93	*T* = 3.32 *P* = 0.006	6.23 ± 1.07
Simulation environment was appropriate	6.29 ± 0.77	6.44 ± 0.84	*T* = 1.46 *P* = 0.14	6.38 ± 0.81
Simulation equipment was appropriate	6.24 ± 0.99	6.42 ± 0.91	*T* = 1.44 *P* = 0.14	6.35 ± 0.95
Simulation technology was appropriate	6.33 ± 0.87	6.32 ± 1.03	*T* = 1.74 *P* = 0.145	6.38 ± 0.96

Significance is considered at $p < 0.05$

Table 3. Perception of medical students during post-simulation session.

Variables	Male Mean ± SD *N* = 125	Female Mean ± SD *N* = 131	Test of significance	All students *N* = 256
Actively participated in debriefing sessions	6.29 ± 0.88	6.34 ± 1.01	*T* = 0.43 *P* = 0.66	6.32 ± 0.96
Debriefing help me to recognize the appropriate intervention	6.21 ± 0.91	6.54 ± 0.75	*T* = 3.08 *P* = 0.002	6.41 ± 0.84
Debriefing encouraged share of ideas and thoughts regarding a situation	6.18 ± 0.81	6.47 ± 0.72	*T* = 3.01 *P* = 0.002	6.35 ± 0.79
Session objectives have been achieved	6.25 ± 0.83	6.44 ± 0.86	*T* = 1.77 *P* = 0.08	6.37 ± 0.85
I would recommend this to a colleague	6.35 ± 0.93	6.58 ± 0.75	*T* = 2.27 *P* = 0.024	6.42 ± 0.81
The program was well prepared	6.39 ± 0.90	6.45 ± 0.84	*T* = 0.66 *P* = 0.53	6.43 ± 0.87
The program was well organized	6.4 ± 0.94	6.47 ± 0.78	*T* = 0.69 *P* = 0.48	6.44 ± 0.85
Overall learning benefit was satisfactory	6.36 ± 0.92	6.36 ± 0.98	*T* = 0.69 *P* = 0.48	6.38 ± 0.91
I feel I was assessed fairly by the instructors	6.30 ± 0.95	6.36 ± 0.98	*T* = 0.52 *P* = 0.59	6.34 ± 0.97
I feel the assessment tool was a reflection of my ability to practice	6.25 ± 0.93	6.31 ± 1.06	*T* = 0.48 *P* = 0.63	6.29 ± 1.01

Significance is considered at $p < 0.05$

undergraduate pediatric clerkship was not explored before, so this study aimed to explore this issue.

In this study, although most of the students attended the simulation-based session on the management of status epilepticus were satisfied with it, the female students were significantly more satisfied with the learning environment, the orientation about the simulation environment, and the clarity of session objectives than the males. On the other hand, both males and females were satisfied with the simulation technology with no significant difference between them. The simulation session was significantly more helpful to female students in applying knowledge and skills they needed for clinical practice more than the male students. These results were consistent with those of some previous studies. It was observed that the favorable perception toward SBL was significantly higher ($p = 0.04$) among female Indian students as reported by Joseph et al. [14]. In another study conducted to evaluate medical students' satisfaction with SBL strategy at the College of Medicine, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia, it was noticed that the female third-year medical students were significantly ($p = 0.03$) more satisfied with the SDL compared with the males (54 ± 7 vs. 50 ± 9).

Among the technical skills that were intended to be learned by students during the simulation session was the insertion of a vascular access. Although several simulation models for adult central line placement are available, few pediatric options are available. Canadian investigators utilized a self-built femoral vein simulator to teach pediatric femoral vein catheterization to pediatric and emergency medicine residents [15]. It was reported that residents who underwent training with the simulator had significantly higher mean confidence levels for femoral vein catheterization than the residents who received didactic teaching alone [15]. Thus, training the students on such technical skill using simulation was used in this study.

In this study, the students were satisfied with their experience with the SBL during the pediatric clerkship. This finding was consistent with some previous studies in pediatrics of other specialties. Using multiple simulations, Eyck et al. demonstrated better immediate test performance and satisfaction in the simulation group [16]. Brandão et al. reported that the undergraduate medical course at Universidade Cidade de São Paulo, Brazil, used high fidelity simulation associated with audio-visual resources in cardiology, trauma care, and pediatrics [17]. The students accepted this method as a training strategy during clerkship and felt secure in this learning environment.

The study of Dudas et al. provided an evidence to support the use of simulation-based educational methods for undergraduate over the traditional methods for medical student education [18]. They

reported an improvement in the reaction, learning, and behavior of the students who received a series of simulation-based skills building workshops within the pediatric clerkship for more than 2 years [18]. In addition, they reported an improvement in students' knowledge as evidenced by an increase in the mean score on the National Board of Medical Examiners subject shelf examination which suggests that the students' perceptions of active participation as a way to stimulate critical thinking may be accompanied by gains in knowledge.

Among the benefits of simulation is the assertion of greater standardization of content which is difficult to be produced by more traditional educational modalities. The latter often includes searching for patients in the wards as teaching adjuncts that are inherently more difficult to standardize [18].

In this study, it was observed that the students were very satisfied with their learning from the simulation sessions and reported that they helped them to apply knowledge and skills they need for clinical practice. Allowing practice under faculty observation and receiving feedback on the practice could be behind the students' satisfaction. It was stated that simulation exercises provided the sole exposure to direct faculty observation and feedback [19,20]. According to the previous studies, there is a general lack of faculty observation of trainees during clinical practice, and many students reported no observation by a faculty member while providing clinical care during the clerkship [21].

In this study, the students were very satisfied with the instructors' knowledge and competency in simulation and their overall learning benefit was satisfactory. These findings are supported by the findings of Couto et al.'s study on medical students from the Faculdade de Medicina da Universidade de São Paulo who took part of a simulation (SIM) and a case discussion (CD) during their rotation on the pediatric emergency department [22]. They reported that students satisfaction was overall higher for SIM compared with CD with a significant higher rating for the affirmatives; "instructor knowledgeable" (4.86 vs. 4.69) and "positive experience" (4.88 vs. 4.5). On the other hand, they reported no difference on the immediate knowledge gain or retention after 4–6 months between the two methods, and they added that "the higher satisfaction with simulation implies possible unmeasured gains" [22]. It was said that the simulation instructors have crucial multiple roles in simulation-based training. They are responsible for introducing SBL environment to learners, running the scenarios during simulation, ensuring learners' physical safety. "To facilitate, debriefing is one of the key tasks for simulation educators" [23]. During the debriefing, critical reflection of the events takes place. This is often the most crucial processes for learning [24]. In this study, the female students were significantly more satisfied than males with the impact of debriefing after simulation on their ability to recognize the appropriate intervention and to share their ideas and thoughts about different situations.

In conclusion, the use of SBL during the pediatric rotation was well perceived by the fifth-year medical students. Face validity of simulation by the female medical students was evidenced in this study as they were more satisfied with the simulation experience and have a significantly higher positive attitude toward SBL compared to the males. Further studies are recommended to explore methods to maximize the benefits of simulation, especially in improving the retention of knowledge and skills.

Limitation of the study: One limitation of this study was the relatively small sample size of the students participated. Another limitation was the application of SBL in the pediatric rotation on a small scale as only one session was conducted and assessed in this study. Lack of a comparison arm of the study was considered as another limitation that will be avoided in the forthcoming studies.

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