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REVIEW ARTICLES

Emergency Care and Interventions for Construction Site Injuries: A Literature Review.

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Abstract

Introduction: Injuries plague the construction sector, straining healthcare systems and endangering lives. Empowering workers with hazard awareness and equipping them with first-aid skills can reduce injury rates. Robust accident and emergency systems are lifesaving, yet construction sites remain among the most perilous workplaces, marked by frequent trauma, disability, and loss of life.

This review examines the latest evidence on emergency care for construction-site injuries, highlighting prehospital care, rapid on-site response, and seamless coordination with the trauma system.

The review uncovers common injury patterns, highlights the most effective emergency strategies, pinpoints gaps in training and preparedness, and delivers actionable recommendations. Swift recognition, decisive action, strong teamwork, and vigilant safety practices are essential for minimizing complications and saving lives during construction emergencies.

To reduce workplace injuries, regular risk assessments, fitness checks for demanding roles, ongoing safety and wellness training, and the appointment of first-aid marshals are vital. Ensuring adequate qualified staff, maintaining tidy workspaces, clear walkways, visible signage, proper lighting, and comprehensive emergency response training, such as BLS-D, BTLS, PHTLS, and ATLS, all play a crucial role in building a safer construction environment.

Conclusions: Construction site injuries pose a major public health and safety challenge. Timely emergency care—from basic first aid to advanced trauma treatment—is crucial for reducing illness and fatalities. Strengthening prevention, enforcing safety standards, and embracing new technologies can transform construction site safety. Multifaceted or tailored interventions are most effective, but many studies lack rigor.

Keywords: Emergency care, Emergency Medical Services, prehospital care, trauma management.

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Introduction

Construction sites rank among the world's most hazardous workplaces. According to the International Labour Organization (ILO), construction workers face a far greater risk of serious injury or death than those in other industries.[1] Their daily challenges include working at heights, handling heavy machinery, managing electrical systems, exposure to chemicals, and navigating unstable structures.[2]

These risks are particularly pronounced in low- and middle-income countries, where safety regulations are inconsistently implemented, personal protective equipment is frequently unavailable or inadequately used, and first-response capabilities are often limited [3, 4].

Severe injuries on construction sites frequently result in illness, disability, or even death. Global trauma data indicate that rapid emergency care—from immediate first aid to timely hospital treatment—significantly improves survival. Tragically, preventable deaths often stem from delayed responses or a shortage of trained personnel. [5, 6, 7]

Aim of the Study

This review synthesizes the latest evidence on emergency care for construction-site injuries, identifies what works, highlights critical gaps, and offers clear recommendations to enhance emergency response and prevention.

The specific aims of this literature review are to:

- Identify standard injury mechanisms and patterns on construction sites.
- Evaluate the effectiveness of emergency care interventions, including first aid, prehospital management (care provided before hospital arrival), and early hospital treatment.
- Assess factors influencing morbidity and mortality in construction site trauma.
- Summarize global guidelines and evidence-based practices for emergency management of construction injuries.
- Provide recommendations to improve safety, preparedness, and trauma care at construction sites.

Methodology

Study Design

This narrative review adapts PRISMA principles for a non-systematic approach, weaving together current knowledge and synthesizing insights from a wide range of scientific sources.

Databases and Search Strategy

Researchers searched PubMed, Scopus, Web of Science, and Google Scholar, using Boolean operators such as AND and OR to cast a wide net for relevant studies.

Inclusion Criteria

- Peer-reviewed articles published between 2010 – 2024
- Studies focusing on emergency care for construction-related injuries
- English-language publications
- Randomized studies, observational studies, reviews, and guidelines

The initial search uncovered 69 papers. After removing 12 duplicates, 57 remained. (Tab. 1) Eighteen were excluded based on abstract and title review. Eligible papers were required to be in English, present as systematic reviews or meta-analyses, evaluate safety behavior interventions aimed at reducing injuries, and focus on high-risk occupations.

- Documentation in the English language;
- Systematic reviews/meta-analyses;

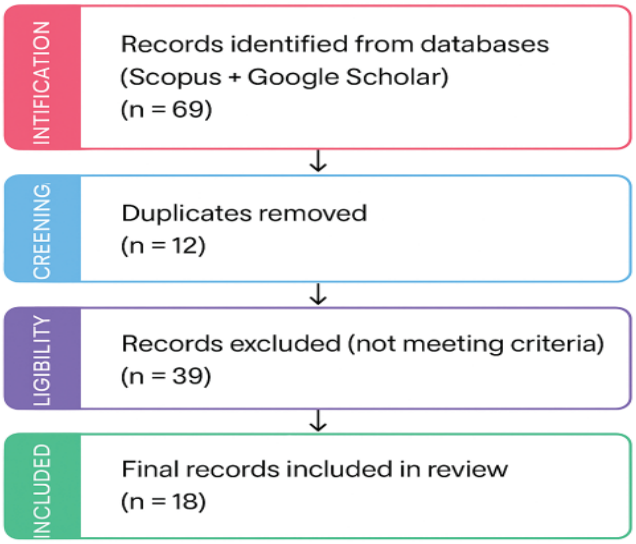

Table 1. Initial Search data

- Assessment of (safety) behavioral interventions;
- Aim to reduce fatal and non-fatal injury;

Target group of 'high-risk' occupations (e.g., employees in construction, agriculture, and manufacturing industries).

The final 19 papers featured diverse study designs, from randomized controlled trials and quasi-experimental studies to interrupted time-series and cross-sectional analyses. Published between 2010 and 2023, with some interventions dating back to 2002, these studies focused on adults aged 18 and above and spanned a wide range of sample sizes.

Assessment of Risk of Bias

Two authors assessed the risk of bias in all included reviews using the **ROBIS** (Risk of Bias in Systematic reviews) tool. The final ratings—weak, mediocre, or good—are shown in Table 2.

The ROBIS tool consists of three phases:

1. Optional assessment of relevance
2. Identification of concerns in the review process
3. Evaluation of the risk of bias

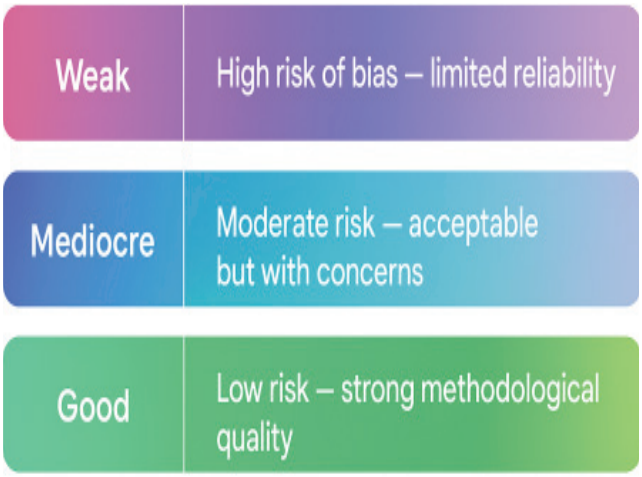

Table 2. Summary classification of ROBIS results.

Signal questions help reviewers judge the risk of bias. The authors used phase 2 to identify concerns, then completed phase 3 to provide the final assessment. If disagreements arose, they discussed them to reach a decision.

Exclusion Criteria

- Case reports with limited generalizability.
- Articles unrelated to emergency care
- Studies focused solely on long-term rehabilitation without acute management.

Data Extraction

Collected data covered study design, participant details, injury types, emergency interventions, clinical outcomes, and key recommendations.

Results

The analysis revealed several factors that effectively reduce injury and accident rates or improve outcomes for affected workers.

Eight of the nineteen papers [8, 9, 10, 11, 12, 13, 14] found that a multi-faceted approach improves intervention effectiveness. These interventions targeted different aspects of the problem. For example, Lehtola et al. [15] evaluated a multifaceted safety campaign and a drug-free workplace program, both of which reduced fatal and nonfatal injuries. Rautiainen et al. [16] reported that educational interventions alone did not reduce injury rates [17, 18].

Five of the nineteen papers [9, 12, 14, 19, 20, 21] found that tailored interventions are more effective, as they increase participant engagement by addressing group-specific characteristics. For example, El Dib et al. [22] showed that tailored interventions led to greater use of hearing protection than no intervention.

One important finding is that these intervention studies are methodologically limited. Eight papers [11, 12, 17, 19, 20] reported that the overall evidence was weak due to low study quality or insufficient studies. Table 1 gives an overview of the studies, their findings, intervention types, and target groups [23].

Frequency and Mechanisms of Construction Site Injuries

The literature consistently identifies several dominant injury categories:

Falls from Height

Falls from ladders, scaffolding, and roofs are the leading cause of fatal injuries, making up 30 to 40 percent of severe trauma cases. These falls often lead to brain injuries, spinal injuries, broken long bones, pelvic fractures, and internal bleeding.

Struck-by-Object Injuries

Falling tools, building materials, and moving equipment often cause head injuries, chest trauma, and broken limbs. These types of incidents account for 20-25% of reported injuries [24, 25].

Machinery-Related Trauma

Heavy machines like cranes, excavators, forklifts, and concrete mixers can cause crush injuries, amputations, and injuries to the chest and abdomen.[26]

Electrical Injuries

Electrocution and electrical burns often occur during wiring, insulation removal, or contact with power lines. These injuries can cause cardiac arrest, severe burns, and nerve damage.[27]

Chemical and Respiratory Exposures

Breathing in toxic fumes, cement dust, or chemical irritants can lead to acute respiratory problems, eye injuries, or systemic poisoning.[28]

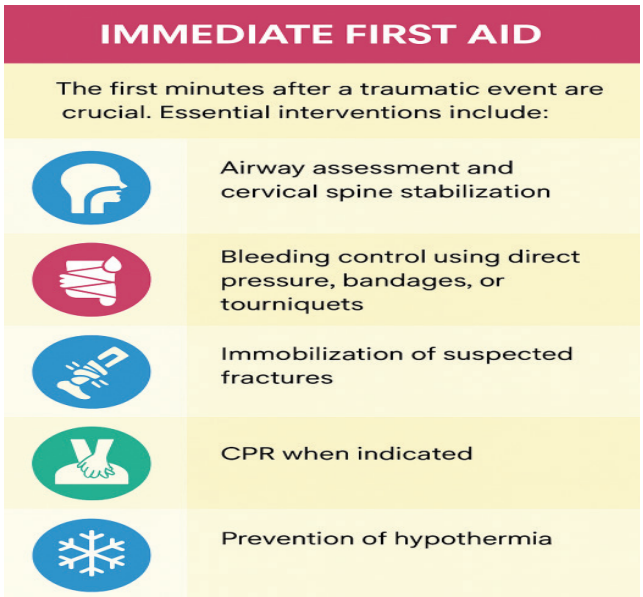

Table 3. Immediate first aid for injuries at construction sites. ***Emergency Interventions at Construction Sites***

Immediate First Aid

The first few minutes after an accident are crucial. Important steps include [29, 30]:

- Airway assessment and cervical spine stabilization
- Bleeding control using direct pressure, bandages, or tourniquets
- Immobilization of suspected fractures
- CPR when required
- Prevention of hypothermia

Research shows that the presence of trained on-site staff significantly improves survival rates, particularly during severe bleeding or cardiac arrest.

Prehospital Trauma Care

Emergency medical services (EMS) are vital for:

- Rapid ABC assessment
- Oxygen therapy and airway management
- Intravenous access and fluid resuscitation
- Application of pelvic binders or immobilization devices
- Rapid transport to trauma centers

Adherence to Advanced Trauma Life Support (ATLS) guidelines is associated with reduced mortality rates. [31, 32, 33]

Hospital-Based Emergency Care

The first hour after an injury, known as the "golden hour," is crucial for preventing further harm and shock. Effective hospital treatments include [33]:

- Immediate diagnostic imaging (FAST, X-ray, CT scan)
- Control of internal bleeding
- Damage control surgery for polytrauma
- Burn care for electrical injuries
- Intensive care monitoring

The main factors that lead to better outcomes are:

Key factors associated with improved outcomes include [34,35]:

- Early hemorrhage control
- Rapid EMS activation
- Presence of trained first responders
- Shorter transport times
- Proper use of personal protective equipment (PPE)

Conversely, delayed emergency care and inadequate site response systems are associated with higher fatality rates.

The findings make it clear: most construction site injuries are preventable. Yet, despite advances in safety technology, many developing regions continue to face high fatality rates due to weak regulations, insufficient worker training, and scarce emergency resources [36,37].

The literature highlights a powerful connection between emergency preparedness and improved outcomes. First aid training, accessible trauma kits, and rapid communication systems all contribute to lower death rates. Organized prehospital trauma care accelerates stabilization and improves survival. [38, 39]

However, emergency preparedness varies widely: some countries have advanced systems and trauma centers, whereas others have only basic or unreliable EMS services [40, 41, 42].

Emerging evidence supports the integration of new technologies, such as:

- Wearable sensors for fall detection
- Automated emergency alert systems
- Drone-assisted delivery of medical supplies
- Telemedicine for remote triage. [43]

These innovations have the potential to revolutionize emergency response on construction sites, making interventions faster and more effective than ever before. [44]

Conclusions

Construction site injuries pose a major public health and safety challenge. Timely emergency care—from basic first aid to advanced trauma treatment—is crucial for reducing illness and fatalities. This review demonstrates that rapid action, skilled personnel, and well-organized emergency systems are associated with better outcomes. Strengthening prevention, enforcing safety standards, and embracing new technologies can transform construction site safety. Multifaceted or tailored interventions are most effective, but many studies lack rigor. More robust research and the application of Intervention Mapping are needed to identify the most effective safety strategies

Recommendations

- Mandatory first-aid and emergency response training for all construction workers.
- Establishment of on-site emergency response teams equipped with trauma kits and AEDs.
- Improved coordination between construction companies and local EMS systems.
- Regular emergency drills, simulation-based trauma training, and refresher courses.
- Strict enforcement of occupational health and safety standards.
- Routine documentation and reporting of all incidents to identify trends and risks.
- Adoption of new technologies (sensors, drones, telemedicine) to improve response times.
- Investment in trauma centers near large construction sites to reduce transport delays.

Abbreviations

EMS - Emergency Medical Services; BLS-D Basic Life Support and Defibrillation; BTLS - Basic Trauma Life Support; PHTLS - Pre-Hospital Trauma Life Support; ILO - International Labour Organization; ATLS - Advanced Trauma Life Support; FAST Focused Assessment with Sonography in Trauma; ROBIS - Risk of Bias in Systematic reviews; CPR - Cardiopulmonary resuscitation; PRISMA - Preferred Reporting Items for Systematic reviews and Meta-Analyses.

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