



REVIEW ARTICLE

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Patient and employee safety in pre-hospital healthcare: Key findings from 2019–2024 research

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Abstract

This systematic review aims to synthesize and present the findings of studies conducted between 2019 and 2024 on patient and employee safety in pre-hospital healthcare. A total of 268 studies were identified through a database search structured according to the study's purpose across databases of ScienceDirect (n=131), Web of Science (n=50), and PubMed (n=105). Following a systematic screening aligned with the study criteria, 26 studies were selected for synthesis. The systematic review followed a typology combining systematic search and review methods and adhered to the "PRISMA" checklist to guide the research process. This systematic review indicates that the safety culture in pre-hospital healthcare was inadequate and that lack of training negatively affected patient and employee safety. The negative effects of factors such as the COVID-19 pandemic, lack of equipment, and increased stress on the pre-hospital healthcare culture were emphasized. The importance of standard procedures for preventing accidents in patient transfer processes was stressed. This systematic review reveals that the safety culture in pre-hospital healthcare should be strengthened, training programs should be made comprehensive, and standard operational procedures should be developed. In addition, this study also shows the need to develop safety measures for patient transport processes.

Keywords: Pre-hospital care, patient safety, occupational safety, health management

Introduction

Healthcare is inherently designed to be completely personalized, so healthcare varies in every aspect. Therefore, managing these variables in healthcare is a significant challenge. In healthcare institutions, these variables are attempted to be controlled through laws, regulations, rules, protocols, and standard procedures. In this way, the effectiveness and quality of the healthcare service are increased, and process safety is ensured. One of the important approaches in this process is to ensure patient and employee safety. The patient and employee safety management process in healthcare is important in preventing unnecessary injuries and accidents. In 1999, the Institute of Medicine (IOM) published the "To Err is Human" report has created widespread awareness in the healthcare sector by emphasizing that preventable medical errors cause approximately 98,000 deaths each year [1]. Although it was stated that the adequacy in intensive care units is 99%, it was

revealed that patients encounter an average of two errors per day. These findings reveal the importance of patient safety in healthcare.

The patient and employee safety management process can be more challenging in pre-hospital healthcare. For this reason, controlled environments can be created in healthcare institutions. However, the location and context of healthcare in pre-hospital healthcare vary depending on the type and location of the incidents. Pre-hospital healthcare can start in very different environments, such as homes, streets, and traffic accidents, which paramedics and emergency medical technicians (EMTs) are not familiar with, and continue in different environments, such as ambulance vehicles, helicopter ambulances, and airplane ambulances designed in different setups. In this process, physicians, paramedics, and EMTs working in this field have to make important decisions in every incident. Pre-hospital healthcare is an environment that

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requires working under high stress. The decisions made in this area are critical enough to determine patients' life and death status. While employees often have to act with fast decision-making skills, they must also simultaneously cope with many distracting factors. However, these challenging processes can be managed within the framework of certain protocols. For example, standard protocols such as Advanced Cardiac Life Support (ACLS) and Advanced Trauma Life Support (ATLS) allow employees to perform effective and accurate interventions. Due to these risk factors, pre-hospital healthcare is also compared to aviation services [2]. In addition, the need to communicate through different channels makes patient and employee safety management more challenging in this area [3]. Harms to patients usually result from poor communication during care and inadequate cooperation between healthcare teams [4]. Although there are many studies on the safety risks inherent in these features of pre-hospital healthcare, there is not enough evidence in the literature on the consequences of risks in this field [1].

In pre-hospital healthcare, employee safety is another dimension that must be managed meticulously [5]. Paramedics and EMTs working in this field, as the first responders to arrive at the scene, may often find themselves in environments characterized by a wide range of social conflicts. [6]. In addition, they may encounter patients and their relatives who are prone to violence due to psychological problems [7,8]. They may also have to provide healthcare in environments where safety is not guaranteed at the sites of natural or human-induced accidents [9]. In addition, the risks due to transport vehicles can make employee safety management more difficult [10]. Fatigue and burnout from long working hours and shift-based work schedules are significant occupational safety risks for healthcare professionals in pre-hospital healthcare services, such as paramedics and EMTs [11]. In addition to all these risks, the risk of infection in pre-hospital healthcare can be considered another factor that threatens employee safety [12]. The risks posed by the characteristics of pre-hospital healthcare to both patient and employee safety and the issue of safety itself are extensively discussed in the literature. A general review of the literature reveals findings emphasizing the need to enhance the culture of patient and employee safety [4,13-16].

The importance of patient and employee safety in pre-hospital healthcare and the need for development constitute the starting point of this study. This study aims to present current findings by systematically synthesizing scientific studies conducted between 2019 and 2024 on patient and employee safety in pre-hospital healthcare.

This study offers valuable contributions to the literature by comprehensively addressing recent advancements in patient and healthcare worker safety within pre-hospital healthcare services. By highlighting key developments and emerging practices, it aims to enhance understanding and promote improved safety standards in this critical field.

Material and Methods

This study utilized the systematic review method to examine scientific studies conducted between 2019 and 2024 on patient and employee safety in pre-hospital healthcare services. The review process was based on the systematic search and review typology defined by Grant and Booth [17]. The research process was conducted in accordance with the PRISMA checklist developed by Page, et al. [18].

1. Search Strategy

In order to find studies suitable for the research purposes, article types of studies were obtained with the search criterion of ["Paramedic" OR "Emergency Medical Services (EMS)" OR "Emergency Medical Technician (EMT)" OR "Pre-Hospital" AND "Safety" in "title"]. The database search was conducted between 01 and 05 November 2024.

2. Inclusion and Exclusion Criteria

The inclusion criteria are as follows:

- Research articles only,
- Findings and results-based research on patient and employee safety in pre-hospital healthcare,
- Research articles written in English,
- Research articles with full text available,

The exclusion criteria are as follows:

- Abstracts, poster presentations, letters, book chapters, guidelines, protocols, and all kinds of reviews,
- Drug studies,
- Research focusing on issues other than patient and staff safety in pre-hospital healthcare,
- Studies for which full text cannot be accessed,
- Research written in languages other than English,

3. Systematic Screening Process

This study conducted a systematic literature review on patients and staff in pre-hospital healthcare. During the research process, a total of 286 studies were identified as a result of the searches conducted in three different databases [Science Direct (n=131), PubMed (n=105), and Web of Science (n=50)] between 1980-2024. During the elimination phase of the studies, 31 studies were excluded through the software [Endnote 21], and the researchers excluded eight studies because they were repetitive. As a result of this elimination process, a total of 247 studies were found suitable for the research title and abstract evaluation.

During the evaluation process, 119 studies whose titles and abstracts were examined were excluded because they were irrelevant to the topic. The remaining 128 studies were taken

to the full-text evaluation stage. At this stage, 12 studies were excluded because they were irrelevant to the topic. Ninety studies were excluded because they were not included in the specified period (2019-2024). As a result of this elimination process, 26 studies were included in the systematic review. This study synthesized research between 2019 and 2024 to focus on current findings rather than providing a historical perspective on pre-hospital healthcare services (Figure 1).

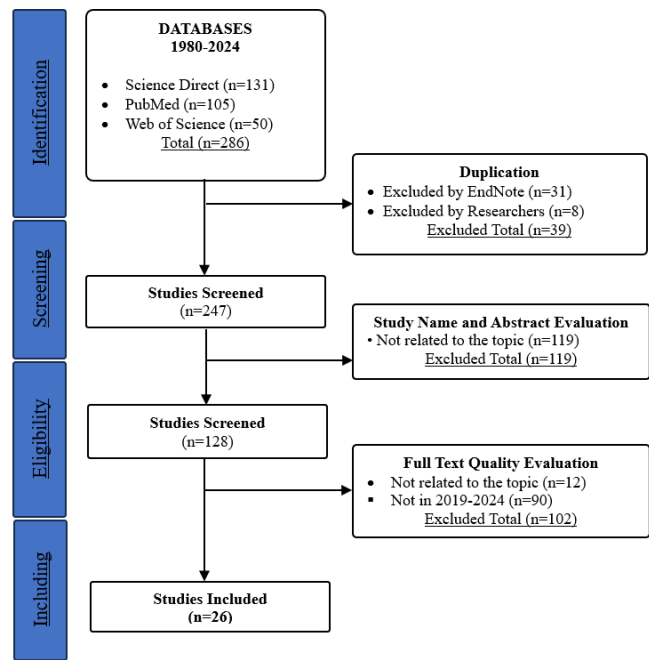


Figure 1. Systematic screening of studies on patient and employee in pre-hospital healthcare

4. Synthesis and Presentation of the Findings

A narrative and taboo approach was used to synthesize and present the findings of these studies [17,19].

Results

Table 1 shows the distribution of studies determined within the scope of this study regarding patient and employee safety in pre-hospital healthcare s by geographical region and research type.

Of the 28 studies in the study, 37.46% (n=10) were conducted in North America, 25.92% (n=7) in Europe, and 19.23% (n=5) in the Middle East. The remaining 3.85% belong to Oceania (n=1), South America (n=1), Africa (n=1), and Asia (n=1), respectively. This situation reveals that most studies were concentrated in North America and Europe, while a limited number were conducted in other regions.

When evaluated in terms of research methods, 61.54% (n=16) of the studies were quantitative research, 34.62% (n=9) were qualitative research, and 3.85% (n=1) were mixed methods. The findings showed that research on pre-hospital healthcare mostly focused on quantitative methods. However, it was noteworthy that qualitative research was included in a significant proportion, while mixed methods were quite limited.

The 26 studies included in this systematic review demonstrated variability in sample sizes and characteristics. Participants comprised a heterogeneous group, including healthcare professionals, patients, witnesses, and EMS workers. Sample sizes ranged from as few as 10 participants to as many as 541,731 EMS encounters, reflecting methodological diversity. Sample selection was structured to align with each study's specific purposes and scope.

Table 2 presents the publication years, aims, samples, methods, and findings of the scientific studies obtained through systematic review. An evaluation of the studies' distribution by year revealed that 26.92% (n=7) were conducted in 2024. The highest proportion, 30.77% (n=8), was published in 2023. In 2022, 23.08% (n=6) of the studies were conducted, while 11.54% (n=3) were from 2021. Additionally, 3.85% (n=1) of the studies were conducted in 2020, and 7.69% (n=2) were published in 2019. These findings indicate a notable increase in research activity in recent years, particularly in 2023.

Table 1. Characteristics of studies

Characteristics		n	%
Region	North America	10	38.46
	Europe	7	26.92
	Middle East	5	19.23
	Oceania	1	3.85
	South America	1	3.85
	Africa	1	3.85
	Asia	1	3.85
Study types & research methodology	Quantitative research	16	61.54
	Qualitative research	9	34.62
	Mixed-methods research	1	3.85
Total		26	100

Table 2. Findings of the studies

No	Study	Aim	Place	Method	Sample	Conclusion
1	Rykhoff et al., 2024	To investigate student attitudes toward interprofessional education and collaborative practice through simulation.	Toronto, Ontario, Canada	Mixed methods	130 healthcare students	Interprofessional simulation improves teamwork, communication, and transfer of care skills, promoting patient safety. Emphasizes early role education for better safety outcomes [3].
2	Rajeh Saifan et al., 2024	To explore the lived experiences of healthcare professionals in pre-hospital emergency services in Jordan.	Jordan	Qualitative exploratory	30 emergency healthcare professionals	Identified deficiencies in knowledge, training, role clarity, and authority. Urges unified guidelines and systematic training to improve patient safety and reduce errors [20].
3	Pemney et al., 2024	To explore Māori experiences of cultural (un)safety in pre-hospital cardiovascular care.	New Zealand (Aotearoa)	Qualitative descriptive	10 Māori patients	Systemic and structural barriers impact cultural safety in care. Recommends culturally safe practices and education for patient safety enhancement [13].
4	Péculo-Carrasco et al., 2024	To identify factors affecting witnesses' perception of patient safety during pre-hospital care.	Andalusia, Spain	Multi-center cross-sectional	1400 witnesses	Patient safety incidents and inadequate communication reduce perceived safety. Calls for improved safety protocols and communication strategies [21].
5	Norouzinia et al., 2024	To evaluate the psychometric properties of the Persian Emergency Medical Services- Safety Attitudes Questionnaire (EMS-SAQ)	Iran	Methodological	484 EMS employees	Demonstrated validity and reliability for assessing EMS safety culture. Highlights the need for ongoing safety culture evaluations to reduce risks [22].
6	Miller & Lenz, 2024	To determine if there has been an increased rate of adverse events in ground and helicopter emergency medical services since the onset of the COVID-19 pandemic.	Midwest Regional Critical Care Transport Service, USA	Retrospective Study	6,354 patient records (3,166 pre-COVID-19 and 3,188 post-COVID-19)	A significant increase in adverse events was observed in the post-COVID-19 period compared to the pre-COVID-19 period, suggesting a need for further studies on causation and mitigation strategies [23].
7	Aghababaeian et al., 2024	To explore the safety challenges faced by pre-hospital emergency personnel in pediatric cases.	Dezful, Iran	Qualitative content analysis	20 male EMS staff	Identified gaps in pediatric care were resources, skills, and protocols. Stresses specialized training to enhance safety [24].
8	Vähäkangas et al., 2023	To describe paramedics' experiences and the skills required for urgent hospital transfers.	Finland	Qualitative Study	20 paramedics	Organizations should support training for paramedics to improve the quality of urgent hospital transfers and enhance patient safety through standardized procedures [25].
9	Sarbaz et al., 2023	To assess occupational exposure to blood and body fluids (BBFs) and the use of protective equipment among pre-hospital EMS workers.	Mashhad, Iran	Cross-sectional Study	442 workers	The study highlighted a high prevalence of BBFs exposure (95.2%), emphasizing the importance of training, continuous monitoring, and prevention strategies to mitigate risks [26].

Table 2. Findings of the studies						
No	Study	Aim	Place	Method	Sample	Conclusion
10	Pereira & Paes, 2023	To analyze the occurrence of incidents during mobile pre-hospital care (MPHC).	Baixada Fluminense, Brazil	Observational descriptive	239 treatment process	Identified 2386 safety incidents; emphasizes stronger infection control, medication safety, and protocol adherence to minimize patient harm [27].
11	Kosydar-Bochenek et al., 2023	To assess variations in perceptions of safety culture in pre-hospital emergency care across countries.	Italy, Portugal, England, China, Netherlands, Germany, France, Finland, Japan	Cross-sectional study	1,128 EMS personnel	The level of safety culture was not sufficient. Variations in safety culture across countries; recommends organizational-level efforts to improve safety practices and reduce risks globally [14].
12	Hartmann et al., 2023	To compare crash incidences between helicopter and ground emergency medical service transportation in the United States.	United States	Retrospective Study	323 HEMS, 159,593 GEMS crashes	Helicopter Emergency Medical Services (HEMS) has a lower crash probability compared to Ground Emergency Medical Services (GEMS), though GEMS has a higher injury incidence [28].
13	Glober et al., 2023	To evaluate the safety and compliance of a novel EMS non-transport protocol during the COVID-19 pandemic.	Marion County, Indiana, USA	Retrospective cohort analysis	222 patients treated under protocol	Protocol reduced EMS burden but revealed deviations in the application. Stresses the need for better training and protocol adherence to ensure patient safety during disaster responses [29].
14	Alburaidi et al., 2023	To compare safety awareness between hospital-based and pre-hospital EMS practitioners in times of crisis.	Riyadh, Saudi Arabia	Cross-sectional study	310 EMS practitioners	Found no significant differences in safety awareness based on work environment, gender, or experience; emphasizes consistent safety culture across EMS settings [30].
15	Rowland & Adefuye, 2022	To investigate the types of human errors and factors influencing patient safety in pre-hospital care.	South Africa	Exploratory study with survey	1,510 emergency care practitioners	Identified poor judgement, insufficient training, fatigue, communication errors, and unsafe environments as key issues. Highlights the need for protocols and continuous training to enhance safety [16].
16	Oliphant et al., 2022	To explore paramedics' perceptions of safety, risk, and communication during the COVID-19 pandemic in Ontario.	Ontario, Canada	Qualitative study	21 paramedics	Highlighted Personal Protection Equipment (PPE) shortages, stress from infection risks, and poor communication as key issues. Recommended equitable PPE distribution and better emergency operational planning [31].
17	Lentz et al., 2022	To analyze mental health training and educational needs among public safety personnel in Canada.	Western Canada	Qualitative thematic analysis	19 public safety personnel (firefighters, paramedics, and communicators)	Identified gaps in mental health training, the need for ongoing resilience education, and better organizational support. Recommends systematic, tailored training for Public safety personnel (PSP) [32].
18	Ivic et al., 2022	To explore pre-hospital emergency nurse specialists' experiences in caring for patients with non-specific chief complaints.	Stockholm, Sweden	Qualitative interview study	11 pre-hospital emergency nurse specialists	Systematic assessment reduces unexplained suffering and enhances patient safety. Recommended optimizing organizational processes, including feedback systems, and widening care level options [33].

Table 2. Findings of the studies

No	Study	Aim	Place	Method	Sample	Conclusion
19	Arzahan et al., 2022	To evaluate the impact of safety culture factors on safety performance in Malaysian paramedic training institutes using Importance-Performance Map Analysis (IPMA) analysis.	Malaysia	Cross-sectional survey with IPMA analysis	258 safety and health committee members	Management commitment and supervision in safety were identified as the most critical factors influencing safety performance, but underperformed. Recommends enhanced policies, training, and resource allocation [34].
20	Touriel et al., 2021	To determine the prevalence and type of violence against EMS personnel in Southeast Michigan.	Southeast Michigan, USA	Cross-sectional survey	137 EMS personnel	58.6% of participants reported violence, primarily from patients or family members. Training inadequacies highlighted the need for better safety protocols and frequent de-escalation training [35].
21	Paulin et al., 2021	To evaluate the safety and outcomes of EMS non-conveyance practices in Finland.	Finland	Prospective cohort study	11,861 EMS non-conveyed patients	EMS non-conveyance is relatively safe for managing ED crowding; critical events were rare but highlight the need for improved triage [36].
22	Krause & Lenz, 2021	To evaluate the safety and utility of ground transport for traumatic cardiopulmonary arrest patients by HEMS crews.	Midwest, USA	Retrospective chart review	31 TCPA patients	Found a 0% survival rate for transported Traumatic Cardiopulmonary Arrest (TCPA) patients and highlighted the risks of using lights and sirens, including crew and public safety concerns [37].
23	England et al., 2020	To assess patient safety incidents and medication errors during a pre-hospital randomized controlled trial.	England & Wales	Randomized controlled trial (RCT)	8,016 trial participants	Three hundred thirty-one patient safety incidents were reported. Medication errors occurred in 3.6% of cases, documentation errors were 49.8%, highlighting the need for improved protocols and training during trials [15].
24	Trivedi et al., 2019	To evaluate the safety of an EMS field-screening protocol for psychiatric emergencies.	Alameda County, CA, USA	Retrospective review	541,731 EMS encounters (53,887 psychiatric holds)	41% of psychiatric hold patients were directly transported to psychiatric facilities with a 0.3% failed diversion rate, supporting EMS-directed screening protocol safety [38].
25	Koski & Sumanen, 2019	To identify risk factors recognized by paramedics during emergency response driving (ERD).	Finland	Qualitative Inductive content analysis	44 paramedics writing essays	Risk factors include lack of training, poor team dynamics, and environmental hazards, suggesting the need for comprehensive ERD education [39].
26	Cash et al., 2019	To evaluate seat belt use among EMS professionals in the ambulance patient compartment.	USA	Cross-sectional survey	1,431 EMS professionals	Seat belt use was inconsistent, with only 40% adherence to policies, emphasizing the need for stricter enforcement and ergonomic ambulance designs [40].

Discussion

The studies within the scope of the research reveal the necessity of developing a pre-hospital patient and employee safety culture. In this context, lack of training [3,13,24,39], systematic and organizational deficiencies [15,27,31,40], working conditions during the pandemic period [23,29,31], violence [35], safety culture [14,22] are transportation and transport safety [28,37] issues appear to have come to the fore.

The need for education in pre-hospital healthcare services emerges as a fundamental factor in enhancing patient and employee safety. In their study, Rykhoff, Pereira and Wilkinson [3] highlighted that interprofessional simulation training improves teamwork, communication, and care transfer skills while enhancing patient safety. The study particularly emphasized the importance of healthcare professionals learning their professional roles at an early stage. Similarly, Norouzinia, Aghabarary and Rahmatpour [22] evaluated the safety culture perceptions of emergency healthcare workers and stressed the necessity of continuously monitoring safety attitudes. The study concluded that educational programs are critical in this context. Another study by Aghababaeian, et al. [24] underscored the importance of specialized training in pediatric care. The study pointed out deficiencies in resources, skills, and protocols in pediatric care negatively impact patient safety and demonstrated the need for specialized training in this field.

Studies have highlighted that the COVID-19 pandemic has significantly increased the demand for training. Oliphant, et al. [31] reported that shortages of personal protective equipment and communication challenges during the pandemic adversely affected healthcare professionals. The study also emphasized the importance of operational training tailored to crisis scenarios. Similarly, Miller and Lenz [23] argued that crisis management training programs should be enhanced to better address and understand the factors contributing to the rise in adverse events following the pandemic.

Studies on transportation and transport safety highlight the critical role of training in ensuring safety. Hartmann, et al. [28] and Krause and Lenz [37] emphasized in their research that healthcare teams should be trained according to standardized operational procedures (SOP) to minimize accidents during emergency transport. Specifically, they underlined the necessity of regular and comprehensive training programs to equip teams with the knowledge and skills required to implement protocols that mitigate safety risks during transport.

The safety culture in pre-hospital healthcare has been recognized as a vital component in safeguarding both patient and employee safety. The reviewed studies provided significant insights into measuring safety culture, its current levels, perceptions, and areas requiring improvement. Norouzinia, Aghabarary and Rahmatpour [22] demonstrated the validity and reliability of the Medical Services- Safety Attitudes Questionnaire (EMS-SAQ) to assess the safety culture in emergency healthcare

services. Kosydar-Bochenek, et al. [14] found that perceptions of safety culture in pre-hospital healthcare across countries vary significantly. These findings indicate a lack of standardization in safety practices and policies across countries.

The COVID-19 pandemic has also attracted attention with its effects on safety culture. Oliphant, et al. [31] stated in their study that personal protective equipment (PPE) shortages during the pandemic weakened employee perception of safety and caused a decline in safety culture. Glober, et al. [29] revealed compliance problems with the protocols implemented during the pandemic and emphasized the negative effects of this on safety culture. Touriel, et al. [35] also included violent incidents among the important factors that damaged safety culture. The effects of the COVID-19 pandemic on pre-hospital healthcare had important consequences in terms of safety culture and patient/employee safety. In this context, studies on the pandemic revealed existing security gaps and deficiencies in crises, drawing attention to the need for improvement in these areas. Miller and Lenz [23] found that adverse event rates increased in the period after the COVID-19 pandemic. These findings indicate that the high workload, stress, and changing working conditions brought about by the pandemic affect patient safety negatively.

The findings by Oliphant, et al. [31] and Miller and Lenz [23] revealed that the pandemic significantly impacted patient safety and employees' workload and psychological state.

The safety of transportation and transport processes in pre-hospital healthcare was considered a critical area that directly affects both patient and employee safety. The reviewed studies revealed that risks and security vulnerabilities experienced during transportation could be reduced by implementing effective protocols and adequate team training. Hartmann, et al. [28] compared the accident rates between helicopter (HEMS) and ground ambulances (GEMS) and found that HEMS had a lower accident risk compared to GEMS. Krause and Lenz [37] found a zero-survival rate during the transportation of patients with traumatic cardiopulmonary arrest (TCPA) and emphasized that this situation has negative effects on both patient and employee safety. The study revealed the risks of using lights and sirens during emergency transportation. It was determined that the risk of lights and sirens in these patients was higher than the benefit they would receive.

Limitations of the Study

This study is limited in its scope due to several factors. Firstly, it includes only studies written in English, which may exclude valuable contributions from non-English publications. Additionally, the analysis is restricted to studies with full-text accessibility, potentially overlooking relevant research with limited availability. Furthermore, most of the included studies are from the period after 2020, thereby constraining the ability to provide a comprehensive historical perspective. As a result, the findings predominantly reflect recent developments and trends.

Conclusion

This systematic review uncovered critical insights by analyzing recent literature on patient and employee safety in pre-hospital healthcare. The findings consistently highlight the pressing need for advancements in this area. Key recommendations include standardizing education programs, enhancing communication skills, and fostering a stronger safety culture. Moreover, the review identified systematic and structural deficiencies and non-compliance with protocols as significant contributors to increased safety risks for patients and employees. The studies also highlighted the pivotal role of safety culture in improving patient care quality and underscored the detrimental effects of violent incidents on employee safety. Specialized training programs focused on pediatric patient safety and other vulnerable patient groups were proposed to address specific gaps. Transportation and transport safety emerged as a critical domain influencing patient and employee safety, emphasizing adhering to standard operational procedures to mitigate risks.

In conclusion, this review underscores the essential role of education, protocol compliance, and organizational development in enhancing safety for patients and employees in pre-hospital healthcare settings. The findings are anticipated to serve as a valuable resource for academicians and healthcare managers seeking to advance safety practices.

While the review highlights extensive research on patient and employee safety in pre-hospital healthcare, it also identifies a notable gap: the lack of studies focusing on predicting the consequences of safety vulnerabilities. Conducting such predictive studies is deemed imperative. Additionally, the review emphasizes the need for comprehensive research on patient and employee safety, specifically within Türkiye's pre-hospital healthcare context.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

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