Heliyon 9 (2023) e15942

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Inclusion of the workshop model in the standardized training of emergency medicine residents

Jin Ma, Qiang Wang, Xiaohua Xia, Zhiqiang Guo, Qiupeng Feng, Yan Zhou, Hua Yuan *

Department of Emergency Medicine, Affiliated Kunshan Hospital of Jiangsu University, Kunshan 215300, PR China

ARTICLE INFO

Keywords:
Workshop model
Teaching model
Emergency medicine
Standardized training of resident physicians
Satisfaction

ABSTRACT

Background: Standardized training of resident physicians (STRP) includes clinical practice, professional required courses, and public required courses, among others. Of them, clinical practice is the most important as it allows residents to implement what they have learned in theoretical education to practice. Clinical practice includes different teaching methods, such as traditional lectures, bedside teaching, and workshops, and each method has its advantages and disadvantages in different situations of interest. Emergency medicine (EM) focuses on the diagnosis and treatment of urgent medical conditions and entails several emergency procedures. In this study, we aimed to compare the effects of workshop-based STRP and traditional STRP on emergency physicians.

Methods: Overall, 125 residents who received STRP in EM between January and December 2021 were selected and randomly divided into two groups: the control group ($n = 60$; received traditional teaching) and the intervention group ($n = 65$; received workshop-based training). The theoretical performance, operative performance, and satisfaction of both groups were compared and analyzed.

Results: Regarding theoretical assessment, the scores of airway management, cardiopulmonary resuscitation, and trauma management in the intervention group were 4.81 ($t = 5.82$, $p < 0.001$), 6.90 ($t = 7.72$, $p < 0.001$), and 5.25 ($t = 6.14$, $p < 0.001$), respectively. Regarding skill assessment, the scores for the same items in the intervention group were 4.43 ($t = 5.30$, $p < 0.001$), 4.55 ($t = 5.61$, $p < 0.001$), and 5.62 ($t = 6.65$, $P < 0.001$), respectively. Regarding satisfaction evaluation, the scores in the intervention group were 1.99 ($t = 6.03$, $p < 0.001$), 1.98 ($t = 6.41$, $p < 0.001$), and 1.96 ($t = 6.14$, $p < 0.001$), respectively. Overall, the scores were higher in the intervention group than in the control group.

Conclusion: The workshop training model effectively improves the theoretical knowledge and practical skills of EM residents undergoing standardized training. The residents found the training and its outcomes satisfactory, ultimately improving their emergency response and first-responder skills.

* Corresponding author. Department of Emergency Medicine, Affiliated Kunshan Hospital of Jiangsu University, No. 91 Qianjin West Road, Kunshan, 215300, China.

E-mail address: yeking3@hotmail.com (H. Yuan).

https://doi.org/10.1016/j.heliyon.2023.e15942
Received 14 January 2023; Received in revised form 24 April 2023; Accepted 27 April 2023
Available online 29 April 2023

1. Introduction

Emergency medicine (EM) is an important specialty that includes the diagnosis and treatment of patients with life-threatening or urgent medical conditions. The EM curriculum includes basic theoretical knowledge and practical skills. The condition of patients admitted to the emergency department is often complex, and healthcare professionals involved in rescuing them are in a proverbial race against time. As a result, the field of EM necessitates comprehensive and high-quality knowledge among emergency physicians. However, resident physicians undergoing standardized training have limited experience, and their knowledge of first-responder skills may not be comprehensive, particularly because of unfamiliar operating skills. Subsequently, they may have fewer opportunities for disease analysis and participation in the diagnosis and treatment of patients [1,2]. Moreover, the characteristics of patients in critical condition, including rapid changes in the clinical course, and the complex skills required for certain procedures greatly increase the difficulty for residents to effectively implement their theoretical knowledge and practical skills.

Although some residents possess a certain amount of theoretical knowledge, their inability to efficiently and scientifically combine theory and practice can hamper their clinical practice ability [3,4]. For residents receiving standardized training in EM, after familiarizing themselves with the daily activities of the undergraduate room, they often need to clinch the diagnosis from urgent, complex, and critical disease presentation; devise treatment options; and learn the diagnosis and treatment related to EM. Procedures such as tracheal intubation, ventilator use, cardiopulmonary resuscitation (CPR), bedside ultrasound, deep venous catheterization, and others are crucial for optimum diagnosis and treatment; therefore, intensive and comprehensive surgical-skill training for residents should be one of the main focus of clinical teaching [5,6]. Given that considerable risks are involved in treating critically ill patients highlight the need for extensive training [7,8]. A few colleges and universities have introduced the workshop model, a student-centered, interactive teaching method that uses clinical models to explain practical procedures, to the teaching process. As facilitators, teachers guide students and allow them to form their views through activities, discussions, and short speeches, among others, to promote the construction of their knowledge and improve independent and comprehensive learning abilities. In particular, workshops cultivate practical skills and are, therefore, one of the commonly used teaching methods in medical education [9].

At present, workshops are gradually being incorporated into the teaching process because they are conducive to establishing students in a dominant position during teaching. Considering that workshops consolidate theoretical knowledge in practice, improve hands-on ability, and increase awareness of teamwork, they have ideal pedagogical effects [10–13]. In this study, we aimed to analyze the effect of incorporating the workshop teaching model into the standardized training for EM residents at our hospital.

2. Materials and methods

2.1. Demographic information

Overall, 125 residents who received standardized EM training in our hospital between January and December 2021 were selected and randomly divided into two groups: the control group and the intervention group. The control group consisted of 60 participants (34 male and 26 female) aged 24–28 (average 26.4 ± 1.7) years. The intervention group consisted of 65 participants (35 male and 30 female) aged 24–29 (26.5 ± 1.2) years. There were no statistical differences in demographics between the two groups ($p > 0.05$).

This study has been approved by the Medical Ethics Committee of Affiliated Kunshang Hospital of Jiangsu University (No.2021-01-03-01), and informed consent was obtained from all participants prior to their inclusion in the experiments.

2.2. Methods

Combined with the standardized training of resident physicians (STRP) curriculum at our hospital, the practical skills course aimed to help residents to master first-responder skills that can be proficiently applied in future clinical settings. The main items of this course were as follows: 1) Airway management, including tracheal intubation and ventilator use; 2) CPR; and 3) treatment of multiple injuries. The teaching items for practical skills were the same in both groups. The training lasted approximately 4–5 h a day.

2.2.1. Specific teaching plan for each group

Control group: In this group, the traditional teaching model was implemented. The teacher provided theoretical knowledge related to the procedure using presentations and books on stage and by playing a high-quality surgical video. Hereafter, another teacher demonstrated the surgery on spot. Then, the residents were allowed to perform the surgery independently under the guidance of two instructors. During this time, if the residents encountered any challenges, they were assisted accordingly.

Research group: Four standardized training residents formed a practical research group. Each resident was allowed to serve as a group leader for different teaching projects. The group leader was responsible for organizing group members to discuss theoretical knowledge related to practical operations. Prior to starting the practical course, the teacher briefly explained the process and format of the teaching model, followed by presentations, videos, and other multimedia materials to explain the skills of a first responder. In addition, prior to performing the procedures in the three workshop teaching projects, the teacher briefly explained the theoretical knowledge, important precautions, and details related to each operation. Hereafter, another teacher demonstrated the operation. Each research group then had group discussions and designed various practices under the supervision of a team leader. After creating a plan, each team member operated in an orderly turn. During the operation, when team members detected problems or errors with each other's performance, they first discussed them amongst themselves, and if the question remained unanswered, the two instructors were consulted for guidance and correction.

2.3. Evaluation of the teaching effect

Combined with the curriculum training objectives and assessment methods of the hospital, the evaluation of the teaching effect mainly included the following three indicators: 1) Theoretical assessment of emergency medical procedures, including airway management, CPR, and trauma, which was a total of 100 points; 2) EM operative assessment, including three practical assessments, with each carrying a total of 100 points; 3) satisfaction survey, with a satisfaction questionnaire based on a 5-point Likert scale (1 = least satisfaction and 5 = most satisfaction). The evaluation included 10 items, with a maximum score of 50 points (see Table 1).

2.4. Statistical methods

Data were analyzed and processed using statistical software SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Quantitative data were expressed as mean ± standard deviation (x ± s). Numerical data were analyzed using paired t-tests. A p-value <0.05 was considered statistically significant.

3. Results

The results of the study showed that the scores for theoretical assessment (Table 2) and practical skills in airway management, CPR, and trauma management (Table 3) were significantly higher in the research group than in the control group ($p < 0.05$).

Moreover, the satisfaction score for the training in airway management, CPR, and trauma rescue was significantly higher in the intervention than in the control group ($p < 0.05$) (see Table 4).

4. Discussion

STRP is work-based learning and based on clinical guidance, and it is highly practical. STRP mainly focuses on mastering theoretical knowledge and is, therefore, different from a college education. In addition, it focuses on priming residents for clinical practice. Clinicians are clear regarding the requirements for mastering clinical practice and its related abilities [14]. EM has flourished in recent years; however, due to the nature of its setting and the skills required, the development of clinical teaching for EM is not at par with real-life clinical settings. Therefore, to further improve standardized training in EM, it is important that residents promptly and comprehensively master the knowledge of EM. In this study, we implemented the workshop model in the standardized training process of EM residents, who are tasked with handling relatively urgent, complex, and critical conditions that require extensive theoretical and practical surgical skills. As the model focuses on teacher–student interactions and there is the availability of clinical models for practical skills, the training in the research group was significantly better than in the control group. In addition, the residents of the research group were more satisfied with the teaching process and outcomes.

Furthermore, the results of the study showed that the theoretical and practical scores of the research group were significantly higher than those of the control group ($p < 0.05$). This indicated that the implementation of the workshop model in the training significantly improved the residents' learning efficiency and increased their interest in learning. This positive outcome may be attributed to the following reasons. First, the workshop model was student-centered, and the teacher played the role of a guide, supervisor, and evaluator of the teaching process, rather than only mechanically transmitting knowledge. Prior to starting each course, the instructor provided a detailed explanation of the key points, skills, and specifications related to the procedure, based on their own experience, to promote the learners' knowledge regarding operative specifications and enhance their technical mastery. Second, the workshop teaching model stimulated the enthusiasm for learning among residents [15,16], encouraging them to use different methods to obtain relevant knowledge and literature and be familiar with the process independently. After the course, the residents were able to effectively communicate their experiences, the challenges they encountered, reflect on other contents of the course, and jointly formulate effective solutions. Consequently, this greatly broadened their clinical thinking skills and improved their ability to analyze and solve critical and urgent problems. Third, the model focuses on a combination of theory and practice. Through the process of simulation and the use of well-designed scenes, students were immersed in the learning process, and the hands-on practice enabled them to address the pedagogical error of emphasizing theory and ignoring the practical aspects. Lastly, the interactive workshop model

Table 1
Contents of the satisfaction survey.

No.	Project name	Very satisfied	Satisfied	Not necessarily	Dissatisfied	Very dissatisfied
1	Overall satisfaction	5	4	3	2	1
2	Clinical thinking ability improved	5	4	3	2	1
3	Clinical practice ability improved	5	4	3	2	1
4	Language skills improved	5	4	3	2	1
5	Communication skills with patients enhanced	5	4	3	2	1
6	Communication skills with colleagues improved	5	4	3	2	1
7	Interest in learning increased	5	4	3	2	1
8	Basic knowledge consolidated	5	4	3	2	1
9	Ability to collect and consult information improved	5	4	3	2	1
10	Helpful for future work	5	4	3	2	1

Table 2
Comparison of theoretical assessment scores.

Group	No. of cases	Airway management	CPR	Trauma treatment
Intervention group	65	85.86 ± 4.66	86.78 ± 5.05	85.62 ± 4.73
Control group	60	81.05 ± 4.57	79.88 ± 4.93	80.37 ± 4.80
t		5.8225	7.7170	6.1449
p		<0.05	<0.05	<0.05

CPR, cardiopulmonary resuscitation.

Table 3
Comparison of skills assessment results.

Group	No. of cases	Airway management	CPR	Trauma treatment
Intervention group	65	85.40 ± 4.74	85.78 ± 4.60	85.55 ± 4.63
Control group	60	80.97 ± 4.60	81.23 ± 4.45	79.93 ± 4.81
t		5.3015	5.6123	6.6519
p		<0.05	<0.05	<0.05

CPR, cardiopulmonary resuscitation.

Table 4
Satisfaction survey comparison table.

Group	No. of cases	Airway management	CPR	Trauma treatment
Intervention group	65	46.74 ± 1.78	46.56 ± 1.65	46.86 ± 1.71
Control group	60	44.75 ± 1.91	44.58 ± 1.79	44.90 ± 1.86
t		6.0265	6.4101	6.1439
P		<0.05	<0.05	<0.05

CPR, cardiopulmonary resuscitation.

incorporates group discussion, situational demonstration, summaries, and reporting methods; encourages students to share their feelings; summarizes their learnings; and cultivates clinical thinking, communication, and teamwork abilities.

In addition, the improved satisfaction with the workshop model could be attributed to the following reasons. First, in traditional teaching methods, the opportunity for residents to practice is limited, and those who have received standardized training can have an intuitive impression only after repeated observation of the procedure. On the other hand, workshops for clinical training can give full play to the training physicians' subjective initiative, allowing residents to systematically study and practice first-responder skills in a short period and improve their learning efficiency. Second, during the training process, the residents' thinking ability could be enhanced, which is conducive to improvements in relevant theoretical knowledge and practical operative abilities, thus further increasing the residents' awareness of acute and critical diseases. Third, EM is often intertwined with multiple disciplines and fields; therefore, it is critical to have solid theoretical knowledge to be competent in this field. Regarding approaches to learning, students inevitably find the content difficult to comprehend through lectures, eventually losing interest in EM as well as the courage to engage in professional work. On the contrary, workshop-based teaching breaks the boundaries between teachers and students, fostering a new connection between them. It enables teachers to inspire and assist students and solve challenges collectively. During the operation, teachers and students can engage in open communication at any time, which would not only deepen their understanding but also help them truly appreciate the value of knowledge for clinical work.

In conclusion, the implementation of the workshop teaching model in EM training is conducive to the prioritization of resident physicians undergoing standardized training during the teaching period. It helps build a strong foundation; strengthens practical abilities; consolidates theoretical knowledge in practice; and cultivates comprehensive abilities, including clinical thinking, communication, humanistic quality, and teamwork, among others.

Nonetheless, this study has some limitations. First, the assessments were conducted immediately after the training; therefore, the information learned was still fresh in their memories. A study suggested that approximately two-thirds to three-fourths of knowledge in medical education will be retained after 1 year and further reduce the following year [17]. Further studies conducting assessments 1 month or 1 year after training to test the students' mastery of theoretical knowledge and skills are required. Second is the small sample size. The students were randomly divided into groups, which may have created selection bias. Lastly, although the students' demographics were compared, their clinical and knowledge skills were not evaluated. The workshop tool was used to assess whether clinical and theoretical knowledge could have the risk of bias. In the future, we intend to process the data further and conduct extensive research.

Author contribution statement

Jin Ma: Performed the experiments; Analyzed and interpreted the data; Contributed materials, analysis tools or data; Wrote the

paper.

Qiang Wang: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed, materials, analysis tools or data; Wrote the paper.

Xiaohua Xia: Performed the experiments; Analyzed and interpreted the data; Contributed materials, analysis tools or data.

Zhiqiang Guo, Qiupeng Feng, Yan Zhou: Contributed materials, analysis tools or data.

Hua Yuan: Conceived and designed the experiments; Contributed materials, analysis tools or data; Wrote the paper.

Data availability statement

Data included in article/supp. Material/referenced in article.

Additional information

Supplementary content related to this article has been published online at [URL].

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

We thank all the residents who took part in our study. We thank our colleagues in the nursing department and medical laboratory for their guidance.

References

[1] J.W. Hurst, The overlecturing and underteaching of clinical medicine, Arch. Intern. Med. 164 (15) (2004 Aug 9-23) 1605–1608, https://doi.org/10.1001/archinte.164.15.1605.

[2] T.M. Chan, K. Van Dewark, J. Sherbino, A. Schwartz, G. Norman, M. Lineberry, Failure to flow: an exploration of learning and teaching in busy, multi-patient environments using an interpretive description method, Perspect Med Educ 6 (6) (2017 Dec) 380–387, https://doi.org/10.1007/s40037-017-0384-7.

[3] E.S. Holmboe, Faculty and the observation of trainees' clinical skills: problems and opportunities, Acad. Med. 79 (1) (2004 Jan) 16–22, https://doi.org/10.1097/00001888-200401000-00006.

[4] H. Guo, H.J. Qi, X.R. Li, N. Xu, Q. Zhao, Z.S. Shen, Y.J. Jia, Effect of a template case report based on cognitive task analysis on emergency thinking ability of resident doctors in standardized training, Patient Prefer. Adherence 15 (2021 Jul 15) 1585–1591, https://doi.org/10.2147/PPA.S302025.

[5] J.L. Trainor, S.E. Krug, The training of pediatric residents in the care of acutely ill and injured children, Arch. Pediatr. Adolesc. Med. 154 (11) (2000) 1154–1159, https://doi.org/10.1001/archpedi.154.11.1154.

[6] P.K. Gala, K. Osterhoudt, S.R. Myers, M. Colella, A. Donoghue, Performance in trauma resuscitation at an urban tertiary level I pediatric trauma center, Pediatr. Emerg. Care 32 (11) (2016) 756–762, https://doi.org/10.1097/PEC.0000000000000942.

[7] A. Mikrogianakis, M.H. Osmond, J.E. Nuth, A. Shephard, I. Gaboury, M. Jabbour, Evaluation of a multidisciplinary pediatric mock trauma code educational initiative: a pilot study, J. Trauma Inj. Infect. Crit. Care 64 (3) (2008) 761–767, https://doi.org/10.1097/TA.0b013e3180341ff8.

[8] M.M. Knudson, L. Khaw, M.K. Bullard, R. Dicker, M.J. Cohen, K. Staudenmayer, J. Sadjadi, S. Howard, D. Gaba, T. Krummel, Trauma training in simulation: translating skills from SIM time to real time, J. Trauma 64 (2) (2008) 255–263, https://doi.org/10.1097/TA.0b013e31816275b0.

[9] E.C. Corbett Jr., N.J. Payne, E.B. Bradley, K.L. Maughan, E.B. Heald, X.Q. Wang, Enhancing clinical skills education: university of Virginia school of medicine's clerkship clinical skills workshop program, Acad. Med. 82 (7) (2007 Jul) 690–695, https://doi.org/10.1097/ACM.0b013e31806745b4.

[10] P. Sricharoen, C. Yuksen, Y. Sittichanbuncha, K. Sawanyawisuth, Teaching emergency medicine with workshops improved medical student satisfaction in emergency medicine education, Adv. Med. Educ. Pract. 6 (2) (2015) 77–81, https://doi.org/10.2147/AMEP.S72887.

[11] M.N. Kelley, L. Mercurio, H.S. Tsao, V. Toomey, M. Carillo, L. Brown, R. Wing, Excellence in communication and emergency leadership (ExCEL): pediatric primary and secondary survey in trauma workshop for residents, MedEdPORTAL 17 (2021 Jan 22), 11079, https://doi.org/10.15766/mep_2374-8265.11079.

[12] C.H. Chan, T.N. Chan, M.C. Yuen, W.K. Tung, Evaluation of a simulation-based workshop on clinical performance for emergency physicians and nurses, World J Emerg Med 6 (1) (2015) 16–22, https://doi.org/10.5847/wjem.j.1920-8642.2015.01.003.

[13] J.R. Holland, R.F. Latuska, K. MacKeil-White, D.A. Ciener, A.A. Vukovic, Sim one, do one, teach one": a simulation-based trauma orientation for pediatric residents in the emergency department, Pediatr. Emerg. Care 37 (12) (2021 Dec 1) e1285–e1289, https://doi.org/10.1097/PEC.0000000000002003.

[14] J.R. Hayes, J. Zeman, B. Johnston, N. Campbell, Outpatient teaching and feedback skills workshop for resident physicians, MedEdPORTAL 16 (2020 Jul 31), 10930, https://doi.org/10.15766/mep_2374-8265.10930.

[15] M. Fatmi, L. Hartling, T. Hillier, S. Campbell, A.E. Oswald, The effectiveness of team-based learning on learning outcomes in health professions education: BEME Guide No. 30, Med. Teach. 35 (12) (2013 Dec) e1608–e1624, https://doi.org/10.3109/0142159X.2013.849802.

[16] J. Jünger, S. Schäfer, C. Roth, D. Schellberg, M. Friedman Ben-David, C. Nikendei, Effects of basic clinical skills training on objective structured clinical examination performance, Med. Educ. 39 (10) (2005 Oct) 1015–1020, https://doi.org/10.1111/j.1365-2929.2005.02266.x.

[17] E.J.F.M. Custers, Long-term retention of basic science knowledge: a review study, Adv Health Sci Educ Theory Pract 15 (1) (2010 Mar) 109–128, https://doi.org/10.1007/s10459-008-9101-y.