Knowledge and confidence

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Research article

Knowledge and confidence levels improvement among obstetrics residents regarding caesarean section training using video-mannequins combination

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ABSTRACT

Background: Cesarean section rates are increasing worldwide. Obstetrics and gynecology residents are required to be experts in this surgery to provide safe procedures. Because of the COVID-19 pandemic situation, an alternative teaching strategy is needed to achieve adequate cesarean section skills. The purpose of this study was to identify the effect of video, mannequins, and the combination of video mannequins on residents' knowledge and confidence regarding cesarean section.

Method: A *quasi-experimental* study with pre-test and post-test designs was done. Based on stratified random sampling, 33 obstetrics and gynecology residents involved as study participant. Three groups were formed and received different interventions, learning using videos, mannequins, and a combination of video-mannequins. Two kinds of questionnaires were used to examine residents' knowledge and their confidence levels. The collected data were analyzed statistically.

Results: Video (0.42(CI95%-0.11–0.9)), mannequin simulation (0.60(CI95%-0.04–1.25)), and the combination of video-mannequin (1.3(CI95%0.73–1.93)) significantly increased resident's knowledge regarding caesarean section skill. Study participant showed increased scores regarding confidence in their caesarean section skills according to all learning subjects ($p < 0.05$) but a difference in confidence level occurred in level *C-* 7th semester residents ($p < 0.05$).

Conclusion: The combination of videos and mannequin simulations is the best method for increasing knowledge of cesarean sections, compared to single video and mannequin simulations. The confidence level has been shown to increase in all subject studies but the effectiveness at each level of resident needs to be investigated further.

1. Introduction

Cesarean delivery rates are increasing worldwide [1–3]. When performing a safe cesarean section, doctors are required to have

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proper and adequate practice [4,5]. Training in surgery was an important component of obstetrics and gynecology resident education, to serve optimum care for patients [6]. COVID-19 is an obstacle for medical students because they have to learn several special skills when providing care to patients in health facilities [7,8]. The education system needed to be reconstructed to react to this pandemic influence [9,10]. COVID-19 pandemic made some interruptions in training experiences among residents of obstetrics and gynecology [11]. Health services with patients directly become constrained because of restrictions on the mobility of people around the world. As a solution, online teaching was introduced to decrease physical contact and minimalizing COVID-19 transmission [12]. However, medical students argued that this method decreased study outcome quality, the emergence of psychological disorders, and fatigue [7, 13,14]. In addition, online learning demonstrated low technical skills of the students and social interaction [15]. They experienced a limited session of clinical supervision from lecturers [16]. As a result, this phenomenon significantly causes medical students to get lower grades than expected grades [17].

Online learning is useful for sharing knowledge [18]. However, this method did not accommodate clinical skill practice. The other learning methods were required to achieve clinical skill competencies. Mannequin simulation and video tutorials could be alternative approaches in educational institution [19]. The limited number of mannequins causes simulations using mannequins to be carried out by students at the same location and time [20].

Video tutorials and mannequin simulations were compared for effectiveness in several studies [19,20]. Previous research revealed that virtual media was more effective technique compared to face-to-face learning method [20]. Otherwise, mannequin simulation is assumed to greatly improve students' clinical skills instead of virtual coaching [21]. A systematic review explained that the combination of online and face-to-face learning substantially enhanced students' knowledge [22]. Blended learning was proven to increase medical students' understanding and clinical capability [23,24]. According to these explanations, the purpose of this study was to identify the effect of video, mannequins, and the combination of video mannequins on residents' knowledge and confidence regarding cesarean section.

2. Method

2.1. Ethics statement

The study's ethical consideration was approved by the research ethical committee of Dr. Soetomo General Academic Hospital No. 0273/KEPK/X/2021.

2.2. Study design

This research is a quasi-experimental research with pre-test and post-test designs. The research was carried out in the Department of Obstetrics and Gynecology at Dr. Soetomo General Academic Hospital-Faculty of Medicine Universitas Airlangga Indonesia from April until November 2021. The independent variables were the cesarean section training using mannequins, video, and mannequin-video combination. The dependent variable was the resident's knowledge and confidence in doing a cesarean section.

2.3. Study participant

This study involved 33 residents of Obstetrics and Gynecology at the Faculty of Medicine Universitas Airlangga Indonesia. Study participant were chosen using stratified proportional random sampling according to inclusion criteria. The inclusion criteria were residents who had not carried out independent cesarean sections as an operator. All participants were required to be in their 5th or 8th semester. The participant would be excluded if they did not follow all the sessions of cesarean section lectures and had been infected by COVID-19 during the research process.

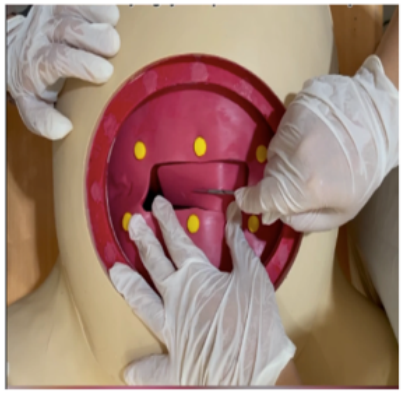

Fig. 1. The prototype of the abdominal organ.

2.4. Research instruments

Research instruments used mannequins and video as learning media. This study collaborated with a team of Design Product Experts from Institut Teknologi Sepuluh Nopember Indonesia to construct the mannequins. Institut Teknologi Sepuluh Nopember is a university that focuses on technology development. The prototype designed according to the Netter Atlas of Anatomy took 8 months to produce. The mannequin models included an abdominal organ (Fig. 1); a set of babies, an umbilicus, a placenta (Fig. 2); and a uterus (Fig. 3). Fig. 1 showed that the abdominal prototype was using for incising the lower uterine segment and expelling the baby. Fig. 2 showed that the umbilical cord is made using disposable silicone so that it can be replaced with another when cutting is done, while for babies and placenta it remains with one prototype so that it can be used repeatedly and does not damage the shape of the prototype. Fig. 3 showed that the uterus consists of the fundus and lower uterine segment for suturing.

Mannequins were formed as like the actual structure of the human body using basic materials from *liquid latex, silicone rubber RTV 48,* and a round *neodymium* magnet. A virtual video was made by researchers using a mannequin model that had been made and a caesarean section checklist that was implemented at the Department of Obstetrics and Gynecology, Faculty of Medicine, Universitas Airlangga. The 13-min video will be played 2 times. The content of the video is tutorials on practical cesarean sections using mannequins.

Study participant knowledge regarding caesarean section was assessed using pre-test and post-test questionnaires. The questionnaire was tested for validity and reliability with Cronbach's alpha on those who were not study participant. The results of the validity and reliability tests obtained 15 valid and reliable questionnaire questions. The questions in the questionnaire consist of abdominal organ anatomy, indications for caesarean section, and surgical techniques. The questionnaire was written in Indonesian and then translated into English (translated by author). Measurement of resident confidence in carrying out caesarean section was carried out using pre-simulator and post-simulator questionnaires. Study participants were asked to answer five questions with 4 levels of the Likert scale, namely very poor, poor, enough and good. The confidence questionnaire was tested for validity and reliability based on the professional judgment of 2 obstetricians and gynecologists. The questionnaire can be found in the supplementary file.

2.5. Research procedures

Stratified random sampling was performed in assigning the respondents into the three groups. Strata are formed based on the similarity of attributes or characteristics of members, in this study, namely the level of resident education. The first group received a video tutorial about caesarean section procedures. The first group was given knowledge and confidence assessment regarding caesarean section then the video is played for 13 min 2 times. Study participants were then asked to fill out a post-test questionnaire. The second group received a mannequin models simulation. The second group underwent a knowledge and confidence assessment and then demonstrated using a caesarean section mannequin model. Study participants also tried caesarean section techniques on the model at least 2 times. After being given a demonstration of a simulation model and experiments with mannequins, the research subjects were assessed by completing knowledge test posts and self-confidence assessments. The third group received a combination of video tutorials and mannequin simulation. The third group underwent a knowledge and confidence assessment. After filling out the questionnaire, a 13-min video was played, accompanied by a demonstration using caesarean section mannequin model. Study participants also tried caesarean section techniques on the model at least 2 times. After that, study participants were then asked to fill out a post-test questionnaire. Pretest and posttest assessments are given in all group 1 week apart. To prevent participants from sharing material such as videos, the researcher played the video using zoom for two views and then was given an evaluation questionnaire. There were 2 resident in group 2 who dropped out because of COVID-19.

2.6. Data analysis

Data were analyzed descriptively and statistically. Residents are divided into several levels, namely level A, B, C, and senior level. Level A is a 5th semester resident, level B is a 6th semester resident, level C is a 7th semester resident and senior level is an 8th semester resident. Clinical experience is divided into 2, namely <3 years and >3 years. The intended clinical experience is generally practice in

Fig. 2. A baby prototype set (including baby, placenta, and umbilical).

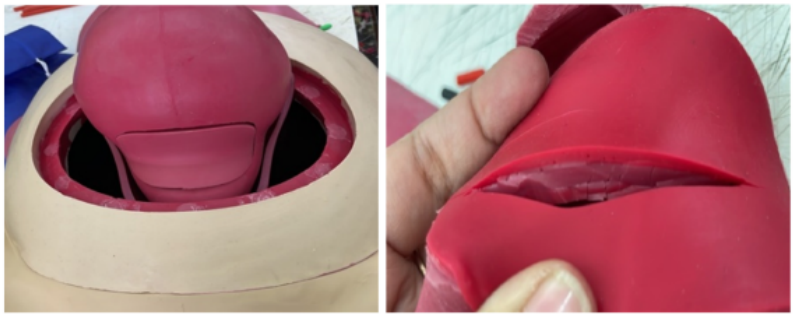

Fig. 3. The uterus prototype.

obstetrics and gynecology such as in pregnancy care, oncology, etc. The data would be analyzed statistically using SPSS 26.0 application. Pre-test and post-test data were analyzed using the Wilcoxon Signed-Rank Test (significant at $p < 0.05$). The data were also tested using the Kruskal Wallis Test (significant at $p < 0.05$). Lastly, this study uses the Mann-Whitney test to examine the effect between the 2 variables (significant at $p < 0.05$).

3. Results

3.1. Respondent's characteristics

The age of the respondents ranged from 28 years to 38 years. Study participants are divided proportionally according to their level. Although the number of residents from Levels A to C varies, this study places 2 senior residents in each group. This study mostly involved male residents. Most study participants had more than 3 clinical experiences in hospitals related to obstetrics and gynecology. This study found that Level B and Level C residents had less clinical experience. Age, level, gender and clinical experience were not statistically different (see Table 1).

3.2. Resident's knowledge and confidence

All study participant demonstrated enhanced knowledge of cesarean section after obtaining the interventions. Statistical analysis presented $p < 0.05$ ($p = 0.038$), which pointed out that mannequin simulation, video tutorial, and the combination of video-mannequin simulation could be an effective method (see Table 2). Third group showed significant differences between the pre-test and post-test (1.3 (CI95%0.73–1.93)). First group and second group presented slight mean differences (0.42 (CI95%-0.11–0.9) vs. 0.60 (CI95%-0.04–1.25). Table 2 was data from questionnaire 1: Knowledge pretest and posttest questionnaire (see supplementary file).

Respondents also showed increased scores regarding confidence in their caesarean section skills according to learning subjects ($p < 0.05$). A significant difference occurred in level C residents who were more confident after the intervention (mean = 1.07). All study participants presented an average difference of more than 0.05 in the subjects studied (see Table 3). The confidence level regarding cesarean section procedures during the pre-test remained low with a score of 2.8. This score has elevated to 3.4 in the post-test. Table 2 was data from questionnaire 2: pre-simulator survey sheet and post survey simulator confidence (See the supplementary file).

Table 1
Respondent's characteristics.

Demographic	Group			p-value
	Group I (Video)	Group II (Mannequins)	Group III (Combination)	
Age (years)	31 (28–36)	32 (29–38)	30 (28–34)	0.174
Resident Level				
Level C	2 (18.2%)	2 (18.2%)	4 (36.4%)	
Level B	3 (27.3%)	3 (27.3%)	2 (18.2%)	
Level A	4 (36.4%)	4 (36.4%)	3 (27.3%)	
Senior Level	2 (18.2%)	2 (18.2%)	2 (18.2%)	0.797
Gender				
Male	7 (63%)	7 (63%)	6 (54%)	0.884
Female	4 (37%)	4 (37%)	5 (46%)	
Clinical experiences				
<3	4	5	5	0.102
>3	7	6	6	

Table 2
Respondent's knowledge.

	Group I (Video)		Group II (Mannequins)		Group III (Combination)		p-value
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	
Mean	(7.2 ± 0.9)	(7.6 ± 0.7)	(7.3 ± 1.2)	(8.0 ± 0.5)	(7.0 ± 1.0)	(8.3 ± 0.8)	0.038
Mean's Differences	0.4 (CI95%-0.1–0.9)		0.6 (CI95%-0.0-1.2)		1.3 (CI95%0.7–1.9)		

4. Discussion

4.1. Key result

The combination of video tutorials and mannequins was the most effective media to increase residents' knowledge significantly. Confidence level increases significantly only occurred in 7th semester residents or level C.

4.2. Interpretation

The video tutorial and mannequin simulation combination significantly improved residents' knowledge about cesarean section surgery. Compared to the single intervention of video and mannequin simulation, this combination showed the highest improvements in residents' cesarean section understanding. This result was supported by previous research, which mentioned that the integrated simulation method and video tutorial escalated cognitive and clinical abilities compared to the single learning method, especially for health professionals and medical students [25–27]. Although it would be influenced by several factors, this combination method improved the theoretical knowledge of residents [23]. Blended virtual video and face-to-face simulation was considered to be an effective approach to link theoretical knowledge and clinical practice [23,24]. The combination of video and mannequin simulation could be an appropriate method to advance cesarean section knowledge for obstetrics and gynecology residents.

The intervention using a single mannequin simulation also displayed knowledge enhancement. According to the study result, this research disclosed that mannequin simulation showed better influence to increase understanding, instead of video tutorial. Previous literature reviews mentioned that this mannequin became an excellent simulation media [28]. Furthermore, a recent study claimed cesarean section practice using mannequin simulation demonstrated important knowledge improvement, particularly in suturing ability [29]. Simulation of clinical practice improved performance more than a single video tutorial in medical students [19]. This method allowed residents to gain experiment chances repeatedly along with a minimum stress environment [29]. Simulation using a mannequin is considered as a complementary medium for learning caesarean section, because the mannequin can be adjusted similar to the management of patients [30].

Video tutorial intervention demonstrated knowledge development, even though it displayed the lowest enhancement score. A study endorsed that online learning was able to improve students' knowledge and skill [10]. This method provided diseases explanation and became an alternative media to practice residents' communication ability [7,31]. Nevertheless, this tutorial video was inadequate to improve clinical ability as the residents did not have any opportunity to try a caesarean section using actual media [7,31]. These reasons led to the low improvement score of this group's intervention. Virtual video authorized the residents to explore their audio and visual senses but did not improve their practical competencies. The use of video tutorials as a medium to reach cesarean section competency was not commonly carried out in frequent courses, however, it was employed as an additional method in a real cesarean section preparation [28].

Educational intervention for residents essentially escalated their self-confidence in doing surgery [32]. This study found that video and mannequin simulation increased residents' self-confidence levels in the cesarean section only in 7th semester resident. Research confirm that intervention using virtual video was suitable as a media to elevate self-confidence of surgery competency [33]. In addition, the mannequin simulation developed residents' self-confidence, so it caused a relaxed and calm situation among residents [30]. Developments in simulation technology can help improve the operating experience [34]. Surgery learning at university levels presented an association with low confidence during surgery performance [34]. The type of clinical training program and the kind of

Table 3
Respondent's confidence level.

	Pre-test	Post-test	Mean Differences	p value
Learning subjects				
Instrument understanding	3.0	3.5	0.5	<0.001
Structure of abdominal wall	3.0	3.6	0.5	<0.001
Caesarean section procedure	2.8	3.4	0.6	0.001
Suturing	3.1	3.7	0.5	<0.001
Residents Level				
Level C	2.4	2.5	1.0	0.026
Level B	3.0	3.2	0.1	0.301
Level A	3.2	3.6	0.3	0.058
Senior Level	3.2	3.7	0.4	0.068

hospital also affected the confidence in their surgery ability [35]. The number of surgery performances could develop residents' confidence to perform a surgery independently [35]. Training programs by forming groups of 4–5 residents can increase operating confidence [34].

4.3. Limitation and recommendation

This research is an initial study that learn the effect caesarean section mannequins in medical learning. This study was a single center study with a small sample size so further investigation is needed. This study also has not examined the difference in scores on the pre-test in interpretation. In addition, there may be bias in the use of the questionnaire. The recommendation for further research is that although knowledge and confidence were investigated in this research, it may be useful to follow up on the resident subsequent performance in clinical practice to evaluate long-term.

5. Conclusion

The combination of videos and mannequin simulations is the best method for increasing knowledge of cesarean sections, compared to single video and mannequin simulations. The confidence level has been shown to increase in all subject studies but the effectiveness at each level of resident needs to be investigated further.

Author contribution statement

Eighty Mardiyan Kurniawati: Conceived and designed the experiments; Performed the experiments; Wrote the paper.
Citra Aulia Bachtiar: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.
Hermanto Tri Joewono: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.
Budi Utomo: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data included in article/supplementary material/referenced in article.

Declaration of interest's statement

The authors declare no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e13907.

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