RESEARCH ARTICLE

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Evaluation of Simulation-Based Educational Approaches in Family Medicine Specialization Education

ABSTRACT

Objective: The purpose of our activity is to increase the skill levels of Family Medicine assistants in the interventional competencies including in the TUKMOS (Medical Specialization Board Curriculum Formation and Standard Setting System) Family Medicine specialization education curriculum by using the facilities in our simulation center.

Methods: We carried out the 'RSIM 1. Family Medicine Assistants Simulation Education project, which we planned in line with the TUBITAK-BIDEP 2237 Support Program with the participation of a total of 32 Family Medicine assistants. Education pretest-posttest was applied to all participants. In addition, a simulation education feedback survey consisting of 34 questions was conducted.

Results: 71.9% (n:23) of the participants in the education were women, and 56.2% (n:18) have been working in a university hospital. Those with an active working period of fewer than 2 years in medicine were 59.4% (n: 19), and those with the assistantship period of 2-3 years were 53.1% (n: 17). When the pre-test and post-test mean scores of the participants were compared, the difference was found to be statistically significant ($p<0.001$).

Conclusions: The post-test score was higher than the pre-test in each group categorized by gender, type of institution, year of work, and duration of the assistantship. In the light of this finding, we can say that the education provided achieved its purpose in all groups. We think that simulation training is effective, useful, and necessary due to the positive results we have achieved as a result of the practical application we have carried out.

Keywords: Simulation-Based Education, Family Medicine, Medical Education.

Aile Hekimliği Uzmanlık Eğitiminde Simülasyon Temelli Eğitim Yaklaşımlarının Değerlendirilmesi

ÖZET

Amaç: Etkinliğimizin amacı TUKMOS (Tıpta Uzmanlık Kurulu Müfredat Oluşturma ve Standart Belirleme Sistemi) Aile Hekimliği uzmanlık eğitimi müfredatında yer alan girişimsel yetkinlikleri simülasyon merkezimizdeki imkanlar kullanılarak Aile Hekimliği Asistanlarına sunularak beceri düzeylerinin arttırılmasıdır.

Gereç ve Yöntem: TÜBİTAK-BİDEP 2237 Destekleme Programı doğrultusunda planladığımız 'RSİM 1. Aile Hekimliği Asistanları Simülasyon Eğitimi' projesini toplam 32 Aile Hekimi asistanın katılımıyla gerçekleştirdik. Tüm katılımcılara eğitim ön test-son test uygulandı. Ayrıca 34 sorudan oluşan simülasyon eğitimi geri bildirim anketi yapılmıştır.

Bulgular: Eğitime katılanların %71,9'u (n:23) kadın, %56,2'si (n:18) üniversite hastanesinde çalışmaktaydı. Hekimlikte geçen aktif çalışma süresi 2 yıldan az olanlar %59,4 (n:19), asistanlık eğitim süresi 2-3 yıl olanlar %53,1 (n:17) idi. Katılımcıların ön test ve son test ortalama puanları karşılaştırıldığında arasındaki fark istatistiksel olarak anlamlı bulundu ($p<0,001$).

Sonuç: Yapılan son test puanı cinsiyet, çalışılan kurum tipi, çalışma yılı süresi ve asistanlık eğitim süresine göre kategorize edilen her grupta ön teste göre daha yüksekti. Bu bulgu ışığında verilen eğitimin bütün gruplarda amacına ulaştığını söyleyebiliriz. Gerçekleştirdiğimiz pratik uygulamanın sonuçlarından elde ettiğimiz olumlu sonuçlar nedeniyle simülasyon eğitiminin etkili, yararlı ve ihtiyaç olduğunu düşünmekteyiz.

Anahtar Kelimeler: Simülasyon Temelli Eğitim, Aile Hekimliği, Tıp Eğitimi.

INTRODUCTION

Simulation, which means imitating the tasks, relationships, behaviors, or some cognitive activities that exist in reality, is nowadays used in many fields from engineering to medicine, from the aviation industry to the defense industry (1). The use of simulation in the field of medicine is based on the 1950s (2). Its development in medicine has been with Ressü-Anni which is a common product of industrial engineering and medical science, in the 20th century (2). The simulator must be able to comply with the actions of the participant. The more these features are in the simulation system, the more the participants can transfer what they have learned to real situations (1,3).

Simulation-based education gives every student a chance to learn, provides equality, allows different learning methods, and ensures the effective use of adult learning principles (1,4-7). For this reason, the need for simulation-based education in medical education is increasingly growing. But the environment and educational materials needed for this method of education are very costly. At the same time, it is necessary to make the correct programming to carry out this education. While we have the facilities of the Clinical Simulation Education Center within our faculty, we wanted to organize an event using these facilities. We realized our event by turning this into a Tübitak Project with appropriate programming.

Emergency room, intensive care unit, delivery room, operating room, Basic Skills laboratory, home health services room, standard patient room, Objective Structured Clinical Examination (OSCE) rooms, debriefing rooms, support areas (warehouse, technical area, etc.), and ambulance are available in the Recep Tayyip Erdoğan University Clinical Simulation Education Center (RSIM) and a complete hospital environment has been created with its physical structure. Here, pre-graduate and post-graduate education opportunities are provided to physicians. At RSIM, not only simulators but also virtual patient practices (Body-interact, Take the Winds, Portugal) contribute to education. In addition, the camera and sound recordings of all kinds of practices and initiatives made by the students are analyzed in the debriefing rooms by the simulation center management and operating system (Learning Space, CAE, USA). This method allows students to learn from their mistakes. It is aimed to provide education to students on topics such as communication with simulated/standardized patients, motivation, teamwork, and patient and employee safety in the OSCE (Objectively Structured Clinical Examination) rooms.

In the project we organized with the TUBITAK Scientist Support Programs Presidency (BIDEP) 2237 Scientific Education Activities Support Program, we aim to develop the basic principles, knowledge, skills, attitudes, and behaviors available in Family Medicine specialization education, as well as to provide appropriate opportunities for the development of health education, research, and management skills. Another aim of the study is to increase the skill levels of Family Medicine assistants in the interventional competencies (Basic Life Support, Advanced Cardiac Life Support, Obstetrics, Approach to Hypertension Patient with Simulated Patient, Approach to Febrile Convulsion and Case Reports with Virtual Patient) including in the TUKMOS (Medical Specialization Board Curriculum Formation and Standard Setting System) Family Medicine specialization education curriculum by using the facilities in our simulation center.

MATERIAL AND METHODS

Ethics committee approval for this study was taken from the Ethics Committee of Recep Tayyip Erdoğan University Faculty of Medicine with protocol number 2022/163.

We carried out the 'RSIM 1. Family Medicine Assistants Simulation Education Project, which we planned in line with the TUBITAK-BIDEP 2237 Support Program for Scientific Educational Activities, on 26-27 November 2021 at the clinical simulation center of our faculty with the participation of a total of 32 Family Medicine assistants from different cities of Turkey. The assistants who will participate in this education were randomly selected from among the applications, paying attention to the conditions of 'to work as a full-time assistant in family medicine specialization education in a university or education and research hospital in any province of Turkey, to have a motivation letter written by the candidates who want to participate in the education, to be a family medicine assistant for at least 12 months '.

The training subjects in our project consisted of 6 topics such as Basic Life Support, Advanced Cardiac Life Support, Obstetrics, Approach to Hypertension patient with Simulated Patient, Approach to Febrile Convulsions, and Case Reports with Virtual Patient in Chest Diseases, which are among the interventional competencies included in the TUKMOS Family Medicine specialty education curriculum. The reason why these course subjects were chosen for the program is that they are among the subjects we need to diagnose, treat and manage the patient correctly in the family medicine specialty education curriculum. In addition, according to the TUKMOS Family Medicine curriculum, we need to have the ability to manage the whole process of the patient's diagnosis and treatment by working as a team on the approach to the pneumonia patient mentioned in Hypertension and Chest diseases.

For each lesson in the project program, firstly, theoretical lessons were lectured. After each

theoretical lesson, a practical application of that lesson was made to reinforce the subjects and increase their retention.

The educator had each participant apply basic life support practical training one by one. While the participant was performing the resuscitation, the adequacy of CPR was evaluated by looking at the amplitude and frequency of the compressions made on the computer, and the wrong practices were tried to be corrected.

Advanced cardiac life support practice was taught to each participant by the educator in groups of two, with patient management on the simulator as a team. The rhythm of the simulated patient was changed over the computer and they were asked to intervene in the patient. The content of these interventions was asystole intervention, CPR, ambulation, adrenaline administration, pulseless VT (ventricular tachycardia) intervention, and defibrillation.

In the practice of approach to the hypertension patient, each participant was compared by the educator with the simulated patient in the hypertensive patient role. Prior to this, the participants were given theoretical education based on the Turkish Hypertension Consensus Report. As the learning objectives, it was aimed that the participants should measure blood pressure in a hypertension patient, question the necessary anamnesis information, systemic examination, doctor-patient relationship, request necessary laboratory tests, explain lifestyle changes, and write the appropriate prescription and follow up. After the practice, the camera footage recorded in the OSCE rooms was watched and the debriefing session was started, and the necessary explanations were made by determining the knowledge and skill levels of the participants.

The practice of the birth lesson was carried out in pairs, in the birth simulator, under the supervision of the educator. The delivery of a term baby with the normal head presentation was performed on a simulated pregnant patient who had labor pains, reached adequate cervical dilation, and entered labor. First, the head of the baby was seen, after the head was removed, the shoulder was helped to come out by holding it, and then the whole baby was removed gradually. The cord was clamped after waiting for 30 seconds to 1 minute. The cord was gently pulled without pulling too much to assist the exit of the placenta. With the removal of the placenta, the normal birth step was completed.

In the febrile convulsion practical education, the participants were divided into groups of two and it was aimed to provide patient management with teamwork. It was requested to intervene in the child who had a fever and had a seizure by using the simulator. Changes were made to the clinical and symptoms of the simulated patient on the computer, according to the interventions made to the patient. The things to be expected from the participants in the first meeting with such a patient are as follows: taking a short anamnesis to explain the etiology quickly (from the simulated patient's relative), doing what needs to be done in the first 2 minutes (opening the airway, giving nasal oxygen, opening the vascular access), to have sufficient knowledge about other treatment options in the patient who could not establish vascular access (rectal diazepam administration), intervention to stop the seizure (oxygen support, cold application) and drugs (paracetamol, diazepam, midazolam, phenytoin).

The practice of the pulmonology step was covered by the educator with case reports on virtual patients with 'Body-interact'. It contributed to the participant's analysis of pneumonia in terms of diagnosis, treatment, and follow-up of the patient. 'Body-interact' is a virtual patient program in which 54 different cases are analyzed. In this program, the participant was able to monitor the patient's anamnesis information and request the necessary laboratory and imaging tests and intervene with the patient.

At the end of each practical lesson, the participant or participants who completed their practice were told what they did wrong during that practical application, and the mistakes made were explained and corrected. Debriefing was done by listening to the positive and negative criticisms, contributions, and ideas of the participants regarding the courses and practical applications.

All participants were asked 4 questions (24 questions in total) from each lesson in order to have an idea about the participant's knowledge about the lessons before the lessons in the project, and a pre-test consisting of 5 questions including demographic information was applied. Demographic information was as name surname, gender, the institution of assistantship, active working year in medicine, and active working month as an assistant. The questions in each topic were created by their own departments. The pre-test was completed at the same time by all the participants in one class. After all the education was completed, the post-test was administered to all participants by applying the same pre-test. After the final test, the data were evaluated and compared with each other. In addition, a simulation education feedback survey was conducted consisting of 34 questions including questions such as 'Were you satisfied with the education provided?, 'Which course did you benefit more from?', 'Does the simulated practices have a high instructive role?'

Statistical Analysis: SPSS 22.0 statistical package program was used in the analysis of the data. Descriptive statistics of the evaluation results are given as numbers and percentages for categorical variables, and as median, minimum, and maximum for numerical variables. Comparisons of numerical variables between two independent groups were evaluated with the Mann Whitney U

test, and comparisons of numerical variables between two dependent groups were evaluated with the Wilcoxon test. The statistical alpha significance level was accepted as p<0.05.

RESULTS

As part of the TUBITAK project, the simulation education we held at RSIM on 26-27 November was held with the participation of 32 family medicine assistants.

71.9% (n:23) of the participants were female and 28.1% (n:9) were male. While 56.2% (n: 18) have been working in the university hospital, 43.8% (n: 14) have been working in the education-research hospital. When the active working time in medicine was evaluated, it was 59.4% (n:19) for those who were fewer than 2 years, 25.0% (n:8) for those who were 2-3 years, and 15.6% (n:5) for those who were more than 4 years. When the duration of the assistantship of the participants was examined, 46.9% (n: 15) have been family medicine assistants for fewer than 2 years and 53.1% (n: 17) for 2-3 years (Table 1).

28.1% (n:9) of the 32 participants who participated in the simulation education held at RSIM had received any simulation education before, and 71.9% (n:23) had not participated in any simulation education before (Figure 1).

Table 1. Sociodemographic characteristics of the participants

Variables	n	%
Gender		
Female	23	71.9
Male	9	28.1
Institution which working at		
University Hospital	18	56.2
Education-Research Hospital	14	43.8
Year of Work		
< 2	19	59.4
2-3	8	25.0
≥ 4	5	15.6
Duration of The Assistantship		
≥ 1, <2	15	46.9
2-3	17	53.1
Status of Receiving Simulation Education Before		
Yes	9	28.1
No	23	71.9

The results obtained in the pre-test-final test study of a total of a 24-question questionnaire consisting of 6 sections and 4 questions applied to all participants are summarized in Table 2.

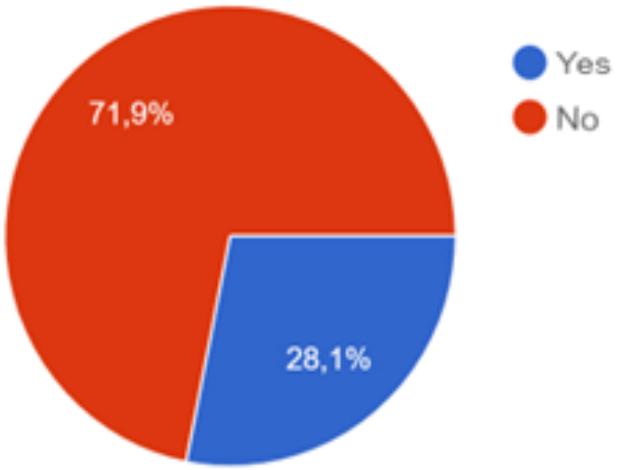

Figure 1. The previous simulation-based education status of the participants

Table 2. Participants' pre-test and post-test scores

	Pre-Test Avg (min-max)	Post-Test Avg (min-max)	p
Whole Group	11 (6-19)	22 (17-24)	<0.001
Gender			
Female	11 (6-16)	22 (17-24)	<0.001
Male	12 (9-19)	22 (17-24)	0.008
Institution which working at			
University Hospital	11 (7-19)	22 (17-24)	<0.001
Education-Research Hospital	11 (6-15)	20.5 (17-24)	0.001
Year of Work			
< 2	12 (6-19)	22 (17-24)	<0.001
≥ 2	10 (8-16)	22 (17-24)	0.001
Duration of The Assistantship			
≥ 1, <2	11 (7-19)	22 (17-24)	0.001
2-3	11 (6-16)	21 (17-24)	<0.001

When the pre-test and post-test mean scores of the participants were compared, the difference was found to be statistically significant ($p<0.001$).

The answers to the evaluation questions included in the satisfaction questionnaire conducted at the end of the education are shown in Table 3.

Table 3. Participants' satisfaction survey results

	5 points n (%)	4 points n (%)	3 points n (%)	2 points n (%)	1 point n (%)
Planned practical education with an educator facilitates the acquisition of new skills.	30 (93.8)	2 (6.3)	-	-	-
Simulation education should be a part of in-service education.	30 (93.8)	2 (6.3)	-	-	-
I think it is a good educational model to eliminate risks in terms of patient safety.	29 (90.6)	3 (9.4)	-	-	-
Simulation education contributed to the increase of my knowledge and skills.	29 (90.6)	3 (9.4)	-	-	-
I think that the clinical skill obtained through simulation-based education is an important skill that I will use in my professional life.	29 (90.6)	2 (6.3)	1 (3.1)	-	-
I think that simulation-based education is effective education for me to see and correct my deficiencies.	28 (87.5)	4 (12.5)	-	-	-
I think that the educational role of practices made through simulation is high.	28 (87.5)	4 (12.5)	-	-	-
The educator's feedback helped me understand the topic better.	28 (87.5)	3 (9.4)	1 (3.1)	-	-
The realism of the environment was effective in making the scenario more believable	58 (78.1)	7 (21.9)	-	-	-
I found the physiology of the simulator realistic	24 (77.4)	6 (18.8)	1 (3.1)	-	-
My expectation about the practice was met	23 (71.9)	6 (18.8)	3 (9.4)	-	-
I think simulation-based education is standardized education	23 (71.9)	4 (12.5)	3 (9.4)	2 (6.3)	-
I have seen that the equal knowledge and skill levels of the people in the team affect the success.	21 (65.6)	8 (25.0)	2 (6.3)	1 (3.1)	-
I think it makes me feel as a real environment in my attempts with the simulator.	19 (59.4)	10 (31.3)	2 (6.3)	-	1 (3.1)
Examples for the practice were sufficient	19 (59.4)	10 (31.3)	2 (6.3)	-	1 (3.1)
The RSIM environment made me feel like I was meeting a real hospital environment.	18 (56.3)	12 (37.5)	2 (6.3)	-	-
Practice time and equipment used were sufficient for crisis management skills	17 (53.1)	10 (31.3)	3 (9.4)	2 (6.3)	-
Seeing the mistakes made in the video recordings contributed to my learning.	17 (53.1)	8 (25.0)	7 (21.9)	-	-
Observing other participants during the education contributed to my learning.	16 (50.0)	11 (34.4)	5 (15.6)	-	-
The theoretical knowledge given on the subject was sufficient in terms of education.	14 (43.8)	11 (34.4)	6 (18.8)	1 (3.1)	-
I would like to make a preliminary evaluation by watching my practice footage again.	11 (34.4)	8 (25.0)	5 (15.6)	5 (15.6)	3 (9.4)
The fact that the practices are being recorded created stress for me.	6 (18.8)	10 (31.3)	5 (15.6)	4 (12.5)	7 (21.9)
During the education, I had difficulty remembering the theoretical information I knew.	6 (18.8)	6 (18.8)	8 (25.0)	9 (28.1)	3 (9.4)
The time allotted to education was sufficient.	3 (9.4)	9 (28.1)	10 (31.3)	6 (18.8)	4 (12.5)
Being in simulation education had a negative effect to show my real performance.	2 (6.3)	3 (9.4)	10 (31.3)	9 (28.1)	8 (25.0)

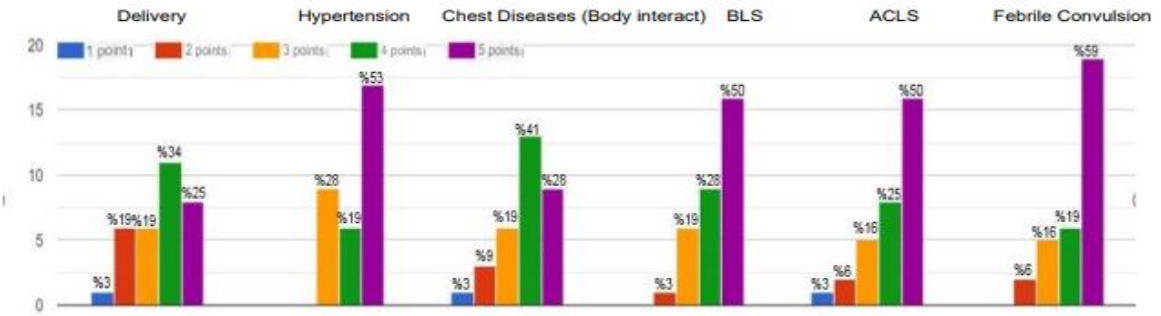

Figure 2. Participants' evaluations of the education parts

The points and course distributions of the answers to the question "Which practice has had the most permanent effect on your education?" in the satisfaction survey are as in Figure 2. The subject of the course with the highest score of 5 was febrile convulsions with 59%, while the subject of hypertension was in second place with 53%. With 25%, the birth course was in the last place.

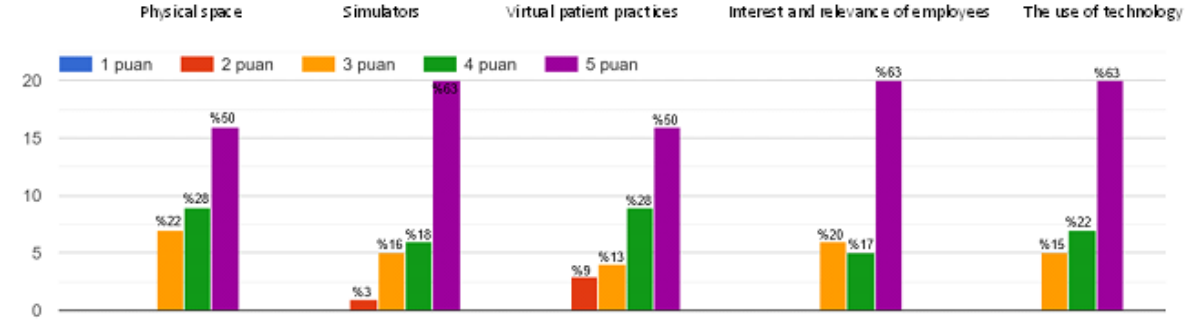

Figure 3. Evaluation of the possibilities of the simulation center

The answers to the question “What are the most impressive aspects of the Clinical Simulation Education Center?” in the satisfaction survey are shown in Figure 3. While the highest scorers with 63% were the use of technology, the interest and relevance of the employees, and the simulators, these were followed by physical space and virtual patient practices with 50% points.

DISCUSSION

Simulation-based medical education practices are innovative practices used in medical education. The increasing number of physicians and medical faculty students in recent years has caused problems in practical applications and inadequacies in education. In order to overcome these negativities, a need for simulation-based education has arisen. Simulation allows real-life events to be repeated in a safe environment, enabling students to improve their practice skills and learn about their failures. Thus, it is possible to improve students' practical skills with simulation-based education without putting the patients at risk (8).

The simulation laboratory provides different educational benefits to learn how to recognize and treat rare, complex clinical problems. The costs of simulator-based education programs include facilities, equipment, and personnel (9). R-SIM, which is within our faculty, includes these features. We have implemented a practice of simulation-based medical education with innovative learning methods and digital practices with family medicine assistants from different provinces of Turkey.

In our single-centered study with 32 people, we found a statistically significant difference between the pre-test applied to the participants before the simulation education and the post-test applied after the training ($p<0.001$). This research has shown that the use of simulation tools and education methods in specialization education after medical education can enable assistants to increase their learning qualities, improve their practice skills, and increase their level of knowledge on specialization issues.

When we examined the studies examining the relationship between the simulation education model and medical education in the literature, Issenberg et al. in a systematic analysis in which they examined simulation studies, revealed that simulation practices are tools that effectively support learning, provided that they are used in the right conditions and with appropriate methodology (10). According to Lammers et al., suitable conditions for an effective simulation education are integrating simulation practices into the education program, providing effective feedback to students during the learning experience, providing repetitive practice, increasing the difficulty level of the scenario or practice throughout the practice, keeping the educational environment under control, enabling individual learning, determining clear and measurable educational goals and outputs (11). In

our study, the pre-test mean score was 11, the post-test mean score was 22, and this difference between the tests was statistically significant ($p<0.001$). The design of our study was adjusted in accordance with the recommendations of Lammers et al. This difference between the two tests can be explained by the fact that the simulation education applied increases the knowledge and education levels of family medicine assistants compared to the pre-education period.

Studies investigating the relationship between the simulation education model and the specialization education of physicians are very limited in the literature. Okuda et al. stated that a remarkable improvement was observed in the team educated in the use of simulation in both vocational and academic emergency medicine education in a five-year emergency medicine education study (12). As far as we know, our study is the first to examine the relationship between family medicine specialization education and the simulation education model.

The post-test score was higher than the pre-test in each group categorized by gender, type of institution, year of work, and duration of the assistantship. In the light of this finding, we can say that the education provided achieved its purpose in all groups.

Simulation-based medical education is a complex service intervention that must be planned and implemented with attention to organizational contexts (13). The contributions of this form of education to the development of skills are seen as having the potential to provide a risk-free learning tool, reduce the number and effects of medical errors, facilitate open change in educational situations, increase patient safety and reduce dependency (14).

Family Medicine specialization education aims to provide opportunities suitable for the clinical knowledge, skills, attitudes, and behaviors of the assistants in line with the basic principles included in the definition of family medicine. Providing the interventional competencies included in the Family Medicine specialization education to the assistants through simulation education contributed to both patient safety and the skill level of the assistants.

The development and research of simulation-based medical education practices have grown and matured in recent years for important and methodological reasons (13). We think that simulation education is effective, useful, and a requirement due to the positive results we have obtained from the results of the practical application we have carried out.

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