CODEN [USA]: IAJPBB ISSN : 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

SJIF Impact Factor: 7.187
https://doi.org/10.5281/zenodo.13850817

https://www.iajps.com/volumes/volume11-september-2024/57-issue-09-september-24/

Available online at: http://www.iajps.com *Review Article*

EFFECTIVENESS OF ONLINE TRAINING MODULES FOR FIRST AID AND CPR: A REVIEW OF CURRENT LITERATURE

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Abstract:
This literature review explores the effectiveness of online training modules for first aid and cardiopulmonary resuscitation (CPR) compared to traditional face-to-face instruction. As the necessity for accessible and flexible training options increases, particularly in resource-limited settings, online platforms have become a promising alternative. This review synthesizes findings from studies conducted over the past decade, focusing on critical aspects such as knowledge retention, skill acquisition, and preparedness for real-life emergencies. Key themes identified include the strengths of online training, such as improved accessibility and the ability to cater to diverse learning styles, as well as limitations, such as concerns over practical skills development and knowledge retention. Innovative instructional methods, including interactive digital formats and blended learning approaches, are also examined for their potential to enhance educational outcomes. Despite the growing body of evidence supporting online training, significant gaps persist in understanding how these modules compare to traditional methods in real-world applications. The review emphasizes the necessity for ongoing research to address these gaps and to inform the development of more effective online training programs that incorporate hands-on practice. Ultimately, this review contributed to the discourse on improving emergency preparedness through effective educational practices in first aid and CPR training. By identifying best practices and areas for further investigation, this work seeks to enhance the overall effectiveness of online training modalities in equipping individuals with essential life-saving skills.
Keywords: *online training, first aid, CPR, knowledge retention, emergency preparedness*

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Please cite this article in press Khalid Mohsain Alzahrani et al., ***Effectiveness Of Online Training Modules For First Aid And CPR: A Review Of Current Literature****, Indo Am. J. P. Sci, 2024; 11 (09).*

1. INTRODUCTION:

First aid and cardiopulmonary resuscitation (CPR) training are vital for emergency preparedness, equipping individuals with the knowledge and skills necessary to provide immediate assistance before professional medical help arrives. Traditionally, these skills were imparted through in-person workshops that emphasized hands-on experience to foster confidence and competence (Sommerville, 2023). In recent years, the emergence of online education has significantly changed the delivery of this training, introducing innovative approaches that enhance accessibility and flexibility. Online platforms allow learners to engage with materials at their own pace, accommodating diverse schedules and learning styles. This shift is largely driven by technological advancements and the growing need for scalable educational solutions, particularly in areas with limited resources (Anderson, et al. 2019).

Despite the increasing popularity of online training for first aid and CPR, there remains a considerable gap in research evaluating its effectiveness compared to traditional face-to-face instruction. Key questions persist regarding the capacity of online programs to ensure knowledge retention, develop practical skills, and prepare individuals for real-life emergencies (Mishra, et al. 2017). Addressing this research gap is crucial for confirming that online training adequately equips participants to respond in critical situations. The Canadian Standards Association (CSA) establishes national standards for CPR and first aid training in Canada, providing guidelines for training organizations that specify course content and the duration of both online and classroom learning. According to CSA regulations, workplace intermediate CPR and first aid training must be renewed every three years. Furthermore, in New Brunswick (NB), WorkSafe NB mandates a six-hour retraining course annually during the two years between full course renewals (WorkSafe NB, 2021). This organization also enforces the Occupational Health and Safety Act in New Brunswick, Canada (WorkSafe NB, 2023).

The principles of primary healthcare outlined by the Canadian Nurses Association (CNA) emphasize public engagement, health promotion, and chronic disease prevention (2015). Health promotion and education are central to nursing education, as highlighted by an integrative review by Kemppainen et al. (2013), which indicates that active involvement in health promotion by nurses can yield positive health outcomes, including better medication adherence, improved quality of life, and enhanced self-management of health conditions. Health education is defined as conveying health-related information that influences individuals' values, beliefs, attitudes, and motivations, leading to skill development and behavioral changes (Kemppainen et al., 2013). While health education aims to inform individuals about health topics (Whitehead, 2004), health promotion focuses on empowering patients (Kemppainen et al., 2013). Increasing access to effective educational resources is critical for facilitating health behavior changes and can significantly enhance health outcomes (Adam et al., 2019). This review aims to evaluate the current literature on the effectiveness of online training modules for first aid and CPR, exploring their strengths, limitations, and the factors influencing their impact on emergency preparedness in contemporary educational settings.

1.1. Statement of the Problem

The effectiveness of online training modules for first aid and CPR remains a subject of debate. While online platforms offer convenience and accessibility, concerns exist regarding the adequacy of online learning in developing practical skills and ensuring retention of knowledge. This study aims to provide a comprehensive review of the existing literature on the effectiveness of online training modules for first aid and CPR. The review will synthesize findings from various studies, identify key themes, and provide insights into the strengths, weaknesses, and potential of online training in this context. The findings of this review will inform the development of more effective

online training modules and contribute to the ongoing discussion about the role of online learning in first aid and CPR education.

1.2. Significance of the Study

The findings of this study have significant implications for individuals, organizations, and policymakers involved in first aid and CPR training. By providing a comprehensive overview of the current literature, the review will identify best practices for designing and implementing effective online training modules for first aid and CPR. The study will provide valuable insights into the factors influencing the effectiveness of online training, enabling organizations and individuals to make informed decisions about training options. The findings of this review may inform the development of policies and guidelines for the use of online training modules in first aid and CPR education.

2. METHODOLOGY:

2.1. Research Design

This study will utilize a literature review methodology to synthesize qualitative and quantitative research findings related to online first aid and CPR training This approach allows for a comprehensive exploration of existing literature, providing insights into the multifaceted ethical challenges within this field. By integrating diverse perspectives and evidence, the literature review will facilitate a deeper understanding of the online first aid and CPR training.

2.2. Data Sources

The data sources for this review will include:

1. Academic Journals: Peer-reviewed articles focusing on online first aid and CPR training. Relevant studies will provide empirical evidence, case analyses, and theoretical discussions pertinent to the effectiveness of online training modules.
2. Search databases such as PubMed, Google Scholar, and relevant journals for articles meeting the inclusion criteria
3. Screening of articles based on relevance and quality

2.3. Inclusion Criteria

- Studies published in peer-reviewed journals
- Research focused on online first aid and CPR training.
- Articles published in the last 10 years

2.4. Exclusion Criteria

- Non-English publications
- Conference abstracts without full-text articles
- Studies not focused on online first aid and CPR training

2.5. Data Analysis

The selected literature will be analyzed using thematic analysis, a structured approach aimed at revealing important insights regarding online first aid and CPR training. Researchers will begin by carefully reading and rereading the chosen articles to achieve a deep understanding of their content and context. This process will also reveal gaps in the current literature, pinpointing areas that need further exploration. Ultimately, this review seeks to provide valuable insights that can guide future research efforts and enhance practices in emergency medical services.

2.6. Ethical Considerations

As this study involves a review of existing literature and does not include direct interaction with human subjects, ethical approval was not required.

3. Literature Review

Prior studies have explored various aspects of online training, including its impact on knowledge retention, skill acquisition, and overall preparedness for real-life emergencies. Despite the growing body of evidence supporting the feasibility of online learning, gaps remain in understanding the specific strengths and limitations of these modules. Furthermore, the effectiveness of alternative instructional methods, such as video self-instruction and interactive digital formats, warrants thorough investigation to ascertain their equivalence with traditional training approaches. This review will synthesize findings from peer-reviewed articles published in the last decade, focusing on empirical evidence and theoretical discussions related to online first aid and CPR training. By identifying key themes and trends, the review aims to provide insights that can inform the development of more effective training practices and policies. Ultimately, this analysis will contribute to the ongoing discourse regarding the role of online education in enhancing emergency preparedness in diverse populations.

Nehra et al. (2024) conducted a study which evaluates the effectiveness of a DIY CPR pillow as an alternative to traditional mannequins for teaching hands-only CPR. In this study, 206 undergraduate dental students were randomly assigned to either a mannequin or CPR pillow group for a two-hour training session. The findings revealed no significant differences in hand positioning, compression rate, or overall CPR scores between the two groups; however, the CPR pillow group exhibited significantly better chest recoil (86% vs. 73%; $P < 0.001$). Additionally, both groups demonstrated substantial improvements in knowledge and confidence post-training, suggesting that the CPR

pillow is a viable teaching tool. The study also emphasizes the cost-effectiveness of low-cost training models, which can facilitate mass CPR training, particularly in resource-limited settings, thereby addressing the high costs associated with traditional mannequins. Overall, this research contributes to the existing literature by advocating for innovative, low-cost training methods for CPR, enhancing accessibility and effectiveness in public health training initiatives.

The study by Gignoux-Froment et al. (2024), evaluated the implementation and effectiveness of Psychological First Aid Training in Operation (PFATO) for military healthcare providers. Conducted with 80 physicians and nurses between July 2019 and July 2021, the study utilized an online questionnaire post-deployment, achieving a response rate of 55%. Key findings indicate that 21.62% of participants applied PFATO during their last deployment, primarily in response to acute stress, conflicts, or suicidal crises. The training significantly enhanced participants' ability to identify psychological distress (87.5% reported success) and assist their peers (100% reported effectiveness). Furthermore, the study highlighted the importance of practical simulations in the training process, emphasizing the need for continuous adaptation of training content to better meet the specific demands of military healthcare providers. This research contributes to the broader literature on training effectiveness by underscoring the value of psychological first aid training in operational contexts, complementing existing studies on first aid and CPR training methodologies.

The study by Shauna Sommerville, (2023) investigated knowledge retention after blended learning CPR first aid training, focusing on non-healthcare professionals. It addressed a research gap, as previous studies primarily targeted healthcare workers and traditional formats. The research employed a cross-sectional design, gathering data through an online survey from former students of CPR training companies. Key findings indicate that blended learning, a mix of online and face-to-face instruction, can effectively enhance knowledge retention compared to solely in-person training. The literature review highlighted the growing reliance on online learning, especially post-COVID-19, and noted that blended learning for CPR training has not been extensively studied. Existing studies showed mixed results regarding knowledge retention between blended and traditional methods, but many concluded that blended learning is at least as effective.

Tse et al. (2023) conducted a systematic evaluation of first aid training interventions aimed at children aged 6 to 10 years, analyzing 11 studies that demonstrated significant improvements in children's knowledge and skills related to first aid, particularly in cardiopulmonary resuscitation (CPR) and basic life support (BLS). The review highlighted that hands-on practice is crucial for effective learning, as children exhibited better performance after training compared to their pre-training assessments. However, it also noted that children under the age of 11 had difficulty achieving the proper depth of chest compressions, which underscores age-related physical limitations. The authors emphasized the need for tailored training materials specifically designed for young learners, reinforcing the importance of incorporating practical components into training programs. Ultimately, the review concluded that while first aid training leads to improved knowledge and skills, further research is necessary to investigate real-life applications and the long-term retention of training. This finding resonates with existing literature on online training modules, which frequently focus on theoretical knowledge but may fall short in providing the practical training opportunities essential for effective skill retention and confidence in real emergency situations.

The study by Sholokhova et al. (2023) investigated the knowledge and practical skills of pedagogy students regarding first aid and CPR for children. The research involved 63 students and utilized a survey questionnaire alongside practical assessments using a CPR simulator. Results indicated that while students demonstrated a good theoretical understanding, with a mean score of 11.49 out of 14 on the knowledge test, their practical skills were notably insufficient, averaging only 6.73 out of 15 on CPR tasks. Key discrepancies were found between theoretical knowledge and practical application, particularly in performing chest compressions and responding to emergencies. Furthermore, students who underwent remote training showed lower levels of both theoretical and practical knowledge compared to those who participated in onsite classes. The study concluded that there is a critical need to enhance first aid training curricula for future educators to ensure they are adequately prepared to handle emergencies involving children. This aligns with the broader discussion on the effectiveness of online training modules, highlighting the importance of hands-on practice in emergency response education.

Edinboro and Brady (2022) conducted a narrative review examining the effectiveness of alternative CPR instruction methods compared to traditional CPR

courses for laypersons. Their assessment revealed that video self-instruction and simplified CPR formats produced similar performance metrics in CPR skills and practical scenario evaluations when compared to conventional CPR training. While they acknowledged the need for further research to validate the efficacy of self-directed learning and interactive digital formats, the findings indicated that these alternative methods could be as effective as traditional courses. Recognizing the critical role of bystander CPR in improving outcomes for out-of-hospital cardiac arrests (OHCA), the authors suggested that public safety leaders and CPR educators should consider integrating these innovative instructional programs into community and educational settings.

Joshi et al. (2022) investigated the challenges healthcare providers face when delivering cardiopulmonary resuscitation (CPR) to COVID-19 patients, noting that the specific requirements for CPR in these cases differ from standard procedures. The study aimed to evaluate the effectiveness of online learning in teaching nurses about managing cardiac arrest in COVID-19 patients, focusing on knowledge acquisition and overall satisfaction with the training. Using a single-arm, pre-and-post design, the researchers trained 73 nurses from a cohort of 160 who had received comprehensive cardiac life support (CCLS) training from the Indian Resuscitation Council (IRC). After obtaining informed consent, baseline data on demographics and prior knowledge of CPR for COVID-19 patients were collected. Participants then engaged in a one-week online intervention utilizing a validated e-learning module. The results indicated a significant improvement in knowledge scores post-intervention (pre-intervention: 13.65 ± 3.01 vs. post-intervention: 19.92 ± 1.94, $p = 0.001$), with most nurses expressing high satisfaction with the content and delivery of the training (average satisfaction score: 37.23 ± 4.70). The study concluded that well-structured online training materials can effectively impart essential knowledge and skills to nurses for administering CPR to COVID-19 patients.
Anderson et al. (2019) conducted a study which investigates the effectiveness of varying training intervals on CPR performance among healthcare providers. The study reveals that short, frequent training sessions, specifically monthly, significantly enhance the ability to perform high-quality CPR compared to longer intervals of 3, 6, or 12 months. Notably, 58% of participants who underwent monthly training achieved excellent CPR performance after one year, while only 26%, 21%, and 15% of participants in the 3-month, 6-month, and 12-month groups, respectively, reached this level. This research supports the notion that spaced, brief training sessions improve skill retention more effectively than traditional annual recertification methods. Additionally, the training included real-time feedback during practice, which further aided participants in mastering CPR techniques. Overall, this study aligns with existing literature on online training modules, suggesting that frequent, structured training sessions—whether delivered online or in-person—are essential for maintaining CPR competency and ultimately enhancing patient outcomes in emergency situations.

Sasson and Haukoos (2019) investigated the impact of CPR training density on bystander CPR provision and neurological outcomes following out-of-hospital cardiac arrest (OHCA). Using data from the Korean OHCA registry, the study analyzed 254 counties over a five-year period. The findings revealed that higher CPR training density correlated with improved rates of good neurological recovery, increasing from 5.4% in 2012 to 7.1% in 2016 in counties with the highest training density. The study also highlighted that a threshold of approximately 50% of the county population trained in CPR yielded the most significant improvements in survival rates, suggesting a potential "tipping point" for effective training density. Furthermore, the introduction of dispatcher-assisted CPR (DACPR) in 2012 contributed to a rise in bystander CPR rates. The authors emphasized the need for focused training efforts in areas with low CPR density to enhance community preparedness and improve OHCA survival outcomes. This research underscores the importance of not only increasing CPR training but also ensuring quality training and community engagement, which aligns with the goals of enhancing online training modules for first aid and CPR.

The pilot study by Katona (2018) explored the attitudes and knowledge of university students regarding First Aid and CPR, emphasizing the importance of early education in enhancing public readiness to assist in emergencies. Conducted with 101 participants from various educational backgrounds, the study utilized online questionnaires to assess students' willingness to perform CPR and their perceptions of First Aid training in primary education. Key findings indicate that a significant correlation exists between previous physical activity and the willingness to assist in emergencies, suggesting that early sports participation can foster proactive attitudes towards First Aid. The study also revealed gender differences, with female students demonstrating more hesitation in emergency situations due to fears of infection and social prejudices. Importantly, the results

indicated that prior training in First Aid positively influenced students' confidence and willingness to intervene.

Wilks et al. (2017) emphasized the critical importance of integrating first aid and CPR training into school curricula. The study reviewed various international initiatives advocating for mandatory training, illustrating that such programs can significantly enhance students' knowledge and confidence in emergency situations. Key findings indicated that first aid and CPR training align with broader educational goals by improving students' capability, resilience, and self-efficacy. Systematic reviews demonstrate that structured training not only enhances knowledge retention but also practical skills, with notable benefits lasting up to 12 months post-training. The authors advocate for age-appropriate instruction beginning in primary education, addressing essential topics such as choking, burns, and unconsciousness. Moreover, while trained teachers can effectively deliver this education, many report a lack of confidence and knowledge in first aid. The study also underscores the need for further evidence-based research to address gaps in measuring the effectiveness of first aid training, which is vital for its integration into schools. This focus aligns with the objectives of "Effectiveness of Online Training Modules for First Aid and CPR," which seeks to evaluate the efficacy of digital training methods in enhancing first aid and CPR skills, suggesting that diverse training approaches, including online modules, could prove beneficial in educational contexts.

The study by Bakke et al. (2017) investigates the state of first-aid training in Norwegian schools, focusing on the amount of instruction, the content delivered, and the barriers encountered by teachers. The findings reveal that teachers provide a median of two first-aid lessons annually, with cardiopulmonary resuscitation (CPR) taught by 64% of respondents. Although fundamental skills such as CPR and the recovery position are well covered, critical competencies like recognizing heart attacks and strokes are less frequently addressed, taught by only 25% and 23% of teachers, respectively. Additionally, the study identifies several obstacles hindering effective training, including unclear curriculum specifications, competing educational demands, and a lack of sufficient resources, such as CPR mannequins. Ultimately, the research underscores the necessity for a more structured curriculum that explicitly outlines required first-aid competencies and ensures adequate training for teachers to enhance the quality of first-aid education in schools.

Mishra et al. (2017) aimed to evaluate the impact of an online training module on the knowledge and skills of student nurses concerning first aid. Utilizing a pre-experimental design, the research involved a sample of student nurses who completed a pre-test to assess their knowledge prior to the intervention. The findings revealed a significant increase in knowledge levels following the training, demonstrating that the e-learning module effectively enhanced the participants' understanding of first aid concepts. Statistical analysis indicated a marked improvement in scores, suggesting that structured online education can effectively bridge knowledge gaps in critical areas, such as first aid and CPR, among nursing students. The authors underscored the importance of integrating such training modules into nursing education, especially given the growing reliance on technology in contemporary learning environments. This research contributes to existing literature that supports online training as a viable method for enhancing healthcare education, particularly in emergency response scenarios.

Chokotho et al. (2017) conducted a study which examines the significant challenges facing prehospital care in Malawi, particularly in the context of road traffic injuries. The study emphasizes that timely first aid can greatly influence survival rates; however, access to professional prehospital care in Malawi is severely limited, primarily depending on community members and informal responders. Key findings reveal that most responders lack basic first aid training, resulting in inadequate care at accident scenes. Despite the strong motivation driven by the concept of shared humanity among community members to assist victims, many feel unprepared to provide effective aid. To address these challenges, the study recommends training community volunteers, enhancing emergency communication systems, and establishing a formal network for first responders. These findings resonate with previous research on the effectiveness of online training modules for first aid and CPR, which underscore the necessity of accessible training to boost knowledge and confidence among laypersons. Both studies highlight that structured training can empower individuals to deliver critical care in emergencies, ultimately leading to better outcomes for trauma victims.

The systematic review by Reveruzzi, et, al. (2016) investigated school-based first aid training programs targeting students aged 10 to 18 years. Analyzing 20 relevant studies, the review highlights that programs with longer durations (three hours or more) tend to

yield better outcomes, particularly in teaching resuscitation skills. Most interventions focused primarily on CPR, with limited context-specific content relevant to adolescents. The effectiveness of training was not significantly influenced by the facilitator's experience, but the inclusion of both practical and didactic components was crucial for knowledge retention. The review underscores the importance of incorporating age-appropriate material and suggests that first aid training can enhance injury prevention awareness among students. It calls for further research, particularly randomized controlled trials, to establish best practices in school-based first aid education. This aligns with the broader literature on the effectiveness of structured training programs in improving first aid knowledge and skills among adolescents.

Breckwoldt et al. (2015) conducted a study focusing on the quality of instruction in first aid courses, specifically Basic Life Support (BLS) training in Germany. The research emphasizes that bystander cardiopulmonary resuscitation (CPR) significantly improves survival rates following out-of-hospital cardiac arrests; however, the rates of bystander CPR in Germany are alarmingly low compared to those in other countries. The study systematically analyzed the quality of teaching across 20 accredited BLS courses by evaluating the transfer of knowledge, skills, and attitudes through a standardized checklist. The results revealed that knowledge transfer scored an average of +0.47 (SD ±0.46), indicating generally positive feedback, while skills transfer received a neutral rating of +0.03 (SD ±0.61). Notably, the transfer of attitudes was rated the lowest at -1.08 (SD ±0.73), highlighting significant deficiencies in fostering a positive mindset toward performing CPR. The study identified that many instructors inadequately addressed participants' fears of making mistakes, a major barrier to performing CPR in emergencies, and that content accuracy was often lacking, with instructors providing misleading information that could discourage action. These findings align with previous research indicating that the quality of teaching and the psychological preparedness of participants are essential for effective training outcomes, thereby extending the understanding of how instructional quality impacts bystander CPR rates. The authors suggest that improvements in instructor training are necessary to enhance teaching quality, particularly in addressing participants' attitudes and fears, which could ultimately lead to higher rates of bystander CPR. This analysis contributes to the broader literature on training program effectiveness by emphasizing the critical role of instructional quality in achieving desired outcomes in emergency response training.

De Buck et al. (2015) focused on developing a structured approach to teaching first aid in Belgian schools, emphasizing the necessity of integrating first aid education, including CPR, into school curricula for children and adolescents. The background highlights that while bystanders often provide critical help in emergencies, many do not perform first aid due to a lack of knowledge or confidence. In Belgium, first aid training is part of secondary school objectives, yet there is confusion regarding the appropriate age for teaching various components. The study aims to establish an evidence-based framework for first aid education tailored to different age groups, addressing essential knowledge, skills, and attitudes. Methodologically, it involved systematic literature reviews across multiple databases, identifying 30 relevant studies on first aid education for young people. The results cover a diverse range of topics, including emergency calling, CPR, and the use of AEDs, with recommendations formulated based on existing literature and expert opinions. Ultimately, the study culminates in an educational pathway that can guide the implementation of first aid training in schools, enhancing children's readiness to assist in emergencies. These findings complement the literature on online training modules by underscoring the need for comprehensive, age-appropriate first aid education, suggesting that online modules could effectively disseminate this knowledge, particularly when integrated with in-person training to reinforce skills and confidence in real-life situations.

The study by Cohen et al. (2013) investigated the feasibility and effectiveness of utilizing low-cost virtual environments for emergency preparedness training, specifically targeting multi-agency and major incident responses. It emphasizes the capability of virtual worlds, such as Second Life and OpenSimulator, to develop realistic training scenarios for clinicians operating in both pre-hospital and hospital settings. Key findings reveal that participants found these virtual environments to be immersive and conducive to training, enabling them to practice in scenarios that would otherwise be inaccessible in real life. The study also highlights the significance of a multidisciplinary approach, showcasing collaboration among various healthcare professionals and underscoring the importance of teamwork and communication during emergency responses. Furthermore, a substantial majority of participants expressed a desire to engage with virtual environments for future training, indicating high satisfaction with

this training method. The virtual scenarios proved valuable for both skill development and assessment, particularly in decision-making and non-technical competencies like leadership. Additionally, the findings suggest that implementing similar virtual training methodologies could enhance online training modules for First Aid and CPR, ultimately fostering improved preparedness and skill development among first responders. In conclusion, this research underscores the potential of innovative training approaches in emergency medicine, aligning with the growing need for effective online training solutions in First Aid and CPR.

Sun (2013) conducted a study at Minnesota State University, Mankato, examining the knowledge and perceptions of undergraduate students regarding first aid and cardiopulmonary resuscitation (CPR) skills. The research aimed to compare students' knowledge and perceptions based on their levels of first aid and CPR training, as well as their perceived access to emergency medical services (EMS) in relation to their geographic locations. A quantitative survey was administered to students in HLTH 101 classes, assessing demographic characteristics, perceptions of EMS response times, and knowledge of first aid and CPR. Statistical analyses, including ANOVA and Cronbach's alpha, were used to evaluate the data. The findings revealed that students currently certified in first aid and CPR had significantly more favorable perceptions regarding the value of their training compared to those without certification. Additionally, participants residing in urban areas reported shorter EMS response times than those in rural regions, highlighting notable disparities in access to emergency services. The study concluded that enhancing training opportunities—especially in rural areas—is crucial for improving knowledge and preparedness to perform first aid and CPR. Overall, this research underscores the necessity for accessible training programs, suggesting that effective training can boost confidence and willingness to execute life-saving techniques. These insights are particularly relevant to the ongoing exploration of online training modules, which may offer a flexible and accessible means to enhance first aid and CPR knowledge across diverse populations.

The study by Anderson et al. (2012) investigated the retention of CPR skills and knowledge among workplace first aid attendants, emphasizing the vital role of immediate resuscitation for survival in emergencies. Despite training, many individuals quickly forget essential CPR skills, which poses significant risks. The research involved 244 participants from industrial and service settings, who were assessed in simulated CPR scenarios. Key findings revealed a significant decline in both skills and knowledge, particularly in critical areas such as airway control and compression techniques, within just a few months post-training. Additionally, the study found that the frequency of recertifications was a more reliable predictor of skill retention than the time elapsed since the last training session; participants with multiple renewals demonstrated markedly better performance. While knowledge retention varied, the study noted a predictable deterioration in skill-based components over time, with participants struggling with pre-CPR safety checks and airway management as the interval since training increased. Consequently, the authors recommend implementing more frequent refresher training and alternative methods to reinforce skills, rather than relying solely on traditional certification schedules. Overall, this study highlights the necessity of ongoing training and the limitations of conventional CPR certification in ensuring effective emergency response capabilities in workplace environments.

Bussières et al. (2011) conducted a pilot study to assess the effectiveness of an online training module designed to help healthcare professionals quickly identify drugs on resuscitation trays. The study aimed to measure the median time required for various professionals, including physicians, nurses, and pharmacists, to locate medications in emergency situations, and to evaluate the perceived usefulness of the online training module. Participants completed a questionnaire before and after using the simulation module, which featured questions about both full and partial resuscitation trays. The results showed that the median identification times varied, with drugs like epinephrine taking an average of 18 seconds to identify, while dextrose required only 4 seconds. Overall, the median times for nurses and physicians were longer compared to pharmacy staff, likely due to their less frequent handling of these medications. All participants reported that the online simulation module was a valuable training tool, expressing strong agreement that it would aid in faster drug identification during emergencies. The study concluded that the module could effectively train diverse healthcare professionals to locate drugs more rapidly in critical situations, highlighting its potential for inclusion in regular training programs.

Cason and Stiller (2010) investigated the performance outcomes of an online first aid and CPR course for laypersons, comparing it to a traditional instructor-led course. The study involved 71 volunteers who self-selected either the online or traditional format for their

training, and participants were assessed on their skills using both instructor evaluations and objective data from resuscitation mannequins. While instructors assessed all participants as passing their skills tests, objective data revealed that none performed effective CPR according to AHA guidelines. Notably, participants in the online group outperformed those in the traditional group on specific skills, such as giving breaths. The online course demonstrated effectiveness regarding skill acquisition and learner satisfaction, with no significant differences in overall performance between the two groups. Participants in the online course reported higher rates of compressions and a greater percentage of compressions of adequate depth. The study emphasized the benefits of online training, including increased accessibility and the ability to learn at a self-directed pace, which may help overcome barriers associated with traditional training methods. Overall, the findings support the integration of online training modules as a viable alternative to traditional courses, suggesting that online education can facilitate broader dissemination of CPR and first aid knowledge among laypersons.

Jayaraman et al. (2009) examined prehospital trauma care in Kampala, Uganda, where no organized emergency system exists. The study assessed the trauma burden on laypeople and the feasibility of a lay first-responder training program. A cross-sectional survey of police officers, taxi drivers, and Local Council officials collected data on their emergency experiences, aid barriers, and training history. A context-specific first-aid course was developed, with knowledge assessments conducted before and after training. Among 309 participants, many had witnessed traumatic emergencies, but most were untrained and ill-equipped. Training significantly improved knowledge, with pre-training scores averaging 45% and post-training scores reaching 86%. The findings highlight the urgent need for organized prehospital care in Kampala and demonstrate the effectiveness of tailored first-aid training for laypersons. Future research should evaluate the long-term impact of such initiatives. This study suggests that similar online training modules could enhance first aid knowledge if adapted to specific learner needs, emphasizing the importance of accessible training in improving emergency response capabilities.

Van de Velde et al. (2009) conducted a study to evaluate the effects of nonresuscitative first aid training on the competence and helping behavior of laypersons. This systematic review involved searching 12 databases for randomized and nonrandomized controlled trials and interrupted time series, with two reviewers independently evaluating study quality and extracting data. The review included four studies, three of which were randomized trials. The results indicated that trained participants achieved significantly better written test scores in first aid knowledge compared to controls, particularly in scenarios such as poisoning. Moreover, in simulated emergencies, those who received training demonstrated improved helping behavior, especially in cases of bleeding and chest pain, compared to individuals who did not undergo training. The findings underscore that first aid training—particularly programs addressing psychological barriers to helping—enhances both knowledge and the likelihood of providing effective assistance in emergencies. This study highlights the importance of integrating training that overcomes inhibitors to helping behavior, suggesting a promising direction for future research on online training modules for first aid and CPR.

Heinrichs et al. (2008) conducted a study examining virtual worlds' role in team training for critical care medicine. The research identifies the need for effective training methods, particularly for emergency department teams. It presents three case studies utilizing 3D virtual environments for trauma management, disaster preparedness, and mass casualty incidents, allowing engagement from multiple locations and enhancing accessibility compared to traditional manikin training. Trainees found the environments realistic enough to "suspend disbelief" and used voice communication tools to simulate teamwork. The study demonstrated significant improvements in team leadership and crisis management skills through pre- and post-tests, with participants reporting increased confidence in managing emergencies. The research highlights virtual training's benefits, including flexibility and the ability to repeat scenarios, which align with best educational practices. The findings suggest that online training modules for First Aid and CPR could similarly incorporate interactive simulations, emphasizing teamwork and communication to improve effectiveness. Overall, the study indicates that virtual world simulations can effectively train medical teams, providing insights to enhance online First Aid and CPR training and improve preparedness in emergencies.

The study by Das and Elzubeir (2001) evaluated the implementation and outcomes of a first aid and basic life support (BLS) training program for first-year medical students at the United Arab Emirates University, which has been in place since 1989. Aiming to equip students with essential skills and

boost their confidence in emergency situations, the program featured a curriculum that combined theoretical instruction with practical skills development through various teaching methods, including lectures, demonstrations, and hands-on practice with mannequins and simulated patients. The high response rate of 91.7% reflected strong student enthusiasm and motivation, with feedback indicating a particular appreciation for the practical components of the course. Post-training assessments revealed that while students generally felt confident in performing various skills, there was a significant correlation between perceived opportunities for practice and self-assessed confidence; however, many expressed a desire for additional practice time, pointing to a need for improved training resources. All participants successfully passed multiple-choice questions and objective structured clinical examinations (OSCEs), demonstrating the program's effectiveness in imparting knowledge and skills. The study highlighted the critical importance of structured practice and adequate resources in training programs, advocating for medical curricula to focus on skill retention through ongoing practice and feedback. These findings resonate with broader literature on online training modules for first aid and CPR, which, while enhancing accessibility and knowledge acquisition, often fall short in providing the hands-on practice essential for skill retention and confidence. Thus, the Das and Elzubeir study emphasizes the necessity of incorporating practical components into any training program, whether delivered in-person or online, to ensure comprehensive skill development.

The review of current literature on the effectiveness of online training modules for first aid and CPR reveals a complex landscape of educational practices that reflect both the potential and limitations of digital learning. While many studies demonstrate significant improvements in knowledge retention and skill acquisition through various online formats, the effectiveness often hinges on the inclusion of practical components and interactive elements that closely mimic real-life scenarios. However, the literature also underscores critical gaps, particularly regarding the long-term retention of practical skills and the challenges associated with purely online formats. Many studies emphasize the necessity of ongoing practice and refresher training to maintain competency in CPR and first aid techniques. Furthermore, the quality of instruction and engagement in online modules remains a crucial factor that influences learning outcomes.

4. Discussion

The review of current literature on the effectiveness of online training modules for First Aid and CPR reveals a multifaceted landscape where accessibility and flexibility are coupled with significant challenges in skill retention and practical application. This discussion synthesizes findings from various studies, addressing the strengths and limitations of online training methodologies.

4.1. Strengths of Online Training Modules

One of the most notable advantages of online training modules is their accessibility, which allows learners to engage with the material at their own pace. Cason and Stiller (2010) highlighted that participants in online courses reported higher satisfaction levels and greater control over their learning pace compared to traditional instructor-led formats. This flexibility is particularly beneficial for individuals with varying schedules and commitments, enabling broader participation in essential training programs. Moreover, studies have demonstrated that online training can effectively enhance knowledge retention. For instance, Mishra et al. (2017) showed a significant increase in knowledge among nursing students following the completion of an online training module. Similarly, the pilot study by Bussières et al. (2011) indicated that an online simulation module helped healthcare professionals improve their ability to locate medications quickly during emergencies. These findings suggest that when designed effectively, online training can be a valuable tool for knowledge acquisition.

4.2. Limitations in Practical Skills Development

Despite these strengths, a critical concern remains regarding the adequacy of online training in developing practical skills. The study by Heinrichs et al. (2008) emphasized the importance of hands-on practice, revealing that while virtual environments can enhance teamwork and crisis management skills, they may not fully substitute for traditional training methods that involve physical practice with mannequins. This sentiment is echoed in the research by Sholokhova et al. (2023), which found discrepancies between theoretical knowledge and practical skills among students who underwent remote training. Furthermore, the findings from Tse et al. (2023) underscore that children trained in first aid demonstrated improved knowledge but struggled with practical application, particularly in performing CPR. This indicates that while online modules can provide theoretical grounding, they may fall short in fostering the muscle memory and confidence required for effective real-life responses.

4.3. The Role of Blended Learning

The concept of blended learning, which combines online and face-to-face instruction, appears to address some of the limitations associated with purely online training. Sommerville (2023) found that blended learning significantly enhanced knowledge retention among non-healthcare professionals compared to in-person training alone. This suggests that integrating practical components into online modules could help bridge the gap in skill development, reinforcing theoretical knowledge with hands-on practice.Additionally, studies like that of Anderson et al. (2019) advocate for frequent, structured training sessions, whether online or in person, to maintain competency. The emphasis on regular refresher courses aligns with the findings of Anderson et al. (2012), which revealed a decline in CPR skills over time without ongoing practice. Thus, a hybrid approach that includes both online learning and regular in-person sessions may optimize training outcomes.

4.4. Implications for Future Training Practices

The literature also highlights the necessity of continuous adaptation and improvement of training content to meet learners' needs. For example, Gignoux-Froment et al. (2024) emphasized the importance of practical simulations for military healthcare providers, advocating for training methodologies that reflect real-world scenarios. This principle can be applied across various contexts, suggesting that online training modules should incorporate interactive elements and realistic simulations to enhance engagement and efficacy. Moreover, the study by Bakke et al. (2017) points to the need for clearer curricular guidelines and adequate resources in educational settings. By ensuring that online training modules are aligned with established educational standards and best practices, organizations can enhance the effectiveness of their training programs. Thus, while online training modules for First Aid and CPR offer significant advantages in terms of accessibility and knowledge retention, they face notable challenges in developing practical skills and ensuring long-term retention. The integration of blended learning approaches, continuous content adaptation, and a focus on hands-on practice are essential for maximizing the effectiveness of online training. Future research should further explore these dynamics, aiming to refine online training methodologies to better prepare individuals for real-life emergencies.

5. CONCLUSION:

This review highlights the evolving landscape of first aid and CPR training, emphasizing the significant potential of online training modules as effective educational tools. The literature indicates that while online platforms can enhance accessibility and flexibility, the effectiveness of these modules is largely contingent upon the incorporation of interactive and practical components that simulate real-life scenarios. Key findings reveal that many online training programs successfully improve knowledge retention and student satisfaction; however, concerns persist regarding the development and retention of practical skills. Studies consistently underscore the necessity for blended learning approaches, which combine online instruction with hands-on practice, to foster both confidence and competence in emergency response situations. Moreover, the review identifies critical gaps in the current research, particularly concerning long-term skill retention and the comparative efficacy of various instructional methods. Future research should focus on the integration of innovative training techniques, such as virtual simulations and frequent refresher courses, to enhance the overall effectiveness of online training modules. Ultimately, as the demand for flexible, scalable training solutions continues to grow, it is essential for organizations and policymakers to prioritize the design and implementation of comprehensive online training programs that not only impart knowledge but also ensure that participants are adequately prepared to respond effectively in emergencies. By addressing the identified limitations and embracing a multifaceted approach to training, we can significantly improve emergency preparedness and health outcomes across diverse populations.

6. Future Direction

As the landscape of emergency preparedness continues to evolve, further research is essential to enhance the effectiveness of online training modules for first aid and CPR. The following key areas warrant attention:

Future research should focus on longitudinal studies to assess the long-term retention of knowledge and skills acquired through online training.

- Investigating hybrid training approaches that combine online learning with in-person practical sessions could provide valuable insights. Studies should explore how blended learning environments can enhance skill acquisition and confidence among participants, especially in low-resource settings.

- There is a growing need to explore the effectiveness of customized online training modules tailored to specific populations, such as children, elderly individuals, or healthcare professionals.
- The integration of advanced technologies, such as virtual reality (VR) and augmented reality (AR), into online training could enhance simulation experiences. Research should evaluate the effectiveness of these technologies in improving practical skills and learner engagement.
- Investigating how socioeconomic factors influence the accessibility and effectiveness of online training can provide insights into disparities in emergency preparedness. Understanding these influences can guide the development of targeted interventions to reach underrepresented populations.
- Future studies should incorporate objective assessments of practical skills in addition to knowledge-based evaluations. Developing standardized metrics for measuring skill competency in online training environments is crucial for validating training effectiveness.

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