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Safety And Occupational Risks Among Red Crescent Paramedics: A Systematic Review Of Injuries, Stress, And Preventive Strategies (2015–2025)

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Abstract

Background: Paramedics working within Red Crescent systems operate in unpredictable, high-pressure environments that place them at elevated risk of physical and psychosocial harm. Despite growing global attention to the occupational health of emergency medical services (EMS) personnel, limited research has synthesized the unique hazards faced by Red Crescent paramedics.

Objective: This systematic review synthesizes evidence published between 2015 and 2025 on occupational injuries, psychosocial risks, and preventive strategies among paramedics working in Red Crescent and comparable EMS systems.

Methods: A PRISMA-aligned search was conducted in PubMed, Scopus, Web of Science, EMBASE, CINAHL, and Google Scholar. Eligible studies included cross-sectional, cohort, case–control, qualitative, interventional designs, and systematic reviews addressing musculoskeletal disorders (MSDs), needle-stick injuries (NSIs), workplace violence, stress, burnout, fatigue, sleep disturbances, or preventive strategies. Data extraction and quality appraisal were performed using standardized JBI tools. Findings were synthesized narratively due to methodological heterogeneity.

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Results: Thirty-seven studies met the inclusion criteria. MSDs were the most prevalent occupational injuries, affecting 48%–78% of paramedics, with low-back pain as the primary complaint. NSI prevalence ranged from 9%–28%, with under-reporting identified as a major barrier to safety surveillance. Workplace violence was widespread, with 55%–70% reporting verbal aggression and 8%–19% reporting physical assault. Psychosocial risks—including chronic stress, burnout (21%–56%), and sleep disturbances (38%–62%)—were consistently high across Red Crescent settings. Effective preventive measures identified in the literature included ergonomic interventions (e.g., powered stretchers), infection-control training, de-escalation training, peer-

support programs, and organizational improvements; however, implementation remains inconsistent across regions.

Conclusion: Red Crescent paramedics face substantial occupational hazards that threaten both workforce well-being and the quality of prehospital emergency care. Despite the availability of evidence-based preventive strategies, adoption remains uneven. Strengthening ergonomic support, enhancing safety culture, expanding training programs, and providing structured mental-health services are essential to improving workforce resilience and patient safety.

Implications: Findings highlight the urgent need for standardized safety frameworks across Red Crescent systems, targeted interventions addressing both physical and psychosocial risks, and further research evaluating long-term and interventional outcomes.

Keywords: Occupational Safety; Paramedics; Red Crescent; Emergency Medical Services; Musculoskeletal Disorders; Needle-Stick Injuries; Workplace Violence; Burnout; Stress; Fatigue; Prehospital Care; Systematic Review.

1. Introduction

Emergency medical services (EMS) personnel constitute a vital component of modern healthcare systems, providing rapid assessment, stabilization, and transportation for critically ill and injured patients in highly unpredictable environments. Within the Middle East—particularly in Saudi Arabia—the Saudi Red Crescent Authority (SRCA) serves as the primary prehospital care provider, operating an extensive network of stations and ambulance teams across both urban and rural regions (Alzahrani et al., 2023). Paramedics in these settings routinely face complex clinical situations, heavy workloads, and environmental hazards, making them one of the most high-risk occupational groups in the healthcare sector.

International evidence demonstrates that EMS workers experience significantly higher rates of work-related injuries compared to other healthcare professionals. Musculoskeletal disorders (MSDs), especially low-back, neck, and shoulder injuries, remain the most prevalent occupational injuries among paramedics, largely due to manual patient handling, lifting, awkward postures, and confined working spaces (Tahernejad et al., 2024; Nazzal et al., 2024). Additionally, exposure to blood and body fluids, needle-stick injuries (NSIs), and inadequate personal protective equipment continue to impose biological hazards for prehospital providers (Sahebi et al., 2025). Studies from countries with Red Crescent systems report substantial rates of NSIs and under-reporting, contributing to infection risk and psychological burden (Hamoud et al., 2019).

Psychosocial risks—particularly chronic stress, burnout, compassion fatigue, and sleep disruption—have also been widely documented among paramedics. Recent systematic reviews highlight burnout prevalence ranging from moderate to high among EMS personnel, driven by repeated exposure to traumatic events, moral distress, shift work, and organizational pressures (Reardon et al., 2020; Puticiu et al., 2024). Evidence from Asia and the Middle East further indicates that occupational stress among ambulance crews is strongly associated with decreased sleep quality and impaired job performance (Zhang et al., 2024). Workplace violence has emerged as another critical concern, with studies reporting that 50% to 65% of EMS workers experience verbal or physical aggression from patients or relatives (Sahebi et al., 2019; Alqahtani & Alshehri, 2022).

In response to these risks, researchers and health authorities have introduced several preventive strategies aimed at improving occupational safety among EMS personnel. These interventions include ergonomic training for safe patient handling, the introduction of powered stretchers, infection-control education, structured psychological support programs, and workplace violence prevention policies (Betts et al., 2024; Medeni et al., 2024). Early evidence suggests that such

interventions can reduce physical strain, enhance situational awareness, and improve mental well-being. However, despite these advancements, significant gaps persist—particularly in the Red Crescent context, where rapid expansion of EMS services has not always been matched with systematic risk management or comprehensive safety programs (Alzahrani et al., 2023).

Moreover, most prior reviews have focused on single domains—such as MSDs, NSIs, or burnout—rather than offering an integrated synthesis of injury patterns, psychosocial stressors, and preventive strategies among Red Crescent paramedics. Considering the evolving nature of EMS systems between 2015 and 2025, there is a pressing need for an updated, comprehensive review. Therefore, this systematic review aims to synthesize current evidence on (a) occupational injuries, (b) psychosocial stress and burnout, and (c) preventive strategies designed to enhance safety and well-being among Red Crescent paramedics. The findings will provide an evidence-based foundation for improving occupational health policies and strengthening the resilience of prehospital emergency services.

2. Literature Review (APA Style)

2.1. Overview of Occupational Risks in Prehospital Emergency Care

Emergency medical services (EMS) personnel operate in environments characterized by urgency, unpredictability, and physical and psychological strain. Research consistently indicates that EMS workers experience higher rates of occupational injury compared to other healthcare and public safety occupations (Maguire et al., 2021). Factors such as manual patient handling, exposure to trauma, high workload, and environmental hazards contribute to elevated injury and stress levels. Within the Middle East, Red Crescent organizations—most notably the Saudi Red Crescent Authority (SRCA)—represent the primary providers of prehospital emergency care, making occupational safety a critical component of service quality and workforce sustainability (Alzahrani et al., 2023).

Studies from 2015 to 2025 show increasing attention to EMS safety, driven by expanding EMS services, rising call volumes, and new national health policies. However, many challenges continue to persist, particularly in the domains of musculoskeletal injuries, workplace violence, blood-borne exposure, burnout, fatigue, and inadequate safety training.

2.2. Musculoskeletal Disorders and Physical Injuries

2.2.1 Prevalence of Work-Related Musculoskeletal Disorders (WMSDs)

Musculoskeletal disorders are among the most frequently reported injuries in EMS populations. Systematic reviews published between 2020 and 2025 identified high prevalence rates of lower-back, neck, and shoulder pain among paramedics, largely attributed to repetitive lifting, stair-chair transport, carrying equipment, and long shifts in confined spaces (Tahernejad et al., 2024; Nazzal et al., 2024). Prevalence estimates from global studies range from 50% to 78%, underscoring the pervasive nature of WMSDs in this sector.

2.2.2 Risk Factors

Several occupational factors contribute to WMSDs among paramedics:

- Manual patient handling and heavy lifting, especially during transport (Nazzal et al., 2024).
- Poor ambulance ergonomics, including limited cabin space and fixed stretcher positions (Tahernejad et al., 2024).
- Long work shifts, often exceeding 12 hours, resulting in physical fatigue (Brough et al., 2022).

- Exposure to vibration, particularly during long-distance transport in emergency vehicles (Zhang et al., 2024).

Few studies from Red Crescent settings specifically address ergonomic hazards; however, evidence from Saudi Arabia indicates that paramedics frequently report back pain and lifting-related injuries (Hamoud et al., 2019).

2.2.3 Preventive Measures

Technological advancements—including powered stretchers, stair chairs, and mechanical lift systems—have shown reductions in lifting-related injuries in high-income settings (Betts et al., 2024). However, adoption in Middle Eastern EMS systems remains variable. Training in ergonomic body mechanics and safe patient transfer is recommended, yet implementation remains inconsistent across Red Crescent centers.

2.3. Biological Hazards and Needle-Stick Injuries

Exposure to blood and body fluids poses a significant threat to EMS providers. A landmark systematic review reported that needle-stick injuries (NSIs) remain common among EMS personnel worldwide, often occurring during resuscitation, patient transfer, and handling of medical waste (Sahebi et al., 2025). Under-reporting of NSIs further complicates surveillance efforts.

Studies from Saudi Arabia, Qatar, and Iran indicate that EMS workers in Red Crescent systems are at elevated risk due to:

- Limited access to sharps disposal containers in field settings.
- High-pressure emergency procedures.
- Insufficient training in infection control practices (Al-Surimi et al., 2022).

Although Red Crescent authorities have implemented standard protocols for universal precautions, gaps remain in compliance and timely reporting of NSIs.

2.4. Workplace Violence Against EMS Personnel

Workplace violence—particularly verbal aggression and physical assaults—is a growing concern for EMS providers. A meta-analysis by Sahebi et al. (2019) reported that 60%–70% of EMS workers experienced some form of violence, predominantly from patients' relatives or bystanders during emotionally charged emergencies.

2.4.1 Regional Evidence

Studies from Saudi Arabia, Kuwait, and the UAE reveal similar or higher levels of violence toward EMS staff. In Saudi Arabia, 65% of Red Crescent paramedics reported exposure to verbal or physical violence, often due to delays, misunderstandings, or high emotional tension at emergency scenes (Alqahtani & Alshehri, 2022).

2.4.2 Consequences

Workplace violence is strongly associated with:

- **Emotional exhaustion**
- **Fear and decreased job satisfaction**
- **Intentions to leave EMS roles** (Puticiu et al., 2024)

Organizational responses remain limited, and EMS staff frequently report that violent incidents are normalized rather than systematically addressed.

2.5. Psychosocial Stress, Burnout, and Mental Health

Paramedics face extreme psychological pressures, including exposure to trauma, long hours, moral dilemmas, and unpredictable work environments. Research consistently identifies EMS as one of the most psychologically demanding professions (Reardon et al., 2020).

2.5.1 Burnout Prevalence

Burnout among EMS professionals is characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment. Meta-analyses show burnout rates ranging from 20% to 56% across EMS systems (Puticiu et al., 2024).

2.5.2 Stressors in Red Crescent Systems

Studies from Saudi Arabia highlight key contributors:

- High call volumes and traffic congestion
- Frequent exposure to road traffic trauma
- Shift work disrupting sleep cycles
- Limited support and debriefing structures (Alzahrani et al., 2023)

Paramedics report that emotional stress accumulates rapidly, especially when dealing with pediatric emergencies, resuscitations, and traumatic injury cases.

2.5.3 Impact on Patient Care and Workforce Stability

Burnout negatively impacts:

- **Clinical decision-making**
- **Reaction time**
- **Team communication**
- **Retention of skilled paramedics** (Zhang et al., 2024)

2.6. Fatigue, Sleep Disturbance, and Shift Work Effects

Sleep quality is a major determinant of paramedic performance and safety. Several recent studies show strong associations between long shifts, nighttime calls, and impaired sleep patterns among EMS workers (Zhang et al., 2024). Poor sleep increases the risk of errors, accidents, and emotional exhaustion.

Red Crescent staff often work 12–24-hour shifts, creating heightened fatigue risks compared to other healthcare professionals.

2.7. Preventive Strategies and Safety Interventions

2.7.1 Ergonomic and Equipment-Based Interventions

Powered stretchers, hydraulic loading systems, and redesigned ambulance interiors have shown measurable reductions in lifting injuries (Betts et al., 2024). However, limited adoption in Middle Eastern EMS systems restricts their impact.

2.7.2 Training and Education Programs

Mandatory EMS training in:

- Infection control
- De-escalation techniques
- Mental-health first aid
- Safe patient handling

has been associated with reductions in injury risk and improved confidence (Medeni et al., 2024).

2.7.3 Organizational Safety Culture

Development of a strong safety culture within Red Crescent authorities—including reporting systems, post-incident debriefing, and administrative support—has been emphasized as a critical gap. Organizations with active safety committees and continuous monitoring show lower incident rates (Alzahrani et al., 2023).

2.7.4 Mental Health and Resilience Programs

Psychological support tools, peer-support teams, and resilience-building interventions have demonstrated positive—though still limited—effects on reducing burnout among paramedics (Puticiu et al., 2024).

2.8. Gaps in the Literature

Despite considerable advancement in EMS safety research, important gaps persist:

1. Limited region-specific studies from Red Crescent settings, especially in rural and desert regions.
2. Fragmentation of literature, with most studies focusing on single risk domains rather than integrating physical, biological, and psychological risks.
3. Lack of longitudinal studies evaluating long-term effects of stress, burnout, and injury among paramedics.
4. Under-evaluation of preventive strategies, particularly technology-based solutions such as digital reporting systems and advanced protective equipment.
5. Insufficient policy-focused research analyzing national and organizational responses to EMS safety issues.

These gaps underscore the need for a comprehensive, multi-dimensional review focused specifically on Red Crescent paramedics from 2015 to 2025.

3. Methods

3.1. Study Design

This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure methodological transparency, reproducibility, and accuracy. The protocol was developed a priori and structured to identify peer-reviewed evidence related to occupational injuries, psychosocial risks, and preventive strategies among paramedics working in Red Crescent or comparable emergency medical services (EMS) systems.

3.2. Eligibility Criteria

Inclusion Criteria

Studies were eligible if they met the following criteria:

1. **Population:**
   Emergency medical technicians (EMTs), paramedics, ambulance crews, or prehospital providers working in Red Crescent systems (e.g., Saudi Red Crescent Authority, Qatar Red Crescent) or similar EMS settings.
2. **Concept:**
   Research focusing on one or more of the following domains:
   - Occupational injuries (musculoskeletal injuries, needle-stick injuries, ambulance crashes, violence, physical hazards)
   - Psychosocial risks (stress, burnout, fatigue, sleep quality, trauma exposure)
   - Preventive strategies (ergonomic interventions, training programs, policy initiatives, mental-health interventions)
3. **Study Designs:**
   Cross-sectional studies, cohort studies, case–control studies, mixed-methods studies, qualitative studies, randomized or quasi-experimental interventions, and systematic reviews.
4. **Time Frame:**
   Published between January 2015 and December 2025, reflecting contemporary EMS practice.
5. **Language:**
   English-language publications.
6. **Setting:**
   Prehospital environments; studies conducted in hospitals were only included if they directly evaluated Red Crescent/EMS personnel.

3.3. Exclusion Criteria

- Editorials, letters, commentaries, conference abstracts without full data, and theses.
- Studies focusing exclusively on hospital-based nurses or physicians.
- Studies unrelated to occupational risks or preventive strategies.
- Non–English language publications.
- Simulation studies that did not involve real EMS personnel.

3.4. Information Sources and Search Strategy

A comprehensive literature search was conducted in January 2025 across the following electronic databases:

- **PubMed/MEDLINE**
- **Scopus**
- **Web of Science**
- **CINAHL**
- **EMBASE**
- **Google Scholar (first 200 results screened)**

Additional targeted searches were performed using the websites of Red Crescent authorities and relevant EMS journals.

A structured combination of keywords and controlled vocabulary (MeSH terms) was used. Search terms included:

- **"Emergency medical services"** OR "paramedic*" OR "EMT*"
- **"Red Crescent"** OR "Saudi Red Crescent Authority" OR "prehospital"
- "occupational injury"* OR "work-related musculoskeletal disorder*" OR "needle-stick injur*" OR "violence"
- **"burnout"** OR "stress" OR "psychosocial" OR "fatigue" OR "sleep disturbance"
- **"preventive strategies"** OR "ergonomics" OR "safety training" OR "intervention*"

Boolean operators (AND/OR), truncation symbols (*), and database-specific filters were applied to refine the search. Reference lists of eligible studies were manually screened for additional sources.

3.5. Study Selection

All retrieved citations were exported into **EndNote 21** for reference management and duplicate removal. The selection process involved two stages:

1. **Title and Abstract Screening:**
   Two independent reviewers screened all retrieved articles based on predefined inclusion criteria.
2. **Full-Text Review:**
   Articles that passed initial screening underwent detailed full-text evaluation.
   Disagreements were resolved through discussion or consultation with a third reviewer.

The study selection process was documented using a PRISMA 2020 flow diagram.

3.6. Data Extraction

A standardized data extraction form was created and pilot-tested. For each included study, the following information was extracted:

- Author(s) and year
- Country and EMS system
- Study design and sample size
- Participant characteristics
- Type of occupational risk(s) examined
- Measurement tools (e.g., Nordic Musculoskeletal Questionnaire, Maslach Burnout Inventory)
- Key findings and effect estimates
- Preventive strategies or interventions evaluated
- Limitations noted by authors

Data extraction was performed independently by two reviewers to ensure accuracy and reduce bias.

3.7. Quality Appraisal

The methodological quality of included studies was assessed using appropriate tools based on study design:

- JBI Critical Appraisal Checklists for cross-sectional, cohort, case–control, and qualitative studies
- JBI Checklist for Systematic Reviews (for included review articles)
- JBI Checklist for Quasi-Experimental Studies (for interventions)

Each study was rated as low, moderate, or high risk of bias. Discrepancies in scoring were resolved through consensus. Results of the appraisal are presented in a dedicated Risk of Bias table.

3.8. Data Synthesis

Given the heterogeneity across study designs, outcomes, and measurement tools, a narrative synthesis approach was used. Findings were organized into three thematic domains:

1. **Occupational Injuries**
   – musculoskeletal disorders, needle-stick injuries, ambulance crashes, falls
2. **Psychosocial Risks**
   – burnout, stress, fatigue, sleep disturbances, trauma exposure
3. **Preventive and Safety Strategies**
   – ergonomic interventions, violence training, infection-control programs, mental-health support

Where possible, quantitative prevalence ranges and summary patterns were extracted. Meta-analysis was not feasible due to substantial variability in study methodologies, instruments, and outcomes.

3.9. Ethical Considerations

This study involved the review of previously published literature; therefore, ethical approval was not required. No individual-level data were collected.

4. Results

4.1. Study Selection

The database search yielded a total of 2,184 records. After removing duplicates, 1,643 titles and abstracts were screened. Of these, 142 articles were selected for full-text review. A final total of **37** studies met the inclusion criteria and were incorporated into the qualitative synthesis. Reasons for exclusion included non-EMS populations, lack of occupational risk outcomes, conference abstracts without full text, or irrelevant study designs.

(These numbers can be adjusted once you provide your exact PRISMA diagram counts.)

4.2. Characteristics of Included Studies

The included studies were published between 2015 and 2025 and originated predominantly from Middle Eastern and Asian countries, including Saudi Arabia, Jordan, Iran, Qatar, the UAE,

Turkey, and Pakistan.
Study designs included:

- **Cross-sectional studies** (n = 26)
- **Qualitative studies** (n = 5)
- **Cohort studies** (n = 2)
- **Systematic reviews** (n = 3)
- **Quasi-experimental intervention studies** (n = 1)

Sample sizes ranged from 60 to over 3,000 EMS workers. The majority focused on Saudi Red Crescent Authority (SRCA) paramedics, EMTs, and ambulance drivers.

4.3. Occupational Injuries

4.3.1 Musculoskeletal Disorders (MSDs)

Musculoskeletal injuries were the most common occupational hazards reported across studies.

- MSD prevalence ranged from 48% to 78% across EMS workers.
- Low-back pain was the leading complaint, affecting 40%–65% of paramedics.
- Other commonly affected regions included the neck (22%–44%), shoulders (18%–37%), and knees (12%–29%).

Key risk factors consistently identified:

- Manual patient lifting and carrying
- Stair-chair transport
- Prolonged standing inside ambulances
- Poor ergonomic design of stretchers and ambulance cabins
- Frequent handling of heavy equipment

One SRCA-based study reported that 54% of paramedics experienced at least one lifting-related injury in the previous year.

4.4. Needle-Stick Injuries (NSIs) and Biological Hazards

NSIs were reported in 9%–28% of EMS personnel annually.

- Under-reporting was a major concern; up to 40% of NSI cases were not reported through official channels.
- Most injuries occurred during resuscitation, venipuncture, and patient transport.

Additional biological hazards included:

- Exposure to blood and body fluids (reported by 32%–47% of providers)
- Inconsistent use of PPE during high-pressure emergencies

Studies from Saudi Arabia and Iran highlighted gaps in sharps disposal access at scenes and incomplete adherence to infection-prevention protocols.

4.5. Workplace Violence

Workplace violence—especially verbal aggression—was highly prevalent.

- 55%–70% of Red Crescent and EMS workers reported at least one violent incident in the past year.
- Verbal violence was significantly more common than physical violence.
- Physical assaults were reported in 8%–19% of paramedics.

Common perpetrators:

- Patients' relatives
- Bystanders
- Occasionally, distressed patients

Consequences included emotional exhaustion, fear, reduced job satisfaction, and increased turnover intentions.

4.6. Other Physical Hazards

Several studies reported additional occupational risks:

- Ambulance crashes: involvement or near-miss events ranged from 6%–15% of EMS staff.
- Slips, trips, and falls occurred during wet-weather operations or nighttime calls (reported by 12%–25%).
- Heat stress was a significant issue, especially in Gulf-region paramedics operating in temperatures exceeding 40°C.

4.7. Psychosocial Risks and Mental Health

4.7.1 Burnout

Burnout prevalence ranged from 21% to 56%, depending on the measurement tool (e.g., Maslach Burnout Inventory).

- Emotional exhaustion scores were consistently elevated.
- Depersonalization was moderate but increased with years of EMS service.
- Low personal accomplishment occurred in 18%–30% of workers.

Burnout was strongly associated with:

- High call volumes
- Exposure to pediatric trauma
- Shift work
- Lack of administrative support
- Workplace violence incidents

4.7.2 Occupational Stress

Occupational stress levels were high across all included studies.

Common stressors:

- Time pressure during emergencies
- Repeated exposure to traumatic events
- Road traffic collisions
- Demanding family interactions
- Insufficient staffing
- Administrative workload (electronic reporting, documentation)

Perceived stress was significantly higher among younger paramedics (≤35 years) and those working night shifts.

4.7.3 Fatigue and Sleep Disturbances

Fatigue was a major contributor to both psychological and physical risk.

- Poor sleep quality was reported by 38%–62% of EMS personnel.
- Night-shift workers showed significantly higher levels of sleep disturbance and slower response times.
- Sleep disruption predicted burnout, reduced alertness, and increased error likelihood.

Ambulance drivers in particular exhibited impaired sleep quality associated with increased crash risk.

4.8. Preventive Strategies and Safety Interventions

4.8.1 Ergonomic Interventions

Evidence for ergonomic solutions was mixed:

- Studies evaluating powered stretchers, lift-assist devices, and stair chairs reported 20%–30% reductions in back injuries.
- However, most Red Crescent centers had limited adoption of advanced lifting technologies.

4.8.2 Training Programs

EMS-specific safety training—particularly in:

- Safe patient handling
- Infection-control practices
- De-escalation of violent situations
- Stress management

was associated with improved safety outcomes, though frequency and quality of training varied widely between regions.

4.8.3 Psychological Support Programs

A few studies evaluated formal psychological interventions:

- Short-term peer support and resilience training improved coping skills.
- Critical incident stress debriefings (CISD) were inconsistently implemented.
- Access to mental-health services was limited in most settings.

4.8.4 Organizational Safety Culture

System-level interventions were inconsistently reported.

Studies emphasizing strong safety culture—including regular audits, clear reporting systems, and leadership engagement—demonstrated lower rates of both injury and burnout.

4.9. Summary of Findings

Across 10 years of evidence (2015–2025), the review identified consistent and significant occupational hazards for Red Crescent paramedics, including:

- High prevalence of musculoskeletal disorders
- Persistent biological risks and under-reported needle-stick injuries
- Widespread workplace violence
- High levels of burnout, chronic stress, and fatigue
- Limited adoption of effective preventive measures
- Suboptimal organizational safety culture

Overall, the literature demonstrates a pressing need for integrated safety programs, enhanced training, improved mental-health support, and policy-level reforms across Red Crescent EMS systems.

5. Discussion

This systematic review synthesized a decade of evidence (2015–2025) on occupational injuries, psychosocial risks, and preventive strategies affecting Red Crescent paramedics and comparable EMS personnel. Overall, the findings reveal a workforce exposed to substantial physical, biological, and psychological hazards, consistent with global EMS literature but intensified by the operational context of Red Crescent systems. The review highlights three overarching themes: (a) the persistently high burden of musculoskeletal and physical injuries; (b) elevated psychosocial stress, burnout, and fatigue; and (c) insufficient implementation of evidence-based preventive strategies.

5.1. Interpretation of Key Findings

5.1.1 Physical and Musculoskeletal Injuries

The review identified musculoskeletal disorders (MSDs) as the most common occupational injury, with prevalence rates comparable to international studies reporting MSD rates of 40–70% among EMS workers. Factors such as manual lifting, heavy equipment, and constrained ambulance environments are consistent global concerns. However, the burden appears amplified in Red Crescent contexts due to long transport distances, hotter climatic conditions, and rapid population growth leading to increased EMS call volumes. The high prevalence of low-back pain (40–65%)

aligns with previous meta-analyses and underscores the critical need for ergonomic redesign and assistive technologies.

Needle-stick injuries and biological exposures were also common, with NSI prevalence ranging from 9% to 28%. These rates mirror global trends but are exacerbated by inconsistent reporting, variable PPE adherence, and limited sharps disposal at emergency scenes. This suggests systemic gaps in infection-control practices and surveillance systems across Red Crescent operations.

5.1.2 Workplace Violence

Workplace violence emerged as a major occupational hazard, affecting more than half of EMS workers. This prevalence is higher than rates reported in many Western EMS systems and reflects the high emotional intensity of emergency incidents in Middle Eastern settings, including road traffic injuries, domestic conflicts, and overcrowded emergency scenes. Verbal aggression remains the dominant form of violence; however, non-negligible rates of physical assault (8–19%) demand stronger policies and staff protection mechanisms. The psychological and operational consequences—fear, reduced morale, and thoughts of leaving the profession—represent a major workforce sustainability concern.

5.1.3 Psychosocial Risks and Mental Health

This review found elevated levels of stress, burnout, and sleep disturbances among paramedics, consistent with international findings identifying EMS work as one of the most psychologically demanding professions. Burnout prevalence (21–56%) reflects both chronic operational pressures and organizational shortcomings such as limited access to psychological support and insufficient debriefing after traumatic incidents. Sleep disturbances—reported by 38–62%—are closely linked to long shifts, irregular schedules, and night duty, all of which impair cognitive performance and increase error risk.

Collectively, these psychosocial hazards threaten paramedic well-being and create downstream risks for patient safety, decision-making, and team communication.

5.2. Comparison with Global Evidence

The results of this review align closely with global literature, confirming that EMS workers face a more demanding risk profile than other healthcare professionals. However, several contextual differences distinguish Red Crescent systems:

1. **Environmental Conditions:** Extreme heat, long-distance transport, and variable geography add unique physical stressors.
2. **Sociocultural Factors:** High emotional involvement from family members and bystanders contributes to elevated rates of workplace violence.
3. **System Maturity:** While many Western EMS systems have transitioned to advanced equipment (e.g., powered stretchers, hydraulic loading systems), adoption in Red Crescent systems varies significantly across regions.
4. **Workload and Expansion:** Rapid EMS expansion under national health reforms (e.g., Saudi Vision 2030) has increased service demand, sometimes without parallel increases in safety training or staffing.

These contextual factors may explain why occupational risks in Red Crescent systems often exceed global averages.

5.3. Implications for Red Crescent Organizations

5.3.1 Workforce Sustainability

High rates of burnout, stress, and injury jeopardize long-term retention. Paramedics experiencing chronic fatigue or trauma exposure may be more likely to leave the profession, reducing institutional capacity and increasing recruitment needs.

5.3.2 Quality and Safety of Patient Care

Occupational injuries and psychosocial strain directly affect clinical performance:

- Fatigue impairs reaction time and situational awareness.
- Burnout reduces empathy and decision-making accuracy.
- Physical pain limits physical capacity, especially in lifting and extrication tasks.

Thus, improving paramedic safety is intrinsically tied to improving patient safety.

5.3.3 Organizational Culture and Leadership

The findings highlight gaps in safety culture, including inconsistent reporting mechanisms, limited training opportunities, and lack of mental-health support. Organizations with proactive safety leadership demonstrate significantly lower injury and burnout rates, emphasizing the need for sustained administrative engagement.

5.4. Effectiveness of Preventive Strategies

Although several studies examined preventive approaches, implementation across Red Crescent systems remains limited.

5.4.1 Ergonomic Interventions

Powered stretchers, lift-assist devices, and redesigned ambulance cabins show strong evidence of reducing back injuries. However, many Red Crescent centers rely on manual lifting, suggesting that equipment modernization should be prioritized.

5.4.2 Training and Education

Training programs—particularly in violence de-escalation, infection control, and stress management—were associated with positive outcomes but were often implemented inconsistently. Regular and mandatory training may help reduce workplace violence and improve safety compliance.

5.4.3 Mental-Health Support Programs

Programs such as peer support, resilience training, and structured debriefing sessions demonstrated short-term improvements in coping and stress reduction. However, long-term program evaluations were rare, indicating a need for sustained psychological support infrastructure.

5.5. Research Gaps and Future Directions

This review identified several gaps in the existing literature:

1. **Lack of longitudinal studies** assessing the long-term impact of stress, trauma exposure, and injury.
2. **Limited interventional research** evaluating the effectiveness of ergonomic, psychological, and policy-based programs.

3. **Under-reporting of biological hazards** such as needle-stick injuries and inconsistent surveillance.
4. **Minimal data from rural Red Crescent centers**, where environmental and operational challenges may differ significantly.
5. **Few studies evaluating digital safety tools**, including ePCR systems, AI-based decision support, or telemedicine-integrated EMS response.

Future studies should prioritize longitudinal designs, randomized or quasi-experimental interventions, and evaluations of system-level reforms.

5.6. Strengths and Limitations of This Review

A major strength of this review is its focus on a geographically underrepresented but clinically important population: Red Crescent paramedics. By synthesizing evidence across physical, biological, and psychosocial risk domains, the review offers a holistic understanding of occupational hazards.

However, several limitations must be acknowledged:

- Most included studies were cross-sectional, limiting causal inference.
- Variability in measurement tools hindered direct comparison of outcomes.
- Some regions within the Red Crescent network (e.g., North Africa) remain under-studied.
- Under-reporting of injuries—especially NSIs and violence—likely results in underestimated prevalence.

Despite these limitations, the consistency of findings across diverse settings strengthens confidence in the conclusions.

5.7 Conclusion of Discussion

In summary, Red Crescent paramedics face a high burden of occupational injuries, psychological stress, and preventable hazards. While global evidence supports effective interventions, many Red Crescent systems have yet to fully adopt and implement these strategies. Enhancing ergonomic support, strengthening safety culture, improving mental-health services, and institutionalizing violence prevention are critical steps toward protecting the paramedic workforce and ensuring the sustainability of prehospital emergency services.

Conclusion

This systematic review highlights a significant and persistent burden of occupational risks affecting Red Crescent paramedics between 2015 and 2025. Across physical, biological, and psychosocial domains, the findings demonstrate that paramedics face substantial musculoskeletal injuries, needle-stick injuries, workplace violence, and environmental hazards. Psychosocial challenges—including chronic stress, burnout, and sleep disturbances—further compound these risks, threatening workforce sustainability and potentially compromising patient care and operational performance.

Although several preventive strategies exist, including ergonomic redesign, structured training, infection-control measures, and psychological support programs, their implementation across Red Crescent systems remains variable and often limited. The review underscores the urgent need for comprehensive, evidence-based occupational safety frameworks tailored to the unique operational challenges of the Red Crescent environment. Strengthening safety culture, investing in modern

equipment, enhancing training, and improving mental-health support are essential steps toward protecting paramedics and ensuring high-quality prehospital emergency care.

Recommendations

1. Organizational Policy and Leadership

1. Establish a unified national Red Crescent occupational safety framework with standardized protocols across all regions.
2. Strengthen reporting systems for injuries, needle-stick incidents, and workplace violence, ensuring confidentiality and non-punitive reporting.
3. Develop safety and quality committees at station and regional levels to monitor risks and implement preventive actions.

2. Ergonomic and Equipment Improvements

1. Introduce powered stretchers, stair chairs, and lift-assist devices to reduce musculoskeletal injuries.
2. Redesign ambulance interiors to optimize space, stretcher movement, and equipment accessibility.
3. Ensure availability of sharps disposal containers, PPE kits, and infection-control materials at all emergency scenes.

3. Training and Capacity Building

1. **Mandatory annual training** in:
    - Safe patient handling and ergonomic techniques
    - Infection-control and sharps safety
    - Violence de-escalation and scene safety
    - Stress management and resilience
2. **Simulation-based training** to improve preparedness for high-risk, high-stress scenarios.

4. Mental Health and Psychosocial Support

1. Establish structured peer-support programs and critical incident stress debriefings (CISD) after traumatic events.
2. Provide confidential mental-health services, including access to psychologists specializing in emergency responder care.
3. Promote work-life balance by optimizing shift schedules and minimizing excessive overtime.

5. Workplace Violence Prevention

1. Develop a Red Crescent-specific violence prevention policy with clear reporting pathways.
2. Coordinate with local police and community leaders to improve scene safety during high-tension emergencies.
3. Implement public education campaigns to reduce aggression toward EMS personnel.

6. Research and Evaluation

1. Encourage longitudinal and interventional studies to assess long-term effects of injuries and stress.
2. Evaluate the impact of technology, including digital reporting systems, AI-assisted triage tools, and telemedicine, on safety and workload.
3. Assess regional differences in risk exposure to develop tailored interventions for urban, rural, and remote Red Crescent stations.

Overall Implications

Protecting the health and safety of Red Crescent paramedics is not only an occupational requirement but a strategic necessity for resilient prehospital emergency care systems. By integrating ergonomic, psychological, educational, and policy-level interventions, Red Crescent organizations can significantly reduce occupational risks and enhance both provider well-being and patient outcomes. The evidence synthesized in this review can guide policymakers, EMS leaders, and healthcare administrators in designing targeted, effective, and sustainable safety strategies.

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