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REVIEW

An Effective Triage Education Method for Triage Nurses: An Overview and Update

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Background: Accurate decision-making in triage largely determines the amount of time required for a patient to be evaluated and treated while in the emergency department. Nursing staff worldwide have similar learning characteristics with similar working hours and common goals, despite the fact that different triage scales are used globally. The aim of this mini review is to present the different educational methods and identify the most effective for triage training of triage nurses.

Materials and Methods: We screened studies concerning triage education for nurses in Emergency Department, in databases including PubMed, CENTRAL and CINAHL. From November 12, 2023 to February 15, 2024, databases were searched for relevant literature. "Triage education" OR "triage training" AND "emergency nurses" OR "triage nurses" were the MeSH terms.

Results: There are various educational methods, including traditional, web-based, audiovisual, simulation-based, blended learning, and other specialized approaches. Almost all of the studies that are currently available demonstrate how effectively an educational intervention might improve nurses' comprehension of triage. Except for one, every study concluded that the educational intervention significantly improved nurses' triage knowledge. Comparing the included studies is challenging due to their heterogeneity, and applying the results in practice requires caution.

Conclusion: The majority of studies reported that educational interventions effectively increased nurses' triage knowledge. Blended learning in conjunction with refresher courses enhanced triage-related knowledge and decision-making; however, additional research is required to ascertain whether this approach is superior to the others and whether these improvements will last.

Keywords: educational method, emergency department, triage education

Introduction

Emergency departments (EDs) serve a critical role in health systems.[1] One of the most persistent problems remains overcrowding, whose main cause is the reduced availability of resources in comparison to the increased demand for care.[1,2] A key role in optimizing the patient's wait time is played by the process of triage, which refers to the initial clinical assessment of the patient who visits the ED.[3] It entails an immediate assessment of the patient's medical condition and classifies it as critical, emergency, urgent and non-urgent.[3] There are several different triage scales that have been developed and used worldwide, but their predominant characteristic is to accurately identify the level of urgency.[4] Different triage scales have different aspects and goals, and the ED's particular needs and context determine which scale is ideal.[5]

The choice of the appropriate triage scale depends on the individual and unique characteristics of the ED.[4] Triage decision-making is typically handled by triage nurses, with the occasional involvement of a senior doctor.[2,6] The triage nurses remain at the forefront of providing better health care to emergency room patients as they accurately assess immediate and critical care situations.[7] Nonetheless, since they refer to a particular adult population, the characteristics of triage nurses' educational needs are similar.[8] There is limited published evidence concerning the optimal educational method to enhance prioritizing care and decision-making in the ED by triage nurses.

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Finding the most effective training approach for triage nurses aims to improve professional qualifications, integrate prior knowledge and build competencies. Thereby, education can influence their attitudes or behaviors in order to provide better health services to patients in the ED.[9]

Adult learners like a group of nurses have specific characteristics that differentiate them from children.[10] Therefore, the design of an educational method should take those into account. Adults in general, including nurses, participate in education programs with specific objectives, either professional ones or related to their personal development, and they do so with specific expectations.[10] They have already developed their knowledge, had a wide range of experiences, and formed perceptions.[11] They seek active participation in their training and often wish to be involved in all stages of the education process; they have their own personal learning style and strategy, in line with their abilities, experiences, and general personality traits.[12] As a result, an effective teaching method for adults should take into account all of the above, to ensure active participation and prevent loss of interest.

Nevertheless, their competing interests, obligations, duties, and commitments pose barriers to the learning process.[13] Barriers to learning are the defense mechanisms that adults develop to avoid having their beliefs, and perceptions, or even habits challenged.[13]

In general, nurses are a heterogeneous group of adults, which consists of different genders, age groups, levels of knowledge and experience in medicine, especially when it comes to their learning styles with respect to triage training.[14,15] Assessing the learning needs of nurses is essential to planning effective triage education. The aim of this article is to identify and present data regarding the most effective educational framework for triage nurses.

Methodology

We conducted a literature search to identify pertinent studies concerning triage education for nurses in ED. Study eligibility was independently assessed by two investigators (SCZ and MZ) through the examination of article titles and abstracts, with full-text review undertaken when necessary. The included articles arising from both investigators happened to coincide. Besides PubMed, CENTRAL and CINAHL, we also screened preprint servers, namely medRxiv and Research Square, to identify recent evidence and trends. Our search strategy incorporated the following keywords: (“triage education” OR “triage training”) AND (“emergency nurses” OR “triage nurses”).

We included studies conducted on educational interventions targeted at enhancing triage skills and knowledge among emergency department nurses. Various educational methods, including traditional, web-based, audiovisual, simulation-based, blended learning, and specialized approaches, were considered. We only included studies which involved emergency or triage nurses as participants, and were published in peer-reviewed journals. Preprints on platforms such as medRxiv and Research Square were not included, but were only searched up in order to find new evidence or trends. Eligible articles were only those published from November 12, 2023 to February 15, 2024. Studies not meeting these criteria, or those focusing on healthcare professionals (including students or graduates) other than nurses, or those lacking an educational intervention component were excluded. Finally, we only included articles written in English (Figure 1). The extracted data were organized according to key themes relevant to triage education for nurses in ED. These data are depicted in Table 1.

Results

The first method of teaching described in the included articles was the so-called “old” method of teaching, which revolves around lecture- and paper-based learning. We identified four articles describing this method. It is teacher-based and was the first education approach in human history to transmit fixed knowledge to learners.[32] Therefore, it is not one of the commonly used teaching methods in triage or it is used in combination with other methods.[16,17] One study by Moon SH et al, describes the use of the traditional teaching method in combination with video cased-scenarios to improve the efficacy of triage training on nurses.[17]

The development in the fields of science and technology has contributed to the introduction of modern and advanced teaching methods. The efficacy of these methods, which are mostly based online, was tested during the COVID-19 pandemic; before this period, it was only scarcely used.[33] A total of seven studies investigated this method. Apart from that, a series of three recent studies have indicated that e-learning is most preferred in the triage education of

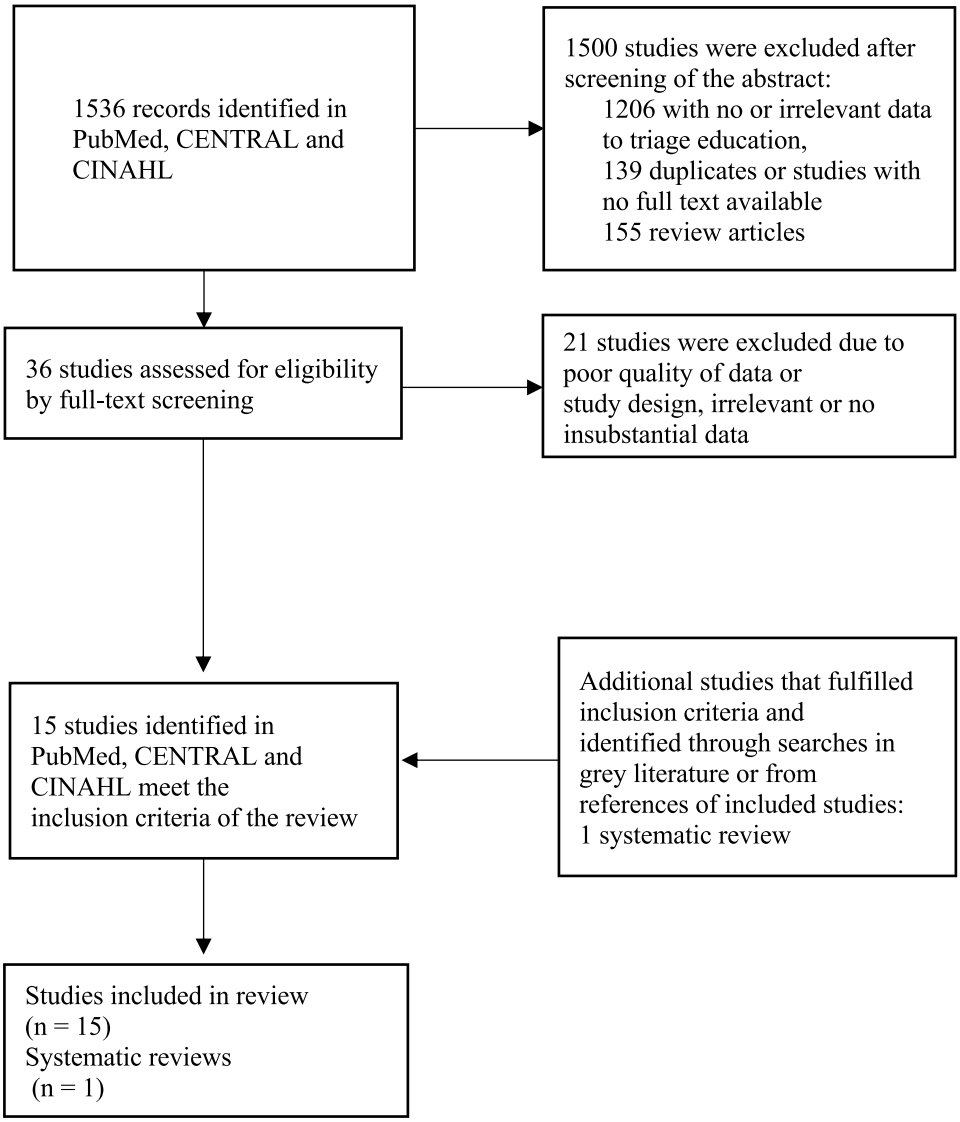

Figure 1 Flow diagram of the study (PRISMA flowchart).

nurses.[20,24,34] For instance, this was successfully established as a new teaching strategy by Campbell et al, who used video simulation via mobile even though the results were not statistically significant.[18] Furthermore, a 6-week online course that was introduced by Attack L et al enhanced the accuracy of triage by nurses.[19] In addition, a large number of existing studies in the broader literature have examined the positive impact of a web-based learning environment in two or four-week programs.[20–23] Apart from the successful improvement in triage learning, the pros of e-learning programs were the low cost of the method and the satisfaction of the learners.[20–23]

A third method, which was the subject of two articles, utilizes audio visual methods and simulation scenarios in teaching. Those media enhance the teaching process, as they engage the learner's senses, they promote interest and reinforce their understanding.[35] The study of Campbell D. et al confirmed the findings of improving outcomes by using video simulation scenarios via mobile in addition to other teaching methods. However, in their twelve-week study no significant improvements of ED accuracy were found.[18]

Regarding the performance of participants and their evaluation of the courses, it appeared that in scenarios with photographs, animation or sounds, they achieved a higher percentage of correct answers compared with paper-based scenarios.[17,21,24] In a six-week virtual course, the nurses also stated that they engaged in the learning process with increased satisfaction.[19] As a conclusion, enjoyment and engagement can be increased in a supportive and goal-oriented

Table 1 Studies of Educational Technique for Triage Training in Emergency Nurses

First Author and Year of Publication	Country of Study Origin	Educational Method	Study Design and Triage Method	Participants per Study	Duration of Intervention	Conclusion and Recommendations
Bergs et al[16] 2014	Belgium	Paper-based learning and lecture	QE, ESI	52	2 days	This educational intervention resulted in suboptimal interrater agreement by using the ESI manual.
Moon et al[17] 2022	Korea	Paper-based learning, lecture and videos	QE, KTAS	31 intervention group, 35 comparison group	One week	This intervention was effective in improving the emergency nurses' triage competency and performance.
Campbell et al[18] 2022	USA	Videos	QE, ESI	33	12 weeks	Results of this intervention to improve the accuracy of ED nurses were not significant. This approach may be considered to improve outcomes.
Attack et al[19] 2005	Canada	Online course	QE, CTAS	23	6 weeks	It appears to be an effective way to educate large numbers of ED staff.
Rankin et al[20] 2013	Canada	Online course	QE, CTAS	65 Intervention group, 67 control Group	6 weeks	This intervention enhanced emergency nurses' triage accuracy.
Yazdannik et al[21] 2018	Iran	Web-based learning	QE, ESI	35 in each group (two groups)	From September to November 2014	The electronic program was an attractive education method for emergency nurses. It is suggested that mobile health is used by authorities along with routine training.
Kim et al[22] 2021	Korea	Web-based learning	QE, KTAS	-	4 hours sessions over 4 weeks	The findings indicate that the Web-based learning program for nurses can be used as an effective tool.
Curran-Smith et al[23] 2004	Canada	Web-based learning	QE, CTAS	-	4 weeks	This positive experience highlighted the need for a new skill set for learners and educators using online learning technologies.
Considine et al[24] 2004	Australia	Web- and paper- based learning	QE, ATS	167 completed adult scenarios and 161 completed pediatric scenarios	-	This intervention appeared to have a positive effect on the nurses' triage performance.
Zagalioti et al[25] 2023	Greece	Blended learning	QE, STS	36	2 weeks	Triage training seems to successfully improve effective and efficient triage.
Jang et al[26] 2023	Korea	Blended learning	QE, KTAS	27	3–24 May 2017	After completing this education program, the emergency nurses showed improved skills.
Gerdtz et al[27] 2023	Australia	Blended learning	QE, ATS with emphasis on vital signs	122	15 months	Progressive sustained improvements in vital sign documentation were observed.
Cheung et al[28] 2023	Canada	Paper-based learning	QE, Protocols for the most frequent ED diseases	-	A year	It had utilized patient waiting time efficiently and increased the nurses' and physicians' job satisfaction.
Brosinski et al[29] 2017	USA	-	QE, Refresher course, ESI	-	7 months	After the intervention the difference in patients that were undertriaged was statically significant.
Vatnøy et al[30] 2012	Norway	-	QE, unclassified triage system, used protocols and emphasis in vital signs	-	April 2008 to November 2009	This intervention increased the decision making and acuity assignment.
Javadi et al[31] 2021	Iran	-	Systematic Review			Almost all studies had reported the effectiveness of an educational intervention in improving nurses' triage knowledge. However, it seems that the non-face-to-face method is superior to the face-to-face method.

Abbreviations: QE, Quasi-experimental; ESI, Emergency Severity Index; KTAS, Korean Triage and Acuity Scale; CTAS, Canadian Triage and Acuity Scale; ATS, Australasian Triage Scale; STS, Swiss Triage System.

Table 2 Summary of Teaching Methods

Educational Method	Number of Articles	Summary of Features
Lecture-, Paper-based learning	4	Commonly teaching method; alone or in combination with others
Web-based learning, Online courses	7	Low cost; satisfaction of learners
Visual methods, Simulation scenarios	2	Engage the learners senses; promote interest; reinforce the understanding; compared to paper-based scenarios, nurses achieved higher percentage of correct answers
Blended learning	3	All types of learners benefit
Focused training programs (protocols, vital signs)	2	Improve the accuracy of decision-making

learning environment by using audio visual methods and simulation scenarios.[20–23] Triage education must thus make every effort to guarantee that the greatest learning environment is offered.

Another learning program combines traditional classroom training with digital or online learning materials. Thus forming the so-called blended learning (presented in three of the included studies). This has been shown to be a useful triage learning method with numerous research-backed advantages.[16,24–26] All types of learners benefit from user engagement when traditional in-class methods are combined with independent learning.[36] Considering that it has been demonstrated to increase nurses' rates of correctly answered questions, it is an effective learning technique.[27,31]

Finally, Cheung W W H, et al developed a different advanced triage system, which consists of protocols for the most frequent reasons why patients end up in emergency departments, as well as a focused training program to go along with it.[28] The final outcome was a reduction in the average length of stay, which increased patient satisfaction by improving patient flow.[28]

Last but not least, focused training courses specifically on vital signs, rather than generally on triage, increased awareness about them. It further reduced the likelihood of mistriage and improved the accuracy of decision-making.[27,30]

Table 2 presents a comprehensive summary of all the above methods.

Discussion

Developing effective, engaging learning triage programs for nurses remains a challenge for emergency medicine as it aims to provide better patient care. Despite the wide variety of triage scales available,[37,38] the adult population consisting by this healthcare team has certain needs and similarities. Healthcare workers organizing the triage learning materials and education can have a better understanding of the variables that encourage nurses to seek further education by examining the theory of nurses' learning.

The learning strategies and theories adopted by adult nurses should consider the unique principles that have been proven to be beneficial in encouraging nurses to broaden their knowledge, improve their problem-solving abilities, accomplish their goals, and continue to provide high-quality care.[39] According to the findings of analyzed studies, there are various triage training approaches, each with unique advantages. Significant changes in participants' knowledge were found in all evaluated studies after the intervention, with the exception of the study of Bergs et al.[16] The e-learning method was a cost-effective technique, a convenient education form with a fast delivery feedback and reconnection between the individuals and mainly with consistency, as implied of the web-based interventions.[18–23,33] The critical aspect that suggested by some paper of using online learning is that mobile device-based learning should be used alongside with traditional methods.[21] Educational strategies focused on a certain activity also yield beneficial outcomes, two studies improved specific practices after intervention, in particular they improve the measurement of vital signs by nurses and better interpretation of them.[27,30] As medical knowledge evolves, a refresher course has shown a positive efficiency in triage, as it ensures better memorizing through repetition.[29]

As learners are more actively involved in the learning process when lectures are combined with additional teaching strategies like educational software and group discussions, the combination of these strategies is more effective than lecturing alone.[40] The blended learning provides more flexibility and a wider range of learning modes. Most of the studies analyzed the results of only one particular education technique. They did not comparing groups of nurses on different triage education techniques, with the exception of the study of Moon SH et al.[17] As in most of the analyzed

studies the results were statistically significant solely on every teaching technique, arises the question of applying a mixed way on learning, in order to cover every positive aspect of the study's results. Blended learning may be the ideal education technique, that will cover every aspect of this idea. The limitation is that there is not a study on nurses that compares the different triage education techniques. But in the current literature is strongly supported that blended learning is a learning approach with positive effect mainly in nursing students, as a convenient and accessible method.[41] Because each learner is unique and has a different learning style, blended learning gives them more flexibility to learn at their own pace.

Limitations and Future Research

Despite the careful and comprehensive nature of the study, it is essential to recognize certain limitations that may potentially influence the interpretation of our findings. One significant limitation is our approach to assessing the risk of bias in the included manuscripts. Although we made efforts to minimize bias by adhering to established guidelines and utilizing standardized assessment tools, the absence of independent evaluations for each manuscript introduces a potential source of bias. This limitation requires caution when applying the results in practice.

Additionally, our study primarily focused on specific methods of triage education, potentially constraining the applicability of our findings to other aspects of the triage process.

As most studies investigated the efficacy of one-time courses, it is likely that acquired knowledge by such courses might not last. This might be a result of several factors, such as the onboarding of new, inexperienced staff that did not attend the courses, as well as the multitude of cases, which might not be covered by a single course. Consequently, ongoing education and refresher courses are highly necessary. The design of such courses could be based off human experience, or even Artificial Intelligence (AI), which has been advancing rapidly in recent years.[42] AI offers significant potential to enhance the continual education of ED nurses, particularly in the domain of Decision-making Support Systems. It holds the potential to be a significant tool within Clinical Decision Support Systems (CDSS),[43] providing healthcare practitioners with additional expertise and support in their clinical decision-making processes. Further investigation into this capacity is essential.

Conclusion

Triage is like the first responder in ED, that defines the patient's path in- or out-of-hospital. As the most decisive step, is crucial to ensure the most effective training technique in order to achieve better knowledge, skills and improvement of survival rates. The effective education of nurses in triage is the key to prevent many deaths, disabilities and additional costs on treatment.

In conclusion, blended learning is recommended as the method of training to achieve superior educational goals; as it is addressed to all type of learners, resulting in more nurses engaging with the education process. Refresher courses combined with blended learning will enhance knowledge and decision-making related to triage; however, additional research is necessary to determine whether these improvements will last.

Abbreviations

ED, Emergency Department; AI, Artificial Intelligence.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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References

1. Mitchell R, McKup JJ, Bue O, et al. Implementation of a novel three-tier triage tool in Papua New Guinea: a model for resource-limited emergency departments. *Lancet Reg Health West Pac*. 2020;5:100051. doi:10.1016/j.lanwpc.2020.100051
2. College of Emergency. *Crowding in Emergency Departments*. London: College of Emergency Medicine Revised;2014.
3. Schuetz P, Hausfater P, Amin D, et al. Optimizing triage and hospitalization in adult general medical emergency patients: the triage project. *BMC Emerg Med*. 2013;13:12. doi:10.1186/1471-227X-13-12
4. Farrohknia N, Castrén M, Ehrenberg A, et al. Emergency department triage scales and their components: a systematic review of the scientific evidence. *Scand J Trauma Resusc Emerg Med*. 2011;19:42. doi:10.1186/1757-7241-19-42
5. Oredsson S, Jonsson H, Rognes J, et al. A systematic review of triage-related interventions to improve patient flow in emergency departments. *Scand J Trauma Resusc Emerg Med*. 2011;19(1):43. doi:10.1186/1757-7241-19-43
6. Parenti N, Reggiani ML, Iannone P, et al. A systematic review on the validity and reliability of an emergency department triage scale, the Manchester Triage System. *Int J Nurs Stud*. 2014;51(7):1062–1069. doi:10.1016/j.ijnurstu.2014.01.013
7. Aghabarary M, Pourghaedi Z, Bijani M. Investigating the professional capability of triage nurses in the emergency department and its determinants: a multicenter cross-sectional study in Iran. *BMC Emerg Med*. 2023;23(1):38. doi:10.1186/s12873-023-00809-7
8. Thawley A, Aggar C, Williams N. The educational needs of triage nurses. health education in practice. *J Res Professional Learning*. 2020;3(1). doi:10.33966/hepj.3.1.14121
9. Forsetlund L, O'Brien MA, Forsén L, et al. Continuing education meetings and workshops: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev*. 2021;9(9):CD003030. doi:10.1002/14651858.CD003030.pub3
10. Russell SS. An overview of adult-learning processes. *Urol Nurs*. 2006;26(5):349–52,370.
11. Palis AG, Quiros PA. Adult learning principles and presentation pearls. *Middle East Afr J Ophthalmol*. 2014;21(2):114–122. doi:10.4103/0974-9233.129748
12. Collins J. Education techniques for lifelong learning: principles of adult learning. *Radiographics*. 2004;24(5):1483–1489. PMID: 15371622. doi:10.1148/rg.245045020
13. Falasca M. Barriers to adult learning: bridging the gap. *Australian J Adult Learning*. 2011;51(3):583–590.
14. Anderson I. Identifying different learning styles to enhance the learning experience. *Nurs Stand*. 2016;31(7):53–63. doi:10.7748/ns.2016.e10407
15. Mangold K, Kunze KL, Quinonez MM, et al. Learning style preferences of practicing nurses. *J Nurses Prof Dev*. 2018;34(4):212–218. doi:10.1097/NND.0000000000000462
16. Bergs J, Verelst S, Gillet J-B, et al. Evaluating implementation of the emergency severity index in a Belgian hospital. *J Emerg Nurs*. 2014;40(6):592–597. doi:10.1016/j.jen.2014.01.006
17. Moon SH, Cho IY. The effect of competency-based triage education application on emergency nurses' triage competency and performance. *Healthcare*. 2022;10(4):596. doi:10.3390/healthcare10040596
18. Campbell D, Fetters L, Getzinger J, et al. A clinical nurse specialist-driven project to improve emergency department triage accuracy. *Clin Nurse Spec*. 2022;36(1):45–51. doi:10.1097/NUR.0000000000000641
19. Atack L, Rankin JA, Then KL. Effectiveness of a 6-week online course in the Canadian triage and acuity scale for emergency nurses. *J Emerg Nurs*. 2005;31(5):436–441. doi:10.1016/j.jen.2005.07.005
20. Rankin JA, Then KL, Atack L. Can emergency nurses' triage skills be improved by online learning? Results of an experiment. *J Emerg Nurs*. 2013;39(1):20–26. doi:10.1016/j.jen.2011.07.004
21. Yazdannik A, Dsatjerdi EI, Mohamadirizi S. Utilizing mobile health method to emergency nurses' knowledge about Emergency Severity Index triage. *J Educ Health Promot*. 2018;7:10. doi:10.4103/jehp.jehp_29_17
22. Kim HJ, Kang HY, Kim HR. Development of a web-based Korean triage and acuity scale learning program for emergency department nurses. *Comput Inform Nurs*. 2021;39(11):821–827. doi:10.1097/CIN.0000000000000723
23. Curran-Smith J, Best S. An experience with an online learning environment to support a change in practice in an emergency department. *Comput Inform Nurs*. 2004;22(2):107–110. doi:10.1097/00024665-200403000-00013
24. Considine J, LeVasseur SA, Villanueva E. The Australasian Triage Scale: examining emergency department nurses' performance using computer and paper scenarios. *Ann Emerg Med*. 2004;44(5):516–523. doi:10.1016/j.annemergmed.2004.04.007
25. Zagalioti SC, Fyntanidou B, Exadaktylos A, et al. The first positive evidence that training improves triage decisions in Greece: evidence from emergency nurses at an academic tertiary care emergency department. *BMC Emerg Med*. 2023;23(1):60. doi:10.1186/s12873-023-00827-5
26. Jang JH, Kim SS, Kim S. Educational simulation program based on Korean triage and acuity scale. *Int J Environ Res Public Health*. 2020;17(23):9018. doi:10.3390/ijerph17239018
27. Gerdtz MF, Waite R, Vassiliou T, et al. Evaluation of a multifaceted intervention on documentation of vital signs at triage: a before-and-after study. *Emerg Med Australas*. 2013;25(6):580–587. doi:10.1111/1742-6723.12153
28. Cheung WW, Heeney L, Pound JL. An advance triage system. *Accid Emerg Nurs*. 2002;10(1):10–16. doi:10.1054/aaen.2001.0315
29. Brosinski CM, Riddell AJ, Valdez S. Improving triage accuracy: a staff development approach. *Clin Nurse Spec*. 2017;31(3):145–148. doi:10.1097/NUR.0000000000000291
30. Vatnøy TK, Fossum M, Smith N, et al. Triage assessment of registered nurses in the emergency department. *Int Emerg Nurs*. 2013;21(2):89–96. doi:10.1016/j.ienj.2012.06.004

31. Javadi N, Rostamnia L, Raznahan R, et al. Triage training in Iran from 2010 to 2020: a systematic review on educational intervention studies. *Iran J Nurs Midwifery Res*. 2021;26(3):189–195. doi:10.4103/ijnmr.IJNMR_155_20
32. Monte-Sano C, Budano C. Developing and enacting pedagogical content knowledge for teaching history: an exploration of two novice teachers' growth over three years. *J Learning Sci*. 2013;22(2):171–211. doi:10.1080/10508406.2012.742016
33. DeCoito I, Estaiteyeh M. Transitioning to online teaching during the COVID-19 pandemic: an exploration of STEM teachers' views, successes, and challenges. *J Sci Educ Technol*. 2022;31:340–356. doi:10.1007/s10956-022-09958-z
34. Lindberg BH, Rebnord IK, Høye S. Effect of an educational intervention for telephone triage nurses on out-of-hours attendance: a pragmatic randomized controlled study. *BMC Health Serv Res*. 2023;23(1):4. doi:10.1186/s12913-022-08994-0
35. Abdulrahaman MD, Faruk N, Oloyede AA, et al. Multimedia tools in the teaching and learning processes: a systematic review. *Heliyon*. 2020;6(11):e05312. doi:10.1016/j.heliyon.2020.e05312
36. Romanelli F, Bird E, Ryan M. Learning styles: a review of theory, application, and best practices. *Am J Pharm Educ*. 2009;73(1):9. doi:10.5688/aj730109
37. Hinson JS, Martinez DA, Cabral S, et al. Triage performance in emergency medicine: a systematic review. *Ann Emerg Med*. 2019;74(1):140–152. doi:10.1016/j.annemergmed.2018.09.022
38. Gorick H, Rai AS. Training nurses to triage: a scoping review. *Emerg Nurse*. 2023. doi:10.7748/en.2023.e2163
39. Mlambo M, Silén C, McGrath C. Lifelong learning and nurses' continuing professional development, a metasynthesis of the literature. *BMC Nurs*. 2021;20(1):62. doi:10.1186/s12912-021-00579-2
40. Liu Q, Peng W, Zhang F, et al. The effectiveness of blended learning in health professions: systematic review and meta-analysis. *J Med Internet Res*. 2016;18(1):2–19. doi:10.2196/jmir.4807
41. Du L, Zhao L, Xu T, et al. Blended learning vs traditional teaching: the potential of a novel teaching strategy in nursing education - a systematic review and meta-analysis. *Nurse Educ Pract*. 2022;63:103354. doi:10.1016/j.nepr.2022.103354
42. Stewart J, Sprivulis P, Dwivedi G. Artificial intelligence and machine learning in emergency medicine. *Emerg Med Australas*. 2018;30(6):870–874. doi:10.1111/1742-6723.13145
43. Fernandes M, Vieira SM, Leite F, et al. Clinical decision support systems for triage in the emergency department using intelligent systems: a review. *Artif Intell Med*. 2020;102:101762. doi:10.1016/j.artmed.2019.101762