REVIEW ARTICLE / PREGLEDNI ČLANAK

PATIENT SAFETY IN THE EMERGENCY DEPARTMENT

SIGURNOST BOLESNIKA U HITNOM BOLNIČKOM PRIJAMU

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Abstract

Patient safety in the emergency department (ED) is a major concern because this high-pressure setting combines crowded conditions, rapid decision making, and frequent handovers, all of which increase the risk of error. Common threats include diagnostic delays, communication failures, and especially medication errors, which affect over one third of ED patients in some studies. Crowding, multitasking, and interruptions further raise the likelihood of patient misidentification and wrong patient orders. Medication safety is a central focus of ED safety strategies.

Systematic reviews show many errors occur during prescribing and administration, with dosing mistakes and wrong application frequency particularly numerous. Involving clinical pharmacists at the point of care, standardizing order sets, and using electronic prescribing with decision support can help intercept these errors before they reach patients. Clear allergy checks, weight-based dosing protocols, and barcode verification provide additional safeguards. Structured tools and culture change are critical for safer ED care. Expert developed emergency department safety checklists define key tasks at triage, assessment, treatment, and disposition to prevent "never events" such as wrong patient treatment, missed vital sign abnormalities, and equipment failures.

Team training that emphasizes communication, leadership, situational awareness, and effective workload distribution improves how staff respond to complex or deteriorating patients. Underpinning all these measures is a strong safety culture that encourages reporting, learning from incidents, and continuous improvement, enabling the ED to achieve its role as a reliable safety net for acutely ill and injured patients.

Key words: communication; emergency medicine; patient safety

Sažetak

Sigurnost bolesnika u hitnoj službi predstavlja veliki problem. Okruženje velikog izazova povezuje gužvu, brzo donošenje odluka i učestalu predaju bolesnika i podataka, što sve povećava rizik od pogrešaka. Uobičajene ugroze uključuju kašnjenja u dijagnostici, neuspjehe u komunikaciji, a posebno pogreške u primjeni lijekova, koje u nekim studijama pogađaju više od trećine bolesnika u medicinskoj službi. Gužva, višezadaćnost (engl. *multitasking*) i prekidi dodatno povećavaju vjerojatnost pogrešne identifikacije bolesnika i pogrešnih naloga. Sigurnost lijekova središnje je žarište strategije sigurnosti u medicinskoj službi. Sustavni pregledi literature pokazuju da se tijekom propisivanja i primjene lijekova događa veliki broj pogrešaka, pri čemu su pogreške u doziranju i primjeni lijeka najčešće.

Uključivanje kliničkih farmaceuta na mjestu pružanja skrbi, standardizacija naloga i korištenje elektroničkog propisivanja lijeka uz podršku u odlučivanju može pomoći u sprečavanju ovih pogrešaka prije nego što utječu na bolesnika. Jasne provjere alergija, protokoli doziranja temeljeni na tjelesnoj težini i provjera *barkodova* pružaju dodatne zaštitne mjere. Strukturirani alati i promjena kulture ključni su za sigurniju skrb u hitnoj službi. Stručno razvijene sigurnosne kontrolne liste hitnih odjela definiraju ključne

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zadatke u trijaži, procjeni i liječenju kako bi se spriječili nepoželjni ishodi poput pogrešnog liječenja, propuštenih poremećenih vitalnih pokazatelja i kvarova opreme. Timska obuka koja naglašava komunikaciju, vodstvo, situacijsku svijest i učinkovitu raspodjelu radnog opterećenja poboljšava način na koji osoblje reagira na bolesnike sa složenim stanjima ili one koji se naglo urušavaju.

Temelj svih ovih mjera je snažna sigurnosna kultura koja potiče prijavljivanje, učenje iz incidenata i kontinuirano poboljšanje, omogućujući hitnoj medicinskoj službi da ostvari svoju ulogu pouzdane sigurnosne mreže za akutno bolesne i ozlijeđene bolesnike.

Ključne riječi: hitna medicina; komunikacija; sigurnost bolesnika

Introduction

Patient safety in emergency departments (EDs) is challenged by overcrowding, time pressure, case complexity and system weaknesses that increase the risk of preventable harm. This narrative review summarizes key safety concerns in EDs, underlying contributory factors and evidence based strategies to improve safety, including the influence of ethical frameworks such as the Helsinki Declaration, medication safety technologies like pre-filled syringes, and the roles of safety culture and safety climate (1-9).

The ED is one of the most unpredictable and stressful hospital environments, where rapid decisions under uncertainty are routine and seconds can be crucial for survival. High patient acuity, frequent interruptions, and simultaneous management of multiple unstable patients make the ED particularly vulnerable to errors in assessment, diagnosis, treatment, and transitions of care. Reviews show that crowding, inadequate staffing, suboptimal teamwork, poor communication, and deficient incident learning systems are recurrent determinants of patient safety incidents in EDs worldwide. Understanding how these factors interact at the levels of individuals, teams and organizations is essential for designing interventions that can realistically improve safety in this complex setting (1-3,7). This review focuses on acute care delivered in hospital EDs and synthesizes recent evidence on major safety domains: safety culture and climate, clinical risk areas (diagnostic error, medication safety, infection prevention and procedural risks), environmental and organizational factors such as overcrowding, and cross-cutting strategies to strengthen safety management. The aim is a clinically oriented overview that can inform local quality improvement initiatives in emergency services, aligned with contemporary international patient safety recommendations and ethical declarations relevant to emergency and peri-anaesthetic care (6,8-10).

Discussion

This is a narrative, non-systematic review that uses a selective literature approach, suitable for an educational overview of patient safety in emergency medicine. Recent qualitative, quantitative and mixed methods studies, as well as systematic or scoping reviews focusing on patient safety, safety culture or safety climate in EDs and pre-hospital emergency care, were prioritized, particularly those published in the last decade. Key sources included studies of safety culture among emergency nurses and physicians, analyses of contributing factors to ED safety incidents, research on medication safety and pre-filled syringes, and international surveys of safety climate in emergency services (5-9).

We searched the Medline database through the publicly available PubMed interface in the time period from 2010 to 2025. All included literature was published in English or German. In this search, we were using Boolean search technique with the operators 'AND', 'OR' and 'NOT'. The inclusion criteria were review articles, retrospective observational studies and meta-analyses on risks, safety and communication under working conditions in ED. Exclusion criteria during the search were articles that were published in languages other than English or German, data available only in abstracts, editorials and letters to the editor. According to the terms within the list of *Medical Subject Headings (MeSH) of the Medicus Index*, we searched for the terms *patient safety, emergency medicine, communication, diagnostic errors and risk management.* Based on the processed data from the selected 21 papers, this review article was written.

Conceptually, the review is organized around three interrelated levels that influence patient safety: 1) individual and team behaviour (knowledge, skills, communication, adherence to safety standards); 2) local work systems (workflow design, protocols, equipment, information systems, including drug delivery systems such as pre-loaded syringes); and 3) organizational

context (culture, climate, leadership, staffing, crowding and policies for learning from incidents). Within this framework, we highlight prominent risk domains—medication safety, infection prevention, diagnostic reliability, environmental and ethical challenges—and map them to evidence based or promising interventions including those inspired by the Helsinki Declaration on Patient Safety in Anaesthesiology (8,10).

Safety culture and safety climate

Safety culture and safety climate are related but distinct constructs that are both central to understanding patient safety in emergency settings. Safety culture refers to the deeper, relatively stable shared values, beliefs and norms about safety in an organization "how we do things around here" including leadership commitment, learning orientation and just responses to error. Safety climate is the measurable snapshot of this culture at a given point in time, typically captured through staff surveys assessing perceptions of management support, teamwork, communication and safety policies (8,9). In EDs, studies indicate that staff perceive patient safety as fragile, shaped by competing pressures between rapid throughput and thorough, error free care. A scoping review exploring safety culture in emergency departments revealed that overcrowding, interruptions, and heavy workloads were identified as major risks. Staff frequently reported near misses and incidents, though these were not always officially documented.

Qualitative work among emergency nurses identified four broad themes undermining safety management: negligence of safety standards and precautions, disregard of ethical principles, professional challenges (such as inadequate training and role conflicts) and inefficient organizational management (1,2). International cross sectional studies of pre-hospital emergency personnel report generally moderate safety climate scores, with weaker perceptions in domains such as teamwork climate, management perception and working conditions. Organizational characteristics—including employment status, position type and work area—have a stronger influence on safety climate than individual factors, underscoring the impact of system design and leadership. Better perceived safety climate is associated with safer behaviour; higher safety awareness, competence and communication correlate with improved safety compliance and participation among emergency workers, whereas poor organizational environments are negatively linked to safety performance (6,8,9). Overall, the safety culture in many EDs appears characterized by high individual commitment to patient care but limited systemic support, inconsistent team communication, and underdeveloped mechanisms for collective learning. Strengthening both the underlying culture and the observable climate is therefore a key target for improving safety in emergency care (6,8).

Overcrowding, workload and environment

ED overcrowding, operating beyond optimal capacity is strongly associated with delays in time critical treatments, hallway care, and increased in hospital mortality. When demand exceeds capacity, clinicians must triage more aggressively, manage patients in non-designated spaces, and multitask under constant time pressure, all of which heighten the risk of omissions and errors. Overcrowding also erodes privacy and confidentiality, impairs communication with patients and families, and limits opportunities for supervision of junior staff (3,7). ED patient safety is influenced by both safety culture and safety climate, as well as overcrowding, workload, and environmental constraints, all of which interact to affect communication, teamwork, and the risk of errors and adverse events.

Environmental factors such as noise, poor physical layout, inadequate equipment availability and frequent interruptions further compound the impact of crowding. Staff describe working in cramped spaces with limited visibility of patients, which can delay recognition of deterioration and complicate safe performance of procedures. High turnover and boarding of admitted patients in the ED contribute to prolonged stays, increasing exposure to hospital acquired infections and adverse events. Together, these environmental stresses create conditions in which even experienced teams find it difficult to maintain consistently safe care (1-3,7).

Medication safety and pre-loaded syringes

Medication errors represent one of the most frequently reported categories of safety incidents in EDs. Errors occur at prescribing, dispensing and administration stages and include wrong dose, wrong drug, wrong route and omissions, often linked to time pressure, illegible orders, interruptions, and confusion between look alike/sound alike drugs. Incomplete medication reconciliation at triage or admission increases the risk of duplication, drug–drug interactions and omission of chronic therapies, especially in older patients with polypharmacy (3,11).

Pre-loaded and clearly labelled syringes have emerged as an important strategy to reduce medication related risk and treatment delays in emergency care. When clinicians draw up drugs from ampoules under time pressure, they are exposed to hazards such as glass cuts, contamination by glass particles, and misreading of small or smeared labels; similar looking ampoules can also be confused. Those syringes, produced under controlled conditions, are sterile, single use products with standardized labeling that clearly states drug name, concentration and expiry, thereby reducing selection and labelling errors (5,7,11).

Evidence from simulation studies show that colour coded, pre-filled medication syringes decrease both time to drug delivery and dosing error rates in simulated paediatric ED resuscitations. In one study, nurses took on average 156 seconds to start infusions using pre- filled syringes compared with 276 seconds when preparing infusions manually, a reduction of about 106 seconds, which is clinically relevant in shock or arrest. Pre-filled syringes also minimize dose preparation losses and help ensure that the patient receives the precise ordered dose, which is critical for high-risk medications such as vasopressors, sedatives and anticonvulsants. Although unit costs are higher, analyses suggest that their routine use in emergency departments may reduce total costs by preventing complications and occupational injuries associated with drug preparation errors (11).

Strategies such as electronic prescribing, barcode medication administration, standardized order sets and involvement of clinical pharmacists can work synergistically to improve medication safety in EDs when integrated into the existing workflow (5,11).

Infection prevention and standard precautions

Adherence to infection prevention and control measures is a core component of patient safety but is frequently compromised in emergency settings. Nurses and physicians report that hand hygiene, use of personal protective equipment (PPE) and aseptic technique during procedures can be neglected under workload and time pressure. In one qualitative study, participants explicitly identified "non hygienic bandaging", neglect of hygiene rules and unsafe transfers as manifestations of poor adherence to standard precautions in EDs (1,2).

The ED environment, with crowded waiting rooms and prolonged stays in shared spaces, facilitates transmission of respiratory and gastrointestinal pathogens if infection control measures are inconsistently applied. Inadequate isolation facilities, delayed recognition of infectious patients and limited staff training on updated infection control protocols further weaken defences. Strengthening infection prevention in EDs requires not only education but also redesign of workflows and environments to make the safe action the default—such as accessible hand rub dispensers, clear signage, standardized PPE stations at points of care, and rapid triage pathways for suspected infectious cases (5,7).

Diagnostic error and clinical decision making

Diagnostic error is an important but often under recognized source of patient harm in EDs, where clinicians must rapidly evaluate undifferentiated symptoms with limited information. Systematic reviews of ED safety incidents highlight missed or delayed diagnoses among the most serious events, including misrecognition of sepsis, myocardial infarction, stroke and serious trauma. Contributing factors include atypical presentations, incomplete histories due to communication barriers, insufficient observation time and cognitive biases such as anchoring and premature closure under time pressure (3,9).

Crowding and interruptions exacerbate diagnostic risk by limiting time for thorough assessment, physical examination and re-evaluation. In some settings, lack of immediate access to imaging or laboratory tests and delays in reporting results further increase diagnostic uncertainty. Interventions such as standardized triage protocols, clinical decision support tools, structured handover templates, and checklists for high-risk conditions have shown promise in reducing diagnostic errors, although implementation in EDs is variable (2,3,6,9).

Communication, teamwork, ethics and Helsinki Declaration

Effective interprofessional communication and teamwork are central determinants of safety in emergency care. Studies report that lack of effective teamwork, particularly during patient transfers and handovers, is a major weakness in ED safety management. Problems include unclear role allocation, hierarchical barriers, incomplete handover information and failure to speak up about safety concerns, especially in high intensity resuscitations and mass casualty events (1,2,4). Ethical challenges intersect with safety concerns when resource constraints, crowding and high workload force clinicians to make difficult prioritization decisions. Qualitative work describes instances of compromised informed consent, insufficient privacy, and limited communication with patients and families due to time constraints, all of which may undermine trust and lead to misunderstandings about care plans. Disregard of overcrowded spaces is perceived by staff as both a moral and a safety issue, since it can contribute to conflict, non-adherence and complaints (2,4).

The Helsinki Declaration on Patient Safety in Anaesthesiology, endorsed by European professional bodies, offers an ethical and practical framework that is highly relevant to emergency medicine. It recognizes that anaesthesiologists share responsibility for quality and safety across the perioperative process and in many emergency situations inside and outside the hospital where patients are most vulnerable. The Declaration promotes minimum monitoring standards, standardized protocols for high risk situations, availability of essential equipment and drugs, and institutional commitment to safety management systems (12-16).

For EDs, Helsinki based principles translate into expectations such as continuous physiological monitoring appropriate to the patient's condition, access to properly maintained resuscitation equipment, standard operating procedures for airway management, sedation and analgesia, and structured training in crisis resource management and team communication. The Declaration also emphasizes non punitive incident reporting, leadership responsibility for safety and regular audit of critical events, which align with recommendations for ED safety culture and learning from incidents. Integrating these principles into ED policies can thus provide a coherent ethical and professional framework linking anaesthesia, intensive

care and emergency medicine around shared patient safety goals (15,17). Finally, the Declaration of Helsinki defines international standards for the safety of sedation, anaesthesia and airway management, which are directly applicable in ED where such interventions are often carried out in emergency and high-risk situations.

Organizational management and incident learning

Inefficient organizational management is a recurring theme in studies of ED patient safety. Staff report that inadequate staffing levels, lack of experienced personnel, and insufficient support from hospital leadership contribute to burnout, turnover, and inconsistent application of safety protocols. In some departments, incident reporting systems exist but are underused due to perceptions that reporting is time consuming, leads to blame, or does not result in meaningful change (7,18).

A systematic review of learning from patient safety incidents in EDs highlights that while many contributing factors are recognized—such as communication failures, environmental constraints and human factors—structured mechanisms to translate incident analysis into system level improvements are often lacking. Successful learning requires non punitive reporting cultures, multidisciplinary morbidity and mortality reviews, and feedback loops that demonstrate to frontline staff how their reports lead to tangible changes in practice or equipment. Organizational leadership plays a crucial role in allocating resources, setting expectations, and modelling behaviours that prioritize safety over throughput when the two are in tension (19,20). ED safety is limited by organizational weaknesses, poor incident learning, and underused reporting systems, while leadership, structured feedback, and new tools like AI can support improvements.

Applications of Generative AI in Emergency Departments

Artificial intelligence is entering all areas of medicine and is therefore promising in EDs as well. For clinicians, generative AI has the potential to alleviate the burden of documentation by automating routine tasks. It can streamline searches within electronic health records (EHR), facilitating rapid access to relevant patient data. Additionally, AI tools can support medical decision-making, assisting clinicians in evaluating complex cases and improving the accuracy and efficiency of their clinical judgements. Beyond clinical use, generative AI demonstrates value in handling administrative tasks. It can optimise processes such as billing, coding, and insurance authorisation, contributing to improved operational efficiency within healthcare organisations (21).

Conclusion

Patient safety in emergency rooms is threatened by an interplay of human, technical and organizational factors, including overcrowding, high workload, diagnostic complexity, medication risks, infection control challenges, and weaknesses in teamwork, safety culture and safety climate. Studies from diverse settings show that frontline staff are acutely aware of these vulnerabilities, highlighting negligence of safety standards, ethical tensions, professional challenges, and inefficient management as major barriers to safe care. At the same time, there is growing evidence that structured interventions range from flow management and medication safety systems such as pre-filled syringes to team training, standardized handovers, and robust incident learning processes can meaningfully reduce risk when supported by strong leadership and a just culture.

The Helsinki Declaration on Patient Safety in Anaesthesiology provides a unifying ethical and professional framework that can guide safety improvements in EDs by emphasizing monitoring standards, equipment availability, crisis management training and non-punitive learning from incidents. For emergency departments seeking to improve patient safety, a pragmatic strategy is to prioritize a small number of high impact domains—crowding management, medication safety (including pre-loaded and labelled syringes), and communication at handover—while progressively building an organizational culture and climate that value transparency, learning and interprofessional collaboration. Ongoing research is needed to adapt and evaluate safety interventions specifically in ED and pre-hospital contexts, and to incorporate patient and family perspectives into safety initiatives, so that the speed and intensity of emergency care do not come at the cost of avoidable harm.

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