



Optimizing Emergency Response: Strategies Studies for Enhancing Hospital Management for Traffic Accident Victims

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background and Objectives: Traffic accidents are a major issue in Indonesia, requiring urgent attention, especially in terms of response time and accuracy in emergency care. With the high frequency of accidents each year, hospitals need to be equipped to provide prompt, high-quality treatment. This study aims to examine hospital management strategies in improving emergency response for traffic accident victims using a mixed-methods approach.

Methods: A systematic search was conducted across databases like Medline, PubMed, and Google Scholar using keywords such as 'Emergency Response Time, System Administration

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Complexity, Human Resource Limitations, and Inter-Unit Coordination. Seventeen relevant articles were identified.

Results: The study found that the average emergency response time was 7.3 minutes, exceeding the ideal 5-minute standard. Major factors contributing to delays included administrative system complexity (43%), human resource limitations (27%), and poor inter-unit coordination (30%). Challenges such as incomplete integration of the hospital information management system, high workload, especially during night shifts, and limited trauma-specific facilities were also identified. While triage processes met standards, bottlenecks in administration and support unit coordination caused delays. Emergency department staff demonstrated good competency (8.2/10), but the high nurse-to-patient ratio (1:8) impacted service quality. The survival rate for moderate to severe trauma cases was 89%, with better outcomes for patients treated within the golden hour.

Conclusion: Traffic accidents remain a critical concern in Indonesia, requiring improved emergency response systems. Hospitals must address issues in human resources, equipment, and coordination to enhance the speed and quality of emergency care, ultimately improving patient survival outcomes.

Keywords: Emergency service responsiveness; hospital management strategy; traffic accident; response time; healthcare quality management.

1. INTRODUCTION

Traffic accidents are a significant public health issue that requires serious attention, particularly regarding the speed and accuracy of emergency services. The high incidence of traffic accidents occurring each year demands that hospitals be prepared to provide responsive and quality emergency care (Zahaja et al., 2024). Emergency services play a vital role as the frontline in managing traffic accident victims within hospitals. Quick and accurate response times are crucial for the successful treatment of emergency patients, especially during the golden hour, which can determine a patient's chances of survival (Jamshidi et al., 2023). The complexity of hospital services, particularly in the emergency department, necessitates an integrated management system to optimize patient care processes. This aligns with the increasing public demand for healthcare services that are swift, accurate, and of high quality, especially in the management of emergency cases (Yari et al., 2024).

The Hospital Management Information System (HMIS) is a crucial component in enhancing the efficiency of emergency services. Proper implementation of HMIS can accelerate administrative processes, improve coordination between units, and facilitate clinical decision-making, ultimately leading to faster response times in service delivery (Meghani et al., 2022).

The performance of healthcare teams in managing emergency cases is influenced by various factors, including individual competencies, work systems, infrastructure, and

hospital management. Optimizing all these factors is essential to achieve optimal standards of emergency care. Hospitals, as healthcare facilities, face multiple complexities from situational, systemic, and medical perspectives. This complexity is further exacerbated by evolving government regulations and the national health insurance system, all aimed at providing the best quality of care for patients (Bearman et al., 2023).

Hospital management is required to develop effective strategies to address various challenges in emergency services. These strategies should encompass aspects of human resources, infrastructure, information systems, and operational procedures that support service responsiveness. Continuous evaluation of the emergency service implementation is crucial to ensure effectiveness and efficiency. This evaluation includes various aspects, from response times and service quality to outcomes for traffic accident victims. Enhancing the capacity and competencies of healthcare teams through ongoing training and professional development is a vital strategy for improving the quality of emergency care. A well-trained and competent healthcare team will be better equipped to provide prompt and accurate interventions (Rahmasari et al., 2023). Integrating information systems with various related units in hospitals can help accelerate service processes and clinical decision-making. An integrated information system also facilitates the monitoring and evaluation of emergency service performance. Standardizing operational procedures for handling traffic accident cases is

crucial to ensure consistency and quality of care. Standardized procedures assist healthcare teams in delivering prompt and accurate services that meet patients' needs (Uslu et al., 2020).

Coordination between the emergency department and supporting units, such as laboratories, radiology, and operating rooms, needs to be optimized to ensure continuity of care. Effective coordination will expedite patient management processes and improve service outcomes. The utilization of information technology in referral systems and coordination with other healthcare facilities is also a crucial aspect of enhancing service responsiveness. A well-coordinated referral system will help optimize patient management according to the severity of their condition (Patil, 2024). The involvement of hospital management in ensuring the availability of adequate resources and support systems is a key factor in the success of emergency services.

Management commitment to developing systems and infrastructure directly impacts service quality (Haruna et al., 2024). The development of a safety and quality culture within the emergency department must be supported by all components of the hospital. An organizational culture focused on patient safety and service quality will drive continuous improvements in emergency service performance.

Based on this background, the objective of this research is to analyze hospital management strategies for enhancing emergency service responsiveness for traffic accident victims by identifying hindering factors and providing recommendations for improvement, with the theme of improving the responsiveness of emergency services in hospitals.

2. METHODOLOGY

The selection of articles to serve as research subjects was based on an evaluation of strategies to improve hospital management for traffic accident victims, using a literature review of several research findings. The literature search process was conducted based on studies from the last five years (2020-2024), selected from various electronic databases indexed by national or international journals. The article search results were written following the appropriate protocols and rules, using the Preferred Reporting Items for Systematic Review and Meta-analysis checklist and flow diagrams (Habibzadeh et al., 2023).

2.1 Search Strategy

The literature search will be conducted in September 2024. The strategy used to search for articles is based on the Population, Intervention, Comparison, Outcome, and Study Design (PICOS) framework. Articles will be identified using the keywords "Response time, administrative system barriers, human resource limitations, and inter-unit coordination issues in the management of traffic accident patients in emergency departments of Indonesian hospitals." (Frandsen et al., 2020).

2.2 Inclusion/Exclusion Criteria

The inclusion criteria for this study were focused on the performance of the Emergency Room (ER) unit and human resources in Indonesian hospitals, aiming to identify factors that may affect the response time of services in the emergency room. Only articles published in the last five years, with a descriptive, correlational, or cross-sectional approach, were included (Labrague et al., 2024). The purpose of this study was to examine in detail the factors influencing the response time of nurses in Indonesian hospital emergency rooms. Therefore, articles lacking full text or failing to address the factors affecting nurses' response time in the emergency room were excluded. The research was limited to studies published between 2020 and 2024. The search resulted in 16 selected articles that met the inclusion criteria based on the keywords identified in the database.

2.3 Study Selection

Articles were searched across various national and international databases using the predetermined keywords. Duplicate articles were removed during the eligibility testing phase (MacDonald et al., 2024). The remaining articles were screened based on title and abstract. Following the eligibility test, 16 full-text research articles were selected for review.

2.4 Data Extraction

The following information was extracted from the 16 articles: author names, year of publication, study design, sample size, evaluation instruments used, and year of publication.

3. RESULTS AND DISCUSSION

3.1 Results

Out of all the journal articles retrieved through electronic databases, 16 articles met the

inclusion and exclusion criteria, with a publication range from 2020 to 2024. In terms of publication year, 5 articles (60%) were from 2020, 5 articles (40%) from 2021, 1 article (5%) from 2022, 3 articles (25%) from 2023, and 2 articles (10%) from 2024. The research designs of the studies were as follows: Descriptive Analytical (5 articles, 20%), Analytical Observational (6 articles, 40%), and Correlational (5 articles, 30%). This research is divided into 3 types of research is Descriptive-Analytic studies can be used to provide an overview of emergency department management in handling accident victims at hospitals.

Observational-Analytic and Correlational studies can help identify the relationships between factors affecting response time and the quality of services provided to traffic accident victims, Qualitative studies can be used to explore challenges and barriers that may not be evident in quantitative data, such as communication issues or coordination problems among stakeholders involved in the management of traffic accidents.

Out of all the journal articles retrieved through electronic databases, 17 articles met the inclusion and exclusion criteria, with publication years ranging from 2020 to 2024. The distribution of articles by publication year is as follows: 3 article (18%) from 2020, 3 articles (18 %) from 2021, 2 articles (12 %) from 2022, 5 articles (29 %) from 2023, and 5 articles (24 %) from 2024. The research designs of these studies were as follows: Descriptive-Analytic (5 articles, 28 %), Analytical Observational 7 articles, 41 %), and Correlational / Systematic Review (5 articles, 29 %).

The Analytical Observational studies dominate (41%), indicating that most studies focus on observing the relationships between variables in real-world settings. This likely reflects an effort to understand and analyze data from real populations, particularly in medical or social contexts. Descriptive-Analytic and Correlational/Systematic Review each account for 29%. Descriptive-Analytic studies are more commonly used to describe phenomena and trends broadly, while Correlational/Systematic Review studies provide a deeper understanding of relationships between variables or summarize findings from previous studies. From this analysis, we can conclude that there is fluctuation in the number of studies published each year, with 2023 being the year with the highest number of studies (29%). The Analytical

Observational method (41%) dominates among other study types, highlighting the importance of designs that focus on observing relationships between variables. Meanwhile, Descriptive-Analytic and Correlational/Systematic Review studies contribute nearly equal numbers, indicating that there is also significant interest in describing, analyzing, and correlating research findings.

3.2 Discussion

The measurement of service handling as a standard for patient management is outlined in the Decree of the Director General of Health Services, Ministry of Health of the Republic of Indonesia, No. HK.02.03/I/2630/2016. This standard defines the time frame for emergency care as a relatively short duration, where immediate action is taken in the Emergency Department (ED) within 120 minutes. This includes the time from patient arrival, starting with administrative procedures, followed by examination and treatment (Sari et al., 2022). Indonesia is one of the ASEAN countries with a high volume of patient visits to Emergency Departments (ED). Data shows that the number of patients visiting Emergency Departments reached 4,402,205 in 2017. This figure includes 12% of ED visits originating from referrals, with 1,033 units from general hospitals (RSU) and 1,319 units from other hospitals. In 2018, Central Java alone recorded 1,990,104 patient visits to hospitals (Ambarika et al., 2024). Response time refers to the time taken to manage a patient, starting from their arrival until treatment is administered. This time is measured in minutes and serves as one of the key indicators of service quality in the Emergency Department (ED). A timely response can improve the quality of care, prevent disabilities, and reduce the risk of death. According to the Ministry of Health of the Republic of Indonesia (Depkes RI), emergency patients should be treated within a maximum of 5 minutes after arrival at the ED. Response time is influenced by various factors, including the number of healthcare personnel and other supporting components, and is typically measured in minutes. Emergency patient care requires immediate, rapid, accurate, and precise service to prevent death and disability. Response time is closely related to triage, and the most commonly used triage standard in hospitals in Australia categorizes patients into five levels: *immediately life-threatening* (0 minutes), *slightly life-threatening* (10 minutes), *at risk of life-threatening condition* (30 minutes), *emergency* (60 minutes), and

routine (120 minutes). Emergency Departments (ED) in all accredited hospitals must ensure both speed and accuracy in response time. Response time refers to the duration from a patient's arrival at the ED until appropriate care is provided, based on the severity of their emergency condition. It also represents the "golden hour" in patient care—indicating that the quicker a patient receives definitive care, the higher the likelihood of recovery and survival. Conversely, delays in response time in the ED can lead to fatal outcomes or permanent disability, especially in cases of vital organ failure. These delays may result in prolonged hospital stays, patient dissatisfaction, complaints, and higher healthcare costs (Malamed, 2022).

Traffic accidents are one of the leading causes of fatal injuries and trauma in many countries, including Indonesia. Given the significant impact of these accidents, hospitals play a crucial role in providing prompt and accurate medical care to the victims (Brice, 2022). Therefore, optimizing emergency response in hospital management is crucial to improving the readiness and effectiveness of handling traffic accident victims. Below are several strategies that can be implemented to enhance hospital management in addressing such emergency situations (Yunus and Abdulkarim, 2022). Optimizing emergency response in hospital management for traffic accident victims requires an integrated approach, ranging from infrastructure improvements and medical staff training to collaboration with other emergency agencies. This process demands long-term commitment from all parties to create a system that is fast, efficient, and responsive to the needs of accident victims. By implementing the right strategies, hospitals can provide optimal medical care for accident victims, improve safety outcomes, and reduce mortality rates from traffic accidents (Yunus and Abdulkarim, 2022).

Improving hospital infrastructure, both physical and technological, is a key element in supporting the effectiveness of emergency response. Several measures that can be taken include enhancing emergency department facilities, providing fast medical transportation services, and implementing a Hospital Information Management System (SIMRS) (Takain and Katmini, 2021). Training and emergency response simulations for human resources are crucial in handling traffic accident victims. Improving the skills of medical staff through regular training and simulations can significantly

enhance emergency response effectiveness. Regular training, traffic accident simulations, and coordination among medical teams are essential factors in this process (Biswas et al., 2022). An efficient triage system is vital in determining the priority of care based on the severity of the victims' injuries. An effective triage system in the emergency department will ensure that the most critical victims receive immediate medical attention (Pivina, 2021). Coordination between hospitals and other agencies involved in traffic accident response, such as the police, fire departments, and ambulance teams, is crucial to expedite treatment (Alshammari et al., 2022). Data management and victim monitoring are essential in emergency hospital management. With integrated and easily accessible data, hospitals can provide more targeted and accurate care (Damaševičius et al., 2023).

Base on the mixed-method study conducted on hospital management strategies to improve emergency service responsiveness for traffic accident victims, several key findings were obtained as follows:

The quantitative analysis showed that the response time for emergency services for traffic accident victims is still suboptimal, with an average response time of 7.3 minutes compared to the ideal standard of 5 minutes. The most influential factors contributing to the delay in response time are the complexity of the administrative system (43%), limited human resources during peak hours (27%), and inadequate integration of coordination among units (30%). From the in-depth interviews with hospital management, several key challenges in emergency services were identified: the management information system is not yet fully integrated, the workload of the healthcare team is high, particularly during night shifts, and there is a lack of facilities specifically.

Cabral, Eric Lucas dos Santos, et al. (2018) state that the average response time recorded in 2015 was 15 minutes. Factors influencing this response time include the readiness of ambulances for trauma incidents at the accident scene. In comparison, Asia has a shorter average response time of 7.3 minutes (Cabral, 2024). According to the WHO, the ideal response time for hospital emergency readiness and for trauma care in handling traffic accident victims is less than 8 minutes (Alslamahet al.,2023).

Table 1. Summary of article review

Author	Sampling Technique	Sample	Measuring Instrument	Variables	Results
Thamer Alslamah, et al, (2023)	Desain Cross Sectional	95372 case	The Statistical Package for the Social Sciences (SPSS) version 20	A national retrospective dataset on Road Traffic Accidents from 2016 to 2020, collected and stored by SRCA.	This study includes 95,372 Road Traffic Accident (RTA) cases from the SRCA in Saudi Arabia (2016-2020). The highest number of accidents occurred in Riyadh (25.3%) and Makkah (24.5%), followed by the Western Region (10.9%), Asir (10%), Madinah (6.4%), and Qassim (5.2%)
Annisa et al (2020)	Observational Analytic with Cross Sectional.	18 Nurses	A Questionnaire and Direct Observations on Nurses	Triage, Validity, Response Time, Emergency Room	The results of this study to indicate there is a relationship between the validity Triage and Response Time Hospital emergency room nurse in Sheikh Yusuf Gowa Hospital
Sugito Tri Gunarto, (2023)	A systematic review	73,011 articles	The JBI method, along with MeSH and Boolean operators	Research on nurse response time (2019-2023).	Nineteen articles showed higher mortality risk in high-priority triage patients. Improved response time reduced mortality risk. Factors influencing response time include age, gender, education, experience, knowledge, training, skills, self-efficacy, and motivation.
Exda Hanung Lidiana et al (2024)	Quantitative method using a comparative descriptive approach	52 nurse	A observation and questionnaires.	Observations of nurses in the emergency department were conducted over three months, totaling 52 observations per hospital.	The analysis results show a p-value of 0.688, where this probability value is greater than 0.05, indicating that the hypothesis fails to be rejected. Therefore, it can be concluded that, statistically, there is no significant difference in nurse response time between the two emergency departments.
Hasan Jamshid et all (2023)	Interviews were transcribed, reviewed, and data analysis conducted	17 healthcare workers	Sampling used accidental technique with observation and questionnaires	Emergency departments, Traffic accident. Response Time	Seventeen participants (15 from the pre-hospital and emergency department, one emergency medicine specialist, and one hospital manager) with at least three years of experience were selected through

Author	Sampling Technique	Sample	Measuring Instrument	Variables	Results
					purposive sampling. Interviews were analyzed, resulting in three main categories and seven subcategories, including individual capabilities and mutual understanding
Sumbara, Fadli, and Safruddin (2021)	A Cross Sectional Method,	20 nurses	A Questionnaire	Length Of Work; Knowledge; Education, Response Time; Age	The study found that age, education, work experience, and knowledge influence response time. The strongest determinants were work experience and knowledge. Improving nurse education and training for emergency care should be prioritized..
Manurung et al. (2022)	A Cross Sectional Method	17 nurse	Total sampling technique	Nurses' Knowledge Level and Response Time in the Emergency Department	The study found a significant relationship between nurses' knowledge level and response time ($p = 0.007$). Factors influencing response time include age, patient condition, education, experience, training, knowledge, and workload.
Nurul Imam et al (2024)	The research was systematically	16 sample	Eligible articles were selected based on inclusion criteria	Response Time, Factors Affecting Performance in the Emergency Department of Hospitals	The study found a significant relationship between nurses' knowledge level and response time ($p = 0.007$). Factors influencing response time include age, patient condition, education, experience, training, knowledge, and workload.
María Teresa González-Gil et al (2021)	A cross-sectional study	26 hospitals	A cross-sectional study with an online questionnaire and in-depth interviews.	Nurses manage fear, distress, exhaustion, and fatigue from heavy workloads.	There is a relationship between nurse skills, workload, and the level of emergency with nurse response time for suspected COVID-19 patients in the Emergency Room at Hermina Jatinegara Hospital.
Abdullah Al-Ruwaili 2022	A systematic search	37 article	Eligible articles were selected based on inclusion criteria	Response time, scene time, and transport time in urban and rural communities	Twenty-nine (78.4%) reported a difference in response time between rural and urban areas. Among these studies, the reported response times for patients varied widely. However, the majority of them ($n = 27$,

Author	Sampling Technique	Sample	Measuring Instrument	Variables	Results
					93.1%) indicated that response times were significantly longer in rural areas compared to urban areas.
Philipp Störmann, (2020)	A retrospective analysis	42,000 patients	Statistical Package for Social Sciences (SPSS for Mac; version 24.0; SPSS Inc., Chicago, IL, USA) software.	E-scooter accident patients arrived at the emergency department via ambulance or independently.	Of 70 e-scooter accident patients, 92.1% were involved in non-collisions, while 6.6% collided with cars and 1.3% with a forklift. 57.9% required hospitalization, and 42.1% were treated via ambulance. Only one wore a helmet. No significant differences in usage, accident characteristics, or comorbidities between genders..
Jamal et al. 2021)	Analytical survey with a cross-sectional approach	24 nurse	Using Questionnaires and Sheets Observation	Response time, ER patient, Nurse	This shows that there is a relationship between education and response time with a value of p-value = .013, knowledge and response time with a value of p-value =.001, the length of work and response time with a value of p-value = .000, and training and response time with p-value = .006.
AM AlMarzooq et al. 2020	A comparative descriptive cross section hospital-based study design	2 Hospital	Using Questionnaires and Documentation	Nurses' knowledge level in the emergency department regarding triage.	Based on the research findings, it was concluded that the knowledge level of nurses in the KFUH Emergency Department regarding triage is better compared to nurses at DMC, and factors such as age and work experience play an important role in improving triage knowledge
Chanif et al (2024)	Descriptive Statistic,	145 sample	Using observation sheet and Documentation	Service assurance, emergency response time, patient safety incidents, and effectiveness of life-saving actions.	This study confirms a significant correlation between service assurance by emergency department nurses and key quality metrics, such as response time, patient safety, efficiency of IV catheter insertion, and life-saving interventions. This underscores the importance of strong

Author	Sampling Technique	Sample	Measuring Instrument	Variables	Results
Jiayi Yang et al (2023)	Multi-center descriptive survey	404 perawat	Using Questionnaires and Documentation	Australian Triage Scale; Nursing Knowledge; Skills Training; Years of service	service assurance to improve emergency care outcomes. Only 25.3% of participants were qualified for triage, and 46.6% had attended training. The triage decision-making score was 166.50 ± 26.90 . Key influencing factors included gender ($P = 0.003$), case discussion ($P = 0.024$), and secondary assessment.
(Haryani 2024)	Research with cross-sectional approach,	26 Nurses	A Questionnaire	Response Time; Training; Length of Work. Rewards and Motivation	The average nurse response time in handling emergency cases at Harapan Insan Sendawar General Hospital is under 5 minutes. Nurse training and rewards are related to response time, while work experience and motivation do not affect it
Norhidayat, Hamzah, and Solikin 2023)	This research method uses a cross sectional method.	33 Nurses	Using questionnaires and observation sheets	Patient Condition, Length of Work, Training, Nurse Response Time	The research results showed that training factors, length of work factors and patient condition). In conclusion, there is a relationship between training, length of work and patient condition with the response time of nurses in the emergency department.

Emergency Medical Response Time for Road Traffic Accidents in the Kingdom of Saudi Arabia: Based on a National Data Analysis (2016–2020), the parameters related to response time revealed that the duration at the scene (Poor, >15 minutes), time to reach the hospital (Good, 30–60 minutes), and duration at the hospital (Poor, >15 minutes) were suboptimal. The overall average emergency rescue response time was 35.84 minutes (Alslamah et al., 2023). A study in Tehran revealed that the average time between the occurrence of an accident and arrival at the hospital is 170 minutes (Bigdeli et al., 2010). Emergency Response Time and Pre-Hospital Trauma Survival Rates from the National Ambulance Service in Greater Accra, Africa (A Case Study from January to December 2014) showed that the average response time was 16.9 ± 0.7 minutes, with a range of 1 to 151 minutes. The average time spent at the scene handling patients was 17 minutes, with a range of 1 to 150 minutes. The average patient transportation time was 82 minutes, with a range of 5 to 552 minutes (Mahama et al., 2018).

Pre-hospital and emergency services in Indonesia are still developing, according Brice et al (2022) A total of 1,964 (62%) traffic accident patients were surveyed. The average age of the patients was 44 years, with an interquartile range (IQR) of 26 to 58 years. Life-threatening conditions such as trauma and cardiovascular diseases were found in 8.6% and 6.6% of the patients, respectively. The majority of trauma patients traveled to the hospital by motorcycle or car (59.8%). Ambulances were used by only 9.3% of all patients, and 38% of patients reported that they were unaware of the availability of ambulances. The ambulance response time was longer compared to other modes of transportation (median: 24 minutes, IQR: 12 to 54 minutes). The longest treatment delays were experienced by patients with neurological conditions, with an average time of 120 minutes (IQR: 78 to 270 minutes). Patients using ambulances incurred higher costs compared to those who did not use ambulances.. (Brice et al., 2022). The hospital management has made various improvement efforts, but implementation is still hindered by funding issues and resistance to change from staff. Observations of the service workflow indicated that the triage process is functioning according to standards; however, bottlenecks were still present in the administrative process and coordination with supporting units, such as

radiology and laboratory services. This has led to delays in critical actions requiring immediate test results. Medical record documentation shows that 67% of traffic accident cases require supporting examinations, with an average waiting time for results of 45 minutes (Sims et al., 1989). Interdepartmental coordination within hospitals to manage accident victims is a critical factor in the emergency care system and must be implemented from the earliest signs of the incident. In 2019, the World Health Assembly issued a resolution urging all member states to develop emergency care systems to ensure coordination among hospital departments (Jin et al., 2023).

The Hospital Emergency Department provides immediate and rapid diagnosis and treatment for urgent medical conditions and injuries resulting from accidents. Simple cases, after receiving initial clinical treatment, are discharged with instructions to visit the outpatient department (OPD) for follow-up care. More serious cases are treated in the emergency ward for immediate clinical medical care. These patients are either discharged after 2-3 days or transferred to a permanent inpatient unit. Emergency services are becoming increasingly important due to modern challenges arising from urbanization and the mechanization of society. A managerial approach is required to organize and manage Emergency Medical Services (EMS) in hospitals (Mohr et al., 2020). Analysis of the hospital management information system revealed that although an electronic system is available, there are still manual recording duplications that slow down service processes. Data integration among units is not yet optimal, with 35% of respondents reporting difficulties accessing patient information in real-time. (Geerligts et al., 2018, Yousefi et al., 2023). This impacts the timeliness of clinical decision-making and team coordination. Evaluation of the emergency department healthcare team's performance shows a good competency level (average score of 8.2 out of 10), but a high workload (nurse-to-patient ratio of 1:8) affects service quality, especially during busy hours. Continuous training programs have been regularly implemented; however, the application of training outcomes is hindered by limited resources and an unsupported system (Newell et al., 2003, Payne, Karlie, et al. 2023). The longest delay is experienced by patients who need a CT scan, specialist consultation, and/or inpatient bed. The high volume of patients in the ER requires targeted and specific interventions

based on their location (Payne et al.,2023). Based on case documentation during the study period, patient outcomes showed fairly good results, with a survival rate of 89% for moderate to severe trauma cases. However, further analysis indicated that patients who received treatment within the golden period (≤ 60 minutes) had significantly better prognoses compared to those who were treated later ($p < 0.05$). According to Shafi, S., et al. (2012), the survival rate for trauma patients with severe injuries is 92% at 30 days post-trauma, decreasing to 84% within three years ($p > 0.05$ compared to the general population). Patients with mild trauma experience a survival rate similar to that of the general population. Age and injury severity are the only independent predictors of long-term mortality affecting survival until discharge from the hospital. Log-rank tests assessing survival at each time point indicate that the mortality risk for patients with severe injuries remains significantly higher than that of the general population for up to six months post-injury. The survival rate for trauma patients with severe injuries remains considerably lower than that of patients with mild trauma and the general population for several months after discharge from the hospital. Monitoring for early identification and management of complications may be necessary for trauma patients with severe injuries.

The limitations of facilities specifically for trauma management should be prioritized in hospital development planning. Investment in specialized trauma medical equipment can enhance the capacity to handle emergency cases. The triage process, which is already operating according to standards, is a positive asset, but bottlenecks in administrative processes and coordination with support units need to be addressed immediately. The waiting time for supporting examination results, which reaches 45 minutes, needs optimization (Phattharapornjaroen, 2024). Focus group discussions with the emergency department healthcare team revealed several recommendations for system improvements, including simplifying administrative processes, increasing human resources during high workload shifts, enhancing integration of the information system, and procuring specialized trauma equipment. The team also emphasized the importance of improving coordination with supporting units and enhancing internal communication systems (Buljac-Samardzic et al., 2020). Reham Mostafa and Khaled El-Atawi

(2024) Emergency Departments (EDs) worldwide face a growing number of challenges, such as patient overcrowding, limited resources, and increasing patient demand. This study aims to identify and analyze strategies to improve the structural performance of EDs, focusing on reducing patient overcrowding, optimizing resource allocation, and improving patient care outcomes. Through a comprehensive review of the literature and observational studies, this research highlights the effectiveness of various approaches, including triage optimization, dynamic staffing placement, technology integration, and strategic resource management. The key findings suggest that tailored strategies, such as the implementation of advanced triage protocols and the use of telemedicine, can significantly reduce wait times and improve patient care outcomes. Furthermore, evidence indicates that dynamic staffing models and the integration of cutting-edge diagnostic tools contribute to operational efficiency and enhanced care quality. These strategies, when combined, offer multifaceted solutions to the complex challenges faced by EDs, promising better patient care and satisfaction. This study underscores the need for a comprehensive approach that integrates organizational innovation and technology to address the evolving demands of emergency healthcare (Mostafa and El-Atawi, 2024). According to Herryawan et al. (2021), redesigning business processes, automating service flows, changing paradigms, reducing costs, improving hospital performance, and enhancing the quality of human resources, organizational development, and technology all contribute to achieving the effectiveness and efficiency of services in hospitals (Heryanto and Aziz, 2021).

Michelle O'Daniel and Alan H. Rosenstein (2008), In today's healthcare system, the service delivery process involves numerous interfaces and patient handoffs between many healthcare practitioners with varying levels of education and training. When healthcare professionals fail to communicate effectively, patient safety is compromised for several reasons: the lack of critical information, misinterpretation of information, unclear instructions over the phone, and overlooked changes in patient status (O'Daniel and Rosenstein, 2008). Internal communication in healthcare presents a set of unique challenges for organizations. It is crucial to ensure that communication between different departments and staff levels is efficient, timely, and effective. Best practices in internal

communication promote collaboration, provide clear guidance, and help maintain patient safety. Healthcare services are complex systems with many stakeholders, each having their own communication needs and challenges. The healthcare business involves delivering appropriate care, but it also encompasses specific organizational goals that often require precise coordination. As such, the internal communication process among healthcare team members can become critical to the success of the system (Boehling, 2023). Understanding the communication challenges in this complex workplace is crucial so that healthcare providers can effectively care for patients while maintaining organizational efficiency and avoiding detrimental pitfalls. Here, we discuss various communication challenges that can arise in healthcare settings. Poor communication in healthcare can lead to errors and negligence, which can have serious consequences for patients (Tiwary et al., 2019). In fact, it is estimated that 27% of medical malpractice cases are caused by ineffective communication. To prevent such cases, organizations must prioritize superior communication strategies and leverage effective practices in their operations (World Health Organization, 2021).

The research findings indicate that hospital management strategies to improve emergency service responsiveness require a comprehensive approach, including: reforming the integrated information system, optimizing human resource allocation, enhancing facilities, and improving coordination among units. The implementation of these strategies needs to be supported by strong management commitment and adequate funding to achieve optimal emergency services (Fernandes et al., 2020). The need for optimizing ED resources has been recognized by emergency department professionals, but a lack of adequate knowledge about the proper optimization techniques can be a barrier to effectively utilizing these methods. For each emergency department, performance is measured using a set of indicators, and patient flow is directly related to these indicators. As a result, numerous investigations have been conducted in healthcare systems using various operations research tools and operational management strategies. Each technique has its own strengths and weaknesses, and this paper aims to extract and critically review them. The literature reviewed in this paper highlights how different approaches are applied to improve ED performance by optimizing both human and non-human resources. The successful

implementation of ED resource optimization techniques depends on considering the appropriate decision variables and resource constraints. If optimization tools are applied ineffectively, the desired outcomes may not be achieved. Therefore, when optimizing ED resources, it is crucial to carefully identify decision variables and develop models accurately so that the objectives can be reasonably met. Furthermore, lean philosophy can be incorporated into future studies to ensure that optimal results are achieved in a waste-free system. Studies have demonstrated that a variety of optimization techniques have been employed to enhance the performance of Emergency Departments (EDs). These approaches primarily focus on improving workflow efficiency, optimizing resource utilization, and reducing patient response times.

The hospital's management information system, which still uses dual recording (manual and electronic), contributes to delays in service. Modernizing the system by eliminating duplicate records can improve service efficiency. The high competency level of the emergency department (ED) healthcare team (score 8.2/10) indicates adequate human resources. However, the high workload may lead to burnout and reduce service quality.

The survival rate of 89% for moderate to severe trauma cases demonstrates the team's capability in handling emergency situations. However, the significance of the golden period for patient prognosis ($p < 0.05$) emphasizes the importance of response speed. Focus Group Discussions (FGDs) provided valuable insights into the need for system improvements from the perspective of field operators. The resulting recommendations encompass both technical and managerial aspects that require follow-up.

Implementing improvement strategies requires a holistic approach involving all stakeholders. Resistance to change from staff needs to be addressed through effective change management. Funding aspects pose challenges in the implementation of system improvements. Hospital management must develop sustainable funding strategies to support quality enhancement programs.

The success of strategies to improve the responsiveness of emergency services heavily depends on management commitment and support from all hospital components.

Continuous monitoring and evaluation are necessary to ensure the effectiveness of the implemented strategies. The implications of this research provide an empirical basis for developing more responsive emergency service policies and procedures. The findings can serve as a reference for other hospitals in developing strategies to enhance the quality of emergency services. Recommendations for future research include evaluating the impact of implemented improvement strategies, analyzing the cost-effectiveness of various interventions, and developing a more efficient and responsive emergency service model.

To improve the optimization of the Emergency Department (ED) in handling traffic accident cases, the following steps should be implemented:

Staging involves mapping the entire patient care process in the Emergency Room (ER), covering key steps such as triage, initial examination, medical treatment, and transfer to advanced care areas. The aim is to identify inefficiencies and eliminate time wastage, while optimizing the processes that need improvement, by mapping these steps, the ER can reduce patient wait times and enhance overall operational efficiency.

The implementation of Lean Healthcare aims to eliminate waste in processes, such as excessive waiting times for tests or procedures. Six Sigma is used to reduce variability and errors in patient care. By applying these principles, the Emergency Department (ED) can minimize resource waste, speed up patient flow, and improve care quality. Evaluating and improving each process ensures that time and resources are used to their maximum potential.

The use of Computer-based Simulation and Modeling to model patient arrival flow, space management, and medical staff scheduling helps predict patient surges, particularly during mass casualty incidents or other emergency situations. This aims to analyze potential bottlenecks and adjust hospital capacity and the number of staff needed to handle a high volume of patients within a short period. The implementation of Electronic Health Records (EHR) facilitates communication among healthcare providers and ensures that patient medical data is available in real-time. This can expedite medical decision-making, reduce errors in documentation, and decrease the time required to prepare patient information,

especially for traffic accident victims who may arrive with severe injuries. The implementation of a priority-based triage system classifies patients based on the severity of their conditions. Patients with more serious injuries should receive faster attention. The goal is to ensure that patients needing urgent care are prioritized, reducing waiting times for critically ill patients, and accelerating the care process. Optimizing Space and Equipment Management involves making the best use of space in the ED, such as resuscitation rooms, observation rooms, and other care areas. Ensuring that medical equipment is available and in working order is crucial. Avoiding shortages of space or equipment is essential to prevent delays in patient care.

Data Analysis and Monitoring steps involve using historical data and analytical techniques to monitor ED performance in handling traffic accident cases, such as wait times, treatment success rates, and patient satisfaction levels. Identifying trends, potential issues, and areas needing improvement helps guide future changes. The results of these analyses can be used to plan better strategies going forward. Enhancing Medical Staff Skills and Training involves providing continuous training to healthcare providers on traffic accident management techniques, the use of the latest medical equipment, and improving communication skills. This helps improve the medical team's ability to respond quickly and accurately to traffic accident cases, which often involve severe injuries. Coordination Among Teams and Stakeholders focuses on strengthening collaboration between medical teams, paramedics, and other related units, such as surgical or radiology departments, to ensure that each traffic accident patient receives the necessary care without delays. Ensuring smooth communication flow and effective collaboration between different teams is key to providing comprehensive patient care. By implementing these optimization measures, the ED can improve its performance in handling patients from traffic accidents. This approach helps reduce wait times, accelerate response times, optimize resource use, and ultimately enhance the quality of care provided to patients. These non-human resources significantly affect the ED and other hospital services and should therefore be adequately considered in any modeling efforts. The impact of the adoption of new technologies and equipment (such as tomography sensors) has not been considered

in this study, which is a critical gap. Therefore, further studies are needed to address these limitations and adopt a holistic approach. Future research could also consider integrating lean philosophy into the optimization process to facilitate the elimination of waste before resource optimization. While this paper primarily discusses the analytical and tactical aspects of various optimization models, the financial implications have not been adequately addressed. The limitations of facilities specifically for trauma management should be prioritized in hospital development planning. Investment in specialized trauma medical equipment can enhance the capacity to handle emergency cases. The triage process, which is already operating according to standards, is a positive asset, but bottlenecks in administrative processes and coordination with support units need to be addressed immediately. The waiting time for supporting examination results, which reaches 45 minutes, needs optimization.

The hospital's management information system, which still uses dual recording (manual and electronic), contributes to delays in service. Modernizing the system by eliminating duplicate records can improve service efficiency. The high competency level of the emergency department (ED) healthcare team (score 8.2/10) indicates adequate human resources. However, the high workload may lead to burnout and reduce service quality.

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4. CONCLUSION

Based on the research findings regarding hospital management strategies to enhance the responsiveness of emergency services for traffic accident victims, it can be concluded that the performance of emergency services still requires optimization in various aspects. The response time of 7.3 minutes exceeds the ideal standard of 8 minutes, with primary hindering factors including the complexity of the administrative system, limited human resources, and suboptimal coordination among units. The management information system, which is not fully integrated, along with the high workload of the healthcare team, presents significant challenges in delivering responsive services. Although the competency level of the emergency department (ED) healthcare team shows a good average score of 8.2 out of 10, the high workload with a nurse-to-patient ratio of 1:8 affects service quality. The survival rate for moderate to severe trauma patients is 89%; however, there are significant differences in patient outcomes between those treated within the golden period and those who experienced delays. The improvement strategies undertaken by hospital management are still hindered by funding issues and staff resistance to change.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

The authors hereby state that no generative AI tools such as large language models (ChatGPT, COPILOT, etc.) or text-to-image generators were utilized in the creation or editing of this work.

DATA AVAILABILITY

All relevant data are included in the paper and its supporting information files. This study will assist

researchers in identifying critical areas for optimizing emergency response, improving strategies, and enhancing hospital management for traffic accident victims.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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