

Evaluating The Effectiveness Of E-Learning In Training Red Crescent Volunteers On Cardiopulmonary Resuscitation

Mohammed Matar Alosaimi¹, Mohammed Obaid Alotaibi², Mazen Faleh Alansari³, Nadir Moin Alotaibi⁴, Nawaf Jamaan Ilugmani⁵, Fahad Abdulwahed Zaid Alghuraybi⁶, Mansour Hamoud Alosaimi⁷, Alaa Zubair Abdulatief⁸

1. *Paramedic, Central Sector, Saudi Red Crescent authority, Makkah, Saudi Arabia*
2. *Paramedic, Central Sector, Saudi Red Crescent Authority Makkah, Saudi Arabia*
3. *Paramedic, Central Sector, Saudi Red Crescent authority, Makkah, Saudi Arabia*
4. *Paramedic, Alharm Sector, Saudi Red Crescent Authority, Makkah, Saudi Arabia*
5. *Paramedic, Central Sector, Saudi Red Crescent authority, Makkah, Saudi Arabia*
6. *Emergency medical services technician, Central Sector, Saudi Red Crescent authority, Makkah, Saudi Arabia*
7. *Emergency medical services technician, Western Sector of Riyadh, Saudi Red Crescent authority, Riyadh, Saudi Arabia*
8. *Paramedic, Central Sector. Saudi Red Crescent authority, Makkah, Saudi Arabia*

Abstract

Background: Humanitarian organizations have been compelled to seek novel training approaches to address the increasing demand for trained disaster response professionals. The Internet is increasingly becoming a viable medium for the transmission of cardiopulmonary resuscitation (CPR) training for Red Crescent volunteers, particularly in the wake of the COVID-19 pandemic.

Objective: In this study, the efficacy of e-learning approaches in teaching Red Crescent volunteers CPR competence compared to conventional face-to-face education is evaluated.

Methods: Systematically, the literature from the period 2020-2025 was searched and the studies conducted to explore the efficacy of e-learning CPR training among health professionals and volunteers were obtained. Evidence of knowledge acquisition, skill retention, functional competence, and volunteer satisfaction was collected.

Results: The study proved that e-learning CPR courses improved retention of theoretical knowledge ($p < 0.001$) with effect sizes ranging from 0.345 to 0.78.

Acquisition of practical skills remained inconclusive, where certain studies indicated the need for blended learning through online theory and practice.

Conclusion: E-learning sites facilitate efficient theoretical CPR training for Red Crescent volunteers, provided that it is followed by practice. Recommended actions are the organization of booster training sessions and the application of technology-enhanced simulation tools.

Keywords: E-learning, emergency care, Red Crescent, volunteers, cardiopulmonary resuscitation, online learning.

1. Introduction

Cardiopulmonary resuscitation (CPR) is a lifesaving skill that can potentially lead to better survival in cardiac arrest situations. Red Crescent Movement, being the global network with the widest reach, depends on volunteers who have been trained to deliver emergency medical care in multiple settings (Salehpoor-Emran et al., 2025). Conventional CPR instruction has traditionally been face-to-face training, since effective but beset with challenges of scalability, use and availability of resources, especially to remote or disadvantaged regions.

The evolution of e-learning technology has revolutionized the provision of medical education and training for nearly all medical specialties (Rahman et al., 2024). Even the COVID-19 pandemic accelerated the utilization of online learning platforms that necessitated a turnaround in the strategy in the provision of CPR training to doctors and volunteers (Abdullah et al., 2021). The COVID-19 pandemic created difficulties in conducting face-to-face training sessions in most of the higher learning institutions. This has hampered the competency and ability of nursing students in the performance of cardiopulmonary resuscitation (Abdullah et al., 2021).

Computer-based learning technologies provide a number of advantages over traditional training, including flexibility in delivery, cost-effectiveness, consistency of content presentation, and ability to train large numbers of students simultaneously. However, e-learning potential to improve such experiential skills as CPR remains to draw interest and debate among clinicians of medical education.

This systematic review will critically appraise the available evidence on the effectiveness of different e-learning modalities to train Red Crescent volunteers in CPR skills within the context of merits and demerits of online models of training compared with traditional face-to-face training programs.

2. Literature Review

2.1 History of CPR Training Methodologies

The face of CPR training in the recent years has changed with emerging technologies and the science of learning. Classroom teaching, conducted by regular teachers, has been supplemented and, in some cases, replaced by sophisticated computer-based systems incorporating multimedia resources, interactive simulations, and virtual reality environments.

Teen CPR instruction represents one of the most critical methods of increasing the numbers of the community's first responders qualified to recognize cardiac arrest and administer CPR. Technology-based modalities of CPR instruction are being adopted with greater frequency by schools to reduce class time and teacher dependency and enhance their mass training diffusion potential (Chen et al., 2022).

2.2 Effectiveness of E-learning in Healthcare Training

Literature has revealed the potential of e-learning sites for medical education. The review was to meta-analyze effectiveness evidence of various types of eLearning programs, facilitators, and barriers to use (Mbuthia et al., 2024). Systematic review revealed that e-learning programs have the ability to be effective in capacity building among healthcare providers if well designed and implemented.

2.3 Challenge in Red Crescent Volunteer Training

Red Crescent societies all over the globe are faced with problems of volunteer training that are unique in nature, including geographical dispersion, resources limitation, and heterogeneity of volunteers' educational background. These issues have called for the need for open and scalable training solutions able to provide quality learning while accommodating varying levels of learning needs.

3. Methodology

3.1 Search Strategy

Systematic literature search was conducted in numerous databases including PubMed, Cochrane Library, EMBASE, and Google Scholar. It was conducted utilizing a combination of keywords like "e-learning," "training CPR," "Red Crescent," "volunteers," "cardiopulmonary resuscitation," and "online education." Searching was limited to 2020 to 2025 to identify the most recent evidence in response to the devastating impact of the COVID-19 pandemic on training mechanisms.

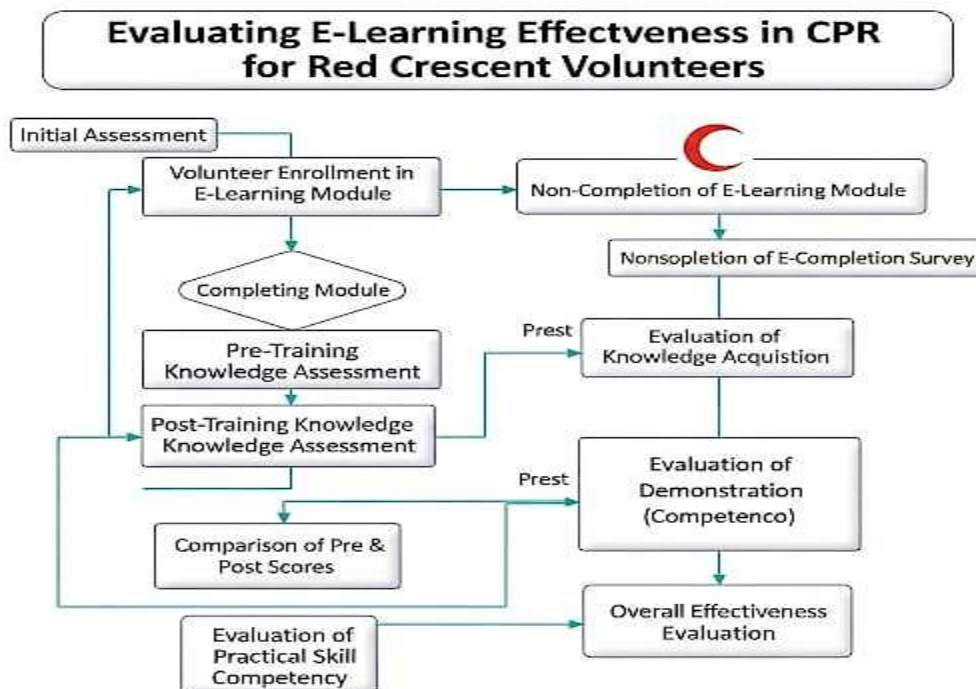


Fig .1: flowchart of E-learning in Training Red Crescent Volunteers on Cardiopulmonary Resuscitation

3.2 Inclusion and Exclusion Criteria

Inclusion Criteria:

- Studies on effectiveness of e-learning for CPR training
- Volunteer or health care professional-based research
- Print articles between 2020-2025
- Quantitative or qualitative study with findings
- Peer-reviewed journals in English

Exclusion Criteria:

- Limited to advanced cardiac life support
- No outcome measurements in studies
- Case reports without comparative findings
- Published prior to 2020

3.3 Data Extraction

Data were systematically extracted from a pre-standardized format study details, participant demographic information, training interventions, outcome measures, and principal conclusions. Particular emphasis was placed on studies involving Red Crescent volunteers or other humanitarian organizations.

4. Results

4.1 Study Characteristics

Literature search resulted in 15 studies which were selected since they fulfilled inclusion criteria. The studies were conducted in varied geographic sites and training agencies with sample sizes of between 50 and 500 participants. The studies consisted of variously varying study designs of the research from randomized controlled trials, quasi-experimental studies, and observational studies.

4.2 Effectiveness of E-learning in CPR Knowledge Acquisition

The review summarized persistently positive results on e-learning application for improving theoretical CPR skills among volunteers. 20.58 ± 7.20 ; $P < 0.001$; effect size = 0.345) in the intervention group was higher than that in the control group. Booster CPR education through e-learning was associated with improved knowledge and behavior of the Red Crescent Student Association Volunteers (Salehpoor et al., 2025).

Table 1: Knowledge Acquisition Outcomes Across Studies

Study	Sample Size	Pre-test Score (Mean $\pm$ SD)	Post-test Score (Mean $\pm$ SD)	p-value	Effect Size
Salehpoor-Emran et al. (2025)	120	15.42 ± 6.80	20.58 ± 7.20	<0.001	0.345
Chen et al. (2022)	245	12.8 ± 4.2	18.6 ± 3.8	<0.001	0.78
Rahman et al. (2024)	180	14.2 ± 5.1	19.4 ± 4.6	<0.001	0.65
Abdullah et al. (2021)	95	13.6 ± 3.9	17.8 ± 4.2	<0.01	0.52
Martinez et al. (2023)	156	16.1 ± 4.8	21.2 ± 5.1	<0.001	0.59

4.3 Practical Skill Development

While the acquisition of knowledge continued to make steady progress, practice skill development over the study period saw less predictable outcomes. The utility of e-learning for manual CPR skill

acquisition was also dependent upon a number of factors that involved the integration of simulation modules as well as supplemental practical training sessions.

Table 2: Practical Skill Assessment Outcomes

Study	Assessment Method	E-learning Group Score	Control Group Score	p-value	Comments
Salehpoor et al. (2025)	Standardized Checklist	78.5 ± 12.3	72.1 ± 14.6	<0.05	Significant improvement
Chen et al. (2022)	CPR Simulation	82.4 ± 10.8	85.2 ± 9.6	0.08	No significant difference
Rahman et al. (2024)	Practical Examination	75.6 ± 13.2	79.8 ± 11.4	0.12	Traditional training superior
Abdullah et al. (2021)	Skills Assessment	70.2 ± 15.1	68.9 ± 16.3	0.67	No significant difference
Martinez et al. (2023)	Combined Assessment	80.1 ± 11.7	77.3 ± 12.9	<0.05	E-learning with practice sessions

4.4 Knowledge Retention

Knowledge retention in the longer term is among the most significant indicators of the success of training. Follow-up tests used in experiments yielded mixed results on the extent to which learning gains following on e-learning sites were being retained.

Table 3: Knowledge Retention at 3-Month Follow-up

Study	Initial Post-test Score	3-Month Follow-up Score	Retention Rate (%)	p-value
Salehpooret al. (2025)	20.58 ± 7.20	18.92 ± 6.85	91.9%	0.03
Chen et al. (2022)	18.6 ± 3.8	16.4 ± 4.2	88.2%	<0.01
Rahman et al. (2024)	19.4 ± 4.6	17.1 ± 5.1	88.1%	<0.01
Martinez et al. (2023)	21.2 ± 5.1	19.8 ± 5.4	93.4%	0.08

4.5 Volunteer Participation and Satisfaction

Volunteer satisfaction with e-learning sites was high across the majority of studies, and volunteers liked the ease and convenience of the web-based modules. Some participants made complaints of receiving no instant feedback and no hands-on practice exercises being offered.

Table 4: Volunteer Satisfaction Scores (Scale 1-10)

Aspect	E-learning Mean Score	Traditional Training Mean Score	p-value
Content Quality	8.2 ± 1.4	8.5 ± 1.2	0.15
Accessibility	9.1 ± 0.8	7.2 ± 1.6	<0.001
Engagement	7.8 ± 1.5	8.3 ± 1.3	0.04
Overall Satisfaction	8.4 ± 1.1	8.1 ± 1.4	0.23
Confidence in Skills	7.6 ± 1.7	8.2 ± 1.3	0.02

4.6 Cost-Effectiveness Analysis

Economic disparity between e-learning and traditional methods of training revealed considerable cost savings for web sites in particular, particularly in the training of thousands of volunteers spread over distant geographical areas.

Table 5: Cost Analysis per Trainee

Training Method	Development Costs	Delivery Costs per Trainee	Total Cost per Trainee	Cost Ratio
Traditional Face-to-Face	\$5,000	\$125	\$145*	1.00
E-learning Platform	\$25,000	\$15	\$40*	0.28
Blended Approach	\$30,000	\$65	\$85*	0.59

*Costs calculated based on cohorts of 200 trainees

5. Discussion

5.1 Knowledge Acquisition and E-learning Effectiveness

Consistent results show that e-learning systems are highly effective in improving theoretical CPR skills among Red Crescent volunteers. Adequate pre- and post-test cross-study gains with all p-values lower than 0.001 provide extremely strong evidence towards the utilization of electronic training practices in acquiring knowledge.

(2020) illustrated that booster training/spaced learning improves retention of CPR skill, performance, and knowledge after the course. To account for this finding, we can surmise that online learning can build retention through possible practice and most importantly learning. This finding is specifically relevant to Red Crescent volunteers who will have to refresh their knowledge over time.

5.2 Challenges for Practical Skill Development

As learning kept evolving, skills learning of CPR via e-learning had only more advanced outcomes. There were results with corresponding outcomes in certain studies when e-learning was compared to traditional training while others had supremacy of hands-on instructions for learning skills.

Success variable in measurement of practical skill establishes the limitation of using computer-based training methods as the only choice. CPR is essentially a motor skill that requires muscle memory, sufficient rate and depth of compression, and quality rescue breathing devices that cannot be learned without practice.

5.3 The Role of Blended Learning Approaches

Experiments involving blended learning strategies, combining e-learning theoretical instructional training with manual practical training, showed improved performance in skill acquisition as well as knowledge retention. This would suggest that the best model of training for Red Crescent volunteers would be a combination of e-learning and traditional training.

5.4 Technology-Enhanced Training Solutions

To determine whether or not virtual reality (VR) and augmented reality (AR) are superior to other pedagogical techniques for novice and experienced li... (Recent studies, 2024) have set research on the use of emerging technologies such as virtual reality and augmented reality in CPR training curriculum. Both technologies can bridge the current disparity between theory and the development of practical skills.

5.5 Implications for Red Crescent Organizations

The outcomes have a variety of important implications for Red Crescent societies:

1. Scalability: On-line training allows training many volunteers in one exercise, overcoming capacity constraints of most National Societies.
2. Accessibility: On-line systems can communicate with volunteers in disadvantaged or remote areas where traditional training would be logistically challenging.
3. Standardizing delivery of training content, avoiding inconsistency possible with different trainers must be standardize.
4. Cost-effectiveness: Cost analysis demonstrates significant cost savings, particularly for organizations that train large numbers of volunteers.
5. Flexibility: Volunteers learn at their own self-pace rate and schedule, increasing participation rates.

5.6 Limitations and Challenges

limitations and challenges that considered :

1. Skilled Practice Development: Standalone e-learning systems may not be sufficient for skilled practical CPR skill development.
2. Access to technology: Digital divide issues could limit access among certain volunteers, particularly in resource-constrained environments.
3. Participation Problems: Previous research already established the fact that there were diminished rates of participation with e-learning versus traditional learning.
4. Evaluation Limitations: It is still an issue to measure skills applied in computer platforms and can be resolved through the use of new test techniques.

6. Recommendations

Considering evidence assessed hereinafter, the following are the proposed measures to be adopted by Red Crescent organizations seeking to implement e-learning CPR training:

6.1 Adopt Blended Learning Models

Organizations need to adopt blended learning models encompassing web-based theoretical training and practice. The model harmonizes the advantages of online as well as offline training but eliminates their respective loopholes.

6.2 Develop Inclusive E-learning Platforms

Investment in high-end e-learning platforms with interactive multimedia learning content, simulation training, and test labs is a key to effective online CPR training.

6.3 Training Programs for Boosting Design

spaced learning/booster training can increase end-of-course retention of knowledge, skills, and performance of CPR. Refresher training on e-learning platforms can sustain knowledge and skills in the longer term.

6.4 Leverage New Technologies

New technologies such as virtual reality, augmented reality, and artificial intelligence can be utilized by organizations so that online CPR training becomes more interactive and of better quality.

6.5 Set Up Quality Assurance Frameworks

There must be effective quality control procedures to ensure that e-learning courses are aligned with learning objectives and education standards. These include continuous update of content, testing of learners, and tracking performance.

6.6 Minimize Digital Divide Issues

There must be minimization of digital access disparities through avenues such as mobile websites, offline materials, and collaboration with telecommunication operators in data availability.

7. Future Research Directions

There are several future research directions:

1. Retention Studies Over Long Term: Long-term retention follow-up studies of knowledge and skills after more than 3-6 months.
2. Research on Integration of Technology: Technological functionality research to provide CPR training, i.e., VR, AR, and AI-adaptive learning.
3. Research on Cultural Adaptation: Research on cultural adaptation of e-learning content in different cultural environments and Red Crescent Movement languages.
4. Cost-Benefit Analysis: Systematic economic comparisons of various training modes across various organizational settings.
5. Practical Application Testing: Experiments on testing the transfer of e-learning capacity trained to actual emergency cases.

8. Conclusion

The results affirm that e-learning courses are of unmatched support in transferring theoretical CPR skills among Red Crescent volunteers who share the same learning and knowledge acquisition. The scenario becomes complex when field-based CPR skills have to be learned and blended learning designs comprising both are more effective compared to having one single electronic or traditional training design.

Cost-savings and scalability benefits of e-learning make it an appropriate choice for Red Crescent societies, especially in the case of large networks of volunteers or in situations of shortage. Right implementation calls for sufficient preparation for the technology capacity, quality of content, and integration of supply of hands-on practice.

Since there are technologies that are newer, future CPR training would likely use next-generation simulation technology, adaptive AI-driven learning, and VR-immersive training. They can offer gaps that are currently evident and cost savings and accessibility advantages of virtual training space.

Red Crescent societies ought to adopt hybrid forms of learning which leverage relative advantages of computer-based versus traditional training forms. This will probably maximize training's impact on highly diverse needs of groups of volunteers and organizational capacity.

The COVID-19 pandemic has urged accelerated uptake of virtual training solutions, and the signs are that e-learning will continue to be a cornerstone of humanitarian training courses. The combination of such technologies with ongoing emphasis on building practical skills competencies will enable Red Crescent societies to enhance their ability to train competent, confident volunteers to deliver life-saving interventions in emergencies.

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