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Training Programs for Paramedics' First Aid Competence in Traffic Accidents

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Abstract. General Background: Road traffic accidents are a major cause of global mortality and disability. Specific Background: Limited prehospital care and inadequate paramedic skills worsen trauma outcomes, particularly in Iraq and similar regions. Knowledge Gap: Evidence on the effectiveness of structured training programs for paramedics in first aid procedures is fragmented. Aim: This review critically appraises studies from 2014–2024 evaluating training programs to enhance paramedics' competencies in managing road traffic injuries. Results: From 17,000 records, 7 high-quality studies were included, covering cardiopulmonary resuscitation, bleeding control, aeromedical evacuation, tactical combat casualty care, and trauma management. Most programs showed significant improvements in knowledge and skills, with simulation-based and video-assisted training being most effective. Novelty: This is the first synthesis focused on paramedics' first aid training for road accidents in Iraq and comparable settings. Implications: Ongoing, evidence-based training programs are essential to reduce preventable deaths and improve emergency response capacity.

Highlights:

1. Highlights the impact of training programs on improving paramedics' first aid skills.
2. Emphasizes the role of continued education in reducing mortality and disabilities.
3. Identifies effective teaching methods like simulation and video-assisted learning.

Keywords: First Aid, Pre-hospital Care, Training Programs, Road Traffic Accidents, Paramedics' Competencies

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Introduction

Zoonotic Road traffic accidents (RTAs) are the leading cause of death worldwide. Over 1.2 million people are killed in traffic accidents each year, and up to 50 million more suffer non-fatal injuries and other health issues [1].

Road traffic injuries are currently thought to be the ninth leading cause of death worldwide for all age groups. Many people in critical condition die as a result of first aid not being provided [2].

Road traffic accidents and the injuries they cause are a major public health concern in developing countries. The severity of injuries and accidents may be lessened for accident victims who receive immediate emergency pre-hospital care and are then taken to a medical facility [3].

Due to poor road infrastructure, increased urbanization, and a lack of traffic safety education, road traffic injuries are on the rise in Arab nations [4]. Egypt was found to have one of the highest rates of RTAs in both Africa and the Middle East, according to WHO statistics from 2018 [5].

In terms of the total number of deaths from road accidents in 2013, Iraq ranks 18th out of 180 nations [5789 mortality], with India leading the pack (13572 fatalities), according to data released by the World Health Organization in 2015. The World Health Organization (WHO) has shown that in the Eastern Mediterranean Region (EMR), Iraq has the second-highest rate of road traffic fatalities [6].

Baghdad, Basra, and Babylon were responsible for almost 38% of all traffic accidents, according to a breakdown of Iraqi governorates by accident frequency. Baghdad has the deadliest roads and the most traffic accidents out of all fifteen of Iraq's cities. On average, seven people are killed in traffic accidents per day, with about 25 incidents occurring in Iraq every day [7].

In the UK, paramedics are traditionally associated with providing emergency care as a component of an emergency medical service (EMS). Recently, paramedics have taken on a new responsibility. Furthermore, current paramedics need to be able to handle a variety of acute medical conditions in addition to providing substantial vital aid. Acute indications of mental illness and social-care examinations [8].

Establishing and implementing training programs for the general public is crucial because of the importance of training in lowering traffic accidents. These initiatives ought to be tailored to the unique resources, infrastructure, and contextual elements of each contemporary globe, including its environment, politics, economy, and culture [9], at a low level of health literacy in both developed and developing countries. To make appropriate and autonomous health decisions, two out of every three Canadian individuals and nine out of ten adults need to receive, comprehend, and act upon health-related information [10]. Increasing understanding of nurses' health behaviors in different healthcare settings using accurate assessment is crucial to further developing training interventions [11].

Prior investigations have demonstrated a positive correlation between the participation of all nursing personnel in Iraqi hospitals within continuing training

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programs and a subsequent reduction in medication errors, patient injuries, and an overall increase in patient safety [12-15].

The occurrence of traffic crashes represents a significant global public health issue, resulting in disabilities, long-term suffering, and significant economic losses. In such situations, the actions taken by bystanders play a critical role. To effectively administer first-aid interventions, bystanders, who are often individuals without professional medical training, require both courage and the necessary knowledge [16].

The role of first aid is of crucial significance in influencing the outcome and severity of future complications [17]. Singletary et al. have shown that the provision of first aid education has the potential to enhance survival rates, reduce the severity of injuries, and relieve symptoms via a range of strategies, including the implementation of health education programs [18].

To critically appraise and synthesize the most pertinent research on the efficacy of training programs in augmenting paramedics' competencies in first aid procedures for road traffic accidents.

Methods

A. Search Strategies

A review of the literature was done in order to evaluate and gather data regarding the competence acquired from first-aid training in traffic accidents, obtained from electronic databases PubMed, Cochrane Library, and Google Scholar. The searched keywords in this study were "First Aid", "pre-hospital care", "Training Programs", "Road Traffic accident", and "Paramedics' competencies".

B. Selection Criteria

2.1 Inclusion Criteria

Only English-language A pre- and post-intervention from the period 2014 to 2024, demonstrating the benefits of first aid procedures for road traffic in this review, were taken into consideration. Studies that were found through literature research that could offer evidence on the subject are checked for eligibility. The following were the inclusion criteria: (1) studies focused on a paramedic`s competencies and health care provider aged ≥20 years who works in the immediate ambulance division and emergency department; (2) pre-post-intervention studies with a control group; (3) research involving first aid training in a traumatic setting; and (4) research assessing at least one of the subsequent results: effectiveness of the educational program, pre-Hospital care, and other keywords. Research adhered to standards set by the European Resuscitation [19]. Council of the American Heart Association [20].

2.2 Exclusion criteria

Studies published in languages other than English. Studies with limited methodological quality (assessed using a pre-determined tool) and articles excluded from the quality assessment were critically appraised due to low methodological rigor.

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C. Study Selection and Evaluation:

Using the inclusion/exclusion criteria, researchers will screen the titles and abstracts of the identified studies to determine their relevance. After identifying potential research, researchers will retrieve their full-text publications and use a standardized approach to carefully evaluate their methodological quality. Studies with significant methodological flaws will be excluded.

D. Critical appraisal:

The CASP Critical Appraisal Checklist for studies presenting first aid data was used to critically evaluate the quality of these 12 papers (supplementary file). All papers were considered if they met at least ten of the criteria listed in the table's column headings and tables 2 and 3.

All papers were assessed based on methodological rigor and data relevance. Five papers were eliminated as a result of the approach (Table 1; Fig. 1). Table 2 shows that the remaining 7 studies used suitable quantitative designs for first aid courses and training programs.

Author name \year	Was a specific question addressed in the review?	Were the correct kinds of papers sought after by the authors?	Do you believe that every significant, pertinent study was covered?	Did the authors of the review adequately evaluate the caliber of the included studies?	Was it a sensible decision to integrate the review's findings?	What are the review's general findings?	How accurate are the findings?	Are the findings applicable to the local populace?	Were all significant results taken into account?	Do the expenses and drawbacks outweigh the advantages?
ChokothoL et al. 2017 [21]	Yes	Yes	No	No	Can't Tell	Can't Tell	Yes	No	Can't Tell	Yes
Horrocks et al. 2019 [22]	No	Yes	Can't tell	No	Can't tell	Can't tell	Can't tell	No	Yes	Yes
Almakrami et al. 2022 [23]	Yes	Can't tell	Yes	No	Can't tell	Yes	Can't tell	Yes	No	No
Grant, 2015 [24]	No	No	No	No	Can't tell	No	No	No	No	No
Rodriguez, 2016 [25]	No	No	Yes	No	Yes	No	No	Yes	Can't tell	No

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Table 1. The First aid training programme that was excluded from the study was evaluated using the CASP critical assessment checklist.

Author name \year	Did the review address a focused question?	Did the authors look for the right type of papers?	Do you think all the important, relevant studies were included?	Did the review's authors do enough to assess the quality of the included studies?	If the results of the review have been combined, was it reasonable to do so?	What are the overall results of the review?	How precise are the results?	Can the results be applied to the local population?	Were all important outcomes considered?	Are the benefits worth the harms and costs?
Govender et al. 2016 [26]	Yes	Yes	Yes	Can't tell	Can't tell	Yes	Yes	Yes	Yes	Yes
Smith. 2018 [27]	Yes	Can't tell	Can't tell	Can't tell	Yes	Yes	Yes	Yes	Yes	Yes
Gaeed and Hassan. 2020 [28]	Yes	Yes	No	Can't tell	Yes	Yes	Can't tell	Yes	Yes	Yes
Ali and Abed. 2022 [29]	Yes	Yes	Can't tell	No	Yes	Yes	No	Yes	Yes	Yes
Ali and Hassan 2019 [30]	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes	Yes	Yes
Ali and Khudur. 2021[31]	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes	Yes	Yes
Aekka et al, 2015 [32]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 2: CASP critical appraisal checklist applied to the included studies reporting training programs about first aid

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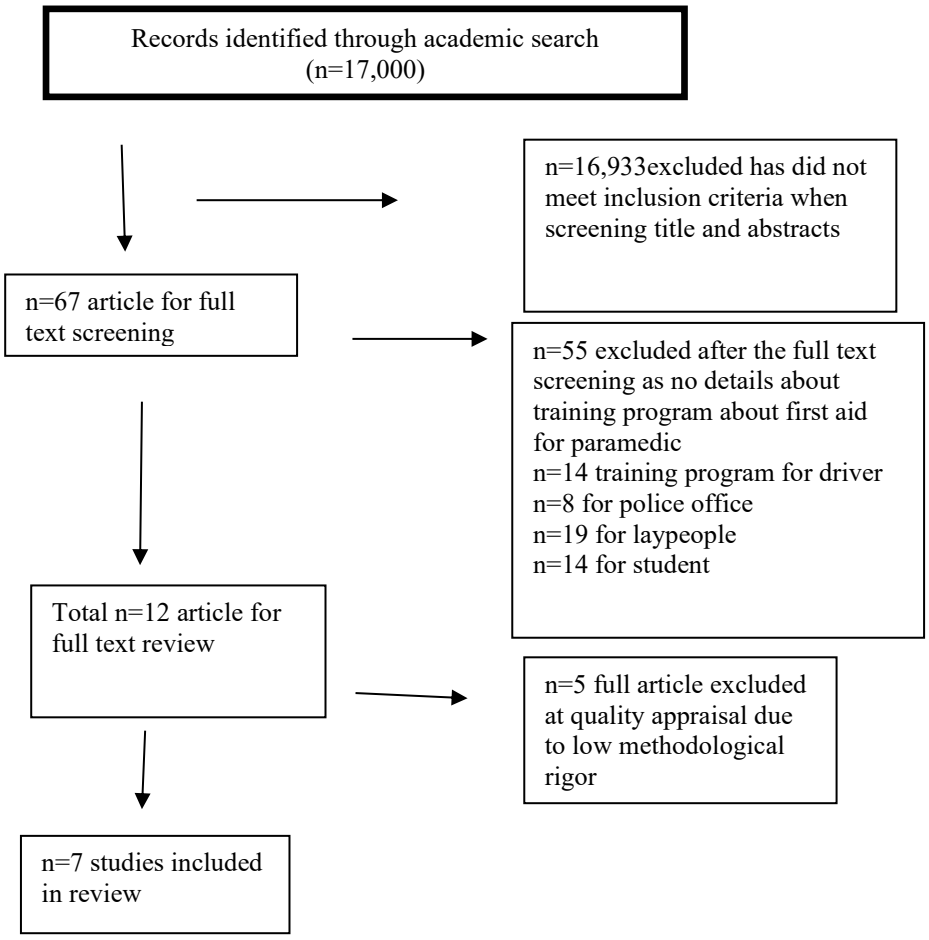

Fig.1. flowchart of study selection

Results

Table (3) Post-Intervention to Assessing the Effects of Training Programs

Authors, Year	Sample size	Subject	Results
Govender et al. 2016 [26]	**n=149**	Examine the effectiveness of cardiopulmonary resuscitation (CPR) training in two sets of paramedics who participated in separate CPR programs.	Compared to paramedics who participated in the regular curriculum and obtained this rating 7.9% of the time, paramedics who received CPR training through the customized program were rated competent 70.9% of the time. The time needed to identify

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			cardiac arrest, the quality of chest compressions, and the time needed to initially check rhythm and administer shock all showed notable improvements. Time to detect cardiac arrest, time to first check rhythm and provide shock, and quality of chest compressions all improved.
Smith. 2018[27]	**n=101**	Trauma education: Educating healthcare personnel in India to reduce bleeding	Most people who took the survey felt more comfortable applying tourniquets and packing wounds on more lifelike mannequins.
Gaeed and Hassan **2020** [28]	**n=30**	Aeromedical Evacuation Programme for Flight Medics at Iraqi Army Air Bases: A Groundbreaking Approach to Treating Emergencies	Paramedics' knowledge regarding the five axes of air evacuation was moderate before the test, and it improved over the first two post-tests
Ali and Abed 2022[29]	**n=40**	Paramedics' Use of Tactical Combat Casualty Care Protocols	The paramedics' practices were found to be unsatisfactory in the pretest, but after implementing the intervention programme, they improved to an adequate level in the posttest. .

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Ali and Hassan. 2019 [30]	**n=30**	Knowledge of Emergency Care for Careers	Results from the post-test demonstrated that careers' understanding of physiological changes, health concerns, and emergency care had improved to a high level, in contrast to the moderate results from the pre-test.
Ali and Khudur 2021[31]	**n=100**	Combatants Preserving Lives in the Command of the Ground Forces	The study's findings reveal that paramedics' total domain knowledge score fell under the moderate level.
Aekka et al, 2015[32]	**n=48**	Trauma education before hospital arrival	The management of cervical spine injuries and hemorrhages showed the greatest improvements in competency, while the installation of intravenous lines showed the least improvement. .

Discussion

Of the seven included studies, all of these studies (Table 2 and Table 3) gave a comprehensive report on training programs for paramedics. Study [26] reported the training programs for cardiopulmonary resuscitation, bleeding [27], aeromedical, tactical combat, fighter [28, 29, 31], elderly emergency care [30], and the last study reported about airway, hemorrhage, fracture, and cervical spine injures, chest injure, IV-line placement, triage, and communication [32]. All samples ranged from 30 to 149, and most of the results of these studies were positive, improving paramedic knowledge. The research settings of this study in Qatar, India, and Iraq, from the period 2014 to 2024.

CPR and Hemorrhage:

Two of the studies reported on training programs for CPR and hemorrhage between 2016 -2018 in Qatar and India; the samples in these two studies were

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paramedics (101,149 samples).

This study looks at the cardiopulmonary resuscitation (CPR) abilities of two sets of paramedics who received CPR training from different programs. At the national ambulance service of the State of Qatar, the Hamad Medical Corporation, 149 new paramedic recruits were evaluated in June 2014 for their CPR performances after receiving training from either a standard or an individualized program.

The content taught in both programs was the same, but the methods used to impart it to students were different. Pre-course work that was required, ongoing evaluations, a locally produced CPR training film, and instructional exercises catered to paramedics' preferred learning styles and backgrounds were all unique features of the tailored curriculum. Upon completion of each training session,

One examiner, blind to the kind of training paramedics had received, assessed their competency in basic life support, condition-specific abilities, and other areas. The results showed that paramedics who participated in the individualized CPR training program were deemed competent 70.9% of the time, in contrast to 7.9% of paramedics who participated in the normal program. There were improvements in the following areas: time to detect cardiac arrest, quality of chest compressions, and time to initially check rhythm and deliver shock [26].

An additional inquiry revealed that 101 individuals who had finished StB training in India were surveyed as cross-sectional allies.

All participants had their pre- and post-training questionnaires taken. Analysis was done on 88 healthcare professionals' responses in total. There were three bleeding control skills covered: applying tourniquets, packing wounds, and compressing wounds.

A sizable majority of participants stated that more lifelike models would boost their confidence in their ability to pack wounds and apply tourniquets. In summary, this is the first StB training that we have heard of in India. Because of transportation delays, uneven access to care, and other factors, it has a high trauma load and a shortage of prehospital staff members. The greater the number of citizen interventions that occur once these crucial life-saving skills are widely used, the more trauma patients will survive long enough to be treated in a trauma center. Get more people involved in the program; thought should also be given to translating the course into regional tongues [27].

Comparative analysis of the two training interventions revealed the superiority of CPR courses [26] over hemorrhage control programs [27]. This advantage can be attributed to the multifaceted design of the CPR curriculum, incorporating tailored program elements, mandatory recourse work, ongoing assessments, a locally produced instructional film specific to CPR, and practical exercises aligned with paramedics' existing knowledge base and preferred learning modalities.

Aeromedical, Tactical Combat, and Fighter

Three studies reported training programs for Aeromedical and Tactical Combat, and Fighter. Between 2020 -2022 in Iraq, the samples in these three studies were paramedic (30,40, 100 samples) [28, 29, 31].

One study found that the aeromedical evacuation program affected the level of expertise among flight medics. From Iraqi army aviation bases, 30 flight medics were selected using a non-probability "purposive" sample method based on a pre-

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experimental design. The questionnaire was divided into two main sections: One part contained fifty paragraphs and inquired about air paramedic demographics, while the other part had five axes. Prehospital Awareness of Emergency Injuries in Paramedics.

The study's findings showed that paramedics' pre-test understanding of the five axes of air evacuation was at a modest level, but that in the first and second post-tests, their knowledge had increased. The program's effectiveness and the paramedic participant's training course location were found to be related at the P ≥0.05 level, according to the study. The study suggested that the current program for implementing emergency case training during aeromedical evacuation be approved [28].

The purpose of the current study, according to Ali and Abed, is to ascertain how well paramedic practices adhere to Tactical Combat Casualty Care (TCCC) recommendations. Baghdad Operations Command in Iraq conducted a pre-experimental design research. Forty paramedics were selected from all units under Baghdad Operations Command using a non-probability "purposive" sample. The first part of the survey asks about the paramedics' personal information; the second part covers four categories and seventy-one questions about the paramedics' practices in meeting the needs of tactical combat casualty care. The paramedics' pretest scores were low across the board when it came to the primary areas related to the TCCC standard application. Posttest I result, on the other hand, showed that paramedics' performance had improved to a satisfactory degree after the intervention program was put into place. Afterward, posttest II results were similar to posttest I results. Results show that there were substantial changes between the pre-and post-tests, highlighting the positive benefits of the program. Results showed that paramedics' perceptions of the TCCC intervention program had changed for the better. Findings from the study support the idea that paramedics should take part in continuing education opportunities, including seminars, conferences, and classes, to keep their knowledge and abilities current [29].

Ali and Khudur (2021 reported A non-probability (purposive) sample of 100 paramedics from who Ground Forces Command in various Iraqi units was chosen for a descriptive design study on the paramedics at the command. The paramedics utilized a knowledge assessment questionnaire.

Data was gathered by means of an Arabic version of the developer questionnaire and a structured interviewing strategy conducted with every paramedic. The study's summary statistic for the " Questionnaire evaluating paramedics' understanding of combat life-saving techniques administered by Ground Forces Command " is presented in the study's results. The questionnaire consists of 25 items, including 16 multiple-choice questions (MCQ) and nine closed-ended questions with Yes/No answers. The participants' overall knowledge domain score fell into the moderate range. The survey found that paramedics' general level of knowledge is moderate. Suggestions: The study suggests expanding medical training and advanced courses to raise the skill level of paramedics [30].

Ali and Abed, this study is better due to the use of guidelines authorized by the WHO.

Prehospital Care Education

Two of the studies reported on trauma education between 2015 -2019 in Iraq

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and India; the samples in these two studies were healthcare providers and first responders (30,48 samples).

Hassan and Al-Mumammedawi. According to reports from 2019, the study aims to assess caregivers' knowledge of emergency care. A quasi-experimental study was carried out in Baghdad City to determine the program's effectiveness in improving caregivers' understanding of emergency treatment for elderly patients. Thirty male and female caregivers made up a purposive sample (non-probability). Implement the program, caregiver data was gathered using an instrument that has two parts: The caregivers' demographic data is covered in the first section, and the second section consists of two areas with a total of 48 items related to the knowledge that caregivers have regarding health issues, physiological changes, and emergency treatment for elderly patients. A group of ten specialists confirmed that this instrument was authentic. Government and private senior care home careers had a modest understanding of physiological changes, health concerns, and emergency treatment, according to pre-test findings. However, the results of the follow-up tests showed that the career knowledge of these subjects had skyrocketed thanks to the program's beneficial impacts.

The study concluded that the career knowledge instruction program was effective in preventing elder abuse and advocated for more training for careers both in and out of Iraq. It also urged careers to take safety measures [3]. Reported by Aekka et al. in 2015.

The absence of adequate prehospital trauma care in underdeveloped regions is a key contributor to the worldwide trauma epidemic. We created a two-dimensional training program for non-doctors who work as first responders. It includes native-language instruction, self-directed learning videos, video-assisted debriefing, and high-fidelity simulation. In Jodhpur, Rajasthan, a trial run was carried out. To educate 48 non-professional first responders in 10 critical areas, 18 instructors from the area were enlisted to create instructional films for self-directed learning that lasted 15-20 minutes, followed by skill sessions with a high-fidelity simulation that lasted 30–40 minutes, and finally, video-debriefing sessions that lasted 15-20 minutes rounded out the program. Using pre- and post-training surveys, we were able to measure changes in competency [32].

All aspects of trauma management—airway, bleeding, fractures, cervical spine damage, chest injury, intravenous line placement, extrication, scene assessment, triage, and communication—showed statistically significant improvements. The management of cervical spine injuries and hemorrhages showed the greatest improvements in competency, whereas the insertion and removal of intravenous lines showed the lowest.

A critical evaluation of the two studies yielded the superiority of the approach outlined in Aekka et al. (2015). This advantage stemmed from its incorporation of several pedagogical techniques, including native language training, self-directed learning videos, video-assisted debriefing, and high-fidelity simulation.

Conclusion

Investing in robust paramedic training programs emerges as a crucial intervention in developing emergency medical systems. While addressing the root causes of road accidents may require broader infrastructural changes, paramedic training represents a

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readily implementable strategy with the potential to save lives and minimize long-term disabilities. This targeted approach offers a significant benefit in improving patient outcomes within the existing emergency care framework. According to research in the field, paramedic training programs greatly enhance first aid knowledge, abilities, and confidence. All studies that have touched on this topic have stressed the significance of this program. However, these training programs do not reduce traffic accidents; rather, they reduce the mortality and disability rates.

Recommendations suggest that all Iraqi hospitals implement a continuing education program for their nursing staff in order to decrease the occurrence of medication errors and the likelihood of patient injuries and to improve patient safety.

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