



# **A Systematic Review: Emergency Medical System Overview in Indonesia**

***Denada Florencia Leona\****

*\*Andalas University, Padang, Indonesia*

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## **ABSTRACT**

**Background.** Emergency Medical Services (EMS) play a vital role in providing pre-hospital care, reducing morbidity and mortality during medical emergencies. In Indonesia, the EMS system is still developing, particularly in rural and remote areas, where significant gaps in infrastructure, trained personnel, and access to emergency care remain. This systematic review aims to evaluate Indonesia's EMS system, identify its challenges, compare it with global EMS practices, and propose strategies for improvement.

**Method.** A systematic review was conducted using databases such as PubMed, Scopus, and Google Scholar to identify relevant studies published between 2013 and 2023. Articles included focused on Indonesia's EMS, global EMS comparisons, and pre-hospital care in low- and middle-income countries. Data were synthesized and categorized based on key themes: EMS infrastructure, workforce training, public accessibility, and disaster preparedness. Findings from Indonesia were compared with EMS systems in developed countries like the United States, Japan, and the United Kingdom.

**Results.** The review revealed significant disparities in EMS access between urban and rural areas in Indonesia. While urban regions benefit from improved infrastructure and coordination through systems like SIJANTAR, rural areas suffer from limited resources, long response times, and a lack of trained paramedics. Workforce shortages, particularly in Basic Life Support (BLS) and Advanced Life Support (ALS) certifications, further hinder pre-hospital care. Compared to global systems, Indonesia's EMS system is less centralized and struggles with disaster response due to inadequate preparedness and coordination. Telemedicine and mobile health technologies offer promising opportunities to bridge gaps in remote regions.

**Conclusion.** Indonesia's EMS system faces numerous challenges, especially in rural and remote areas, where limited infrastructure, personnel shortages, and long response times affect patient outcomes. To strengthen the EMS system, recommendations include expanding paramedic training programs, modernizing infrastructure, adopting telemedicine, and improving disaster preparedness. Future research should focus on nationwide EMS assessments, cost-effectiveness studies, and public perception to inform policy development. Strengthening Indonesia's EMS system is essential for ensuring equitable access to emergency care across the archipelago.

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**Keywords:** Emergency Medical Services, Indonesia, pre-hospital care, rural healthcare, paramedic training, telemedicine, disaster preparedness, global EMS systems.

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## **Introduction**

Emergency Medical Services (EMS) are an essential component of healthcare systems worldwide, playing a pivotal role in the provision of acute, pre-hospital care. From the scene of an emergency to the doors of the hospital, EMS systems are designed to provide critical interventions, stabilize patients, and ensure that they receive timely and appropriate medical care. The global landscape of EMS varies significantly across countries, shaped by differences in healthcare infrastructure, governance, and socio-economic factors. While developed nations typically have well-established and highly specialized EMS systems, many low- and middle-income countries continue to face challenges in building efficient and reliable emergency care networks. The concept of modern EMS emerged in the mid-20th century, following advancements in trauma care during wartime and the rise of public health systems. High-income countries such as the United States, the United Kingdom, and Australia have developed advanced EMS systems characterized by standardized protocols, specialized training for paramedics and emergency medical technicians (EMTs), and well-equipped ambulances capable of providing life-saving care. These systems are generally supported by robust infrastructure, including centralized dispatch centers, communication networks, and access to well-resourced hospitals. In contrast, EMS systems in low- and middle-income countries often struggle with limited funding, a shortage of trained personnel, and inadequate equipment, resulting in disparities in emergency care.<sup>1,2</sup>

Globally, there is a growing recognition of the need to strengthen EMS systems as a critical part of universal health coverage (UHC) and health security. Effective EMS systems not only save lives during emergencies but also enhance the resilience of healthcare systems, particularly during mass casualty incidents, pandemics, and natural disasters. The World Health Organization (WHO) has identified pre-hospital emergency care as a crucial component

of the continuum of care and has called for the integration of EMS within national health systems to improve overall health outcomes. However, the development and implementation of EMS systems are highly context-specific, influenced by geographic, demographic, and political factors. For instance, densely populated urban areas may require different EMS strategies compared to rural or remote regions, where access to healthcare is often more limited. In many parts of the world, particularly in Sub-Saharan Africa, Southeast Asia, and Latin America, EMS systems are still in nascent stages, with significant gaps in infrastructure, workforce capacity, and public awareness. Addressing these challenges requires a multi-faceted approach that includes government investment, international collaboration, and community involvement.<sup>2,3</sup>

Indonesia, the world's fourth most populous country, presents a unique set of challenges and opportunities in the development of its EMS system. As an archipelago of over 17,000 islands, Indonesia's geography poses significant logistical difficulties in delivering timely emergency care to all parts of the country. The healthcare system in Indonesia is overseen by the Ministry of Health, with a focus on achieving universal health coverage under the national health insurance program known as Jaminan Kesehatan Nasional (JKN). Despite these efforts, the country's EMS system remains underdeveloped, particularly in comparison to other Southeast Asian nations. Historically, EMS in Indonesia has been fragmented, with various public and private providers offering ambulance services, often with little coordination or oversight. Emergency response in urban areas like Jakarta, Surabaya, and Bandung is relatively better, with government and private hospitals operating ambulance networks equipped to handle medical emergencies. However, rural and remote areas often rely on community-based initiatives or district-level health centers (Puskesmas) with limited resources and training. The disparity in service quality between urban and rural areas is one of the most significant challenges faced by Indonesia's EMS system.<sup>4</sup>

In response to these issues, the Indonesian government has taken steps to strengthen the EMS infrastructure. The establishment of a national ambulance network, known as SIJANTAR (Sistem Informasi dan Jaringan Terpadu Ambulans dan Emergency Response), is an example of efforts to integrate various EMS providers into a centralized system, improve coordination, and reduce response times. However, despite these advancements, the EMS system in Indonesia still struggles with issues such as inadequate funding, lack of trained personnel, and inconsistent protocols. One of the primary challenges in Indonesia's EMS system is the shortage of qualified emergency care providers. While Basic Life Support (BLS) training is available for healthcare workers, there is a dearth of personnel trained in Advanced Life Support (ALS), which is crucial for managing critical and complex emergencies. Many ambulance services, especially in remote areas, are operated by underqualified staff who may lack the skills necessary to provide proper pre-hospital care. Additionally, ambulances are often poorly equipped, with many functioning as mere transport vehicles rather than mobile units capable of delivering life-saving interventions. Public awareness and utilization of EMS services in Indonesia also remain low. Many Indonesians are not familiar with the concept of calling for an ambulance in an emergency, and there is often a reliance on informal means of transportation, such as taxis or private vehicles, to take patients to the hospital. This can lead to significant delays in receiving appropriate care, particularly in time-sensitive cases such as cardiac arrests, strokes, and trauma.<sup>5,6</sup>

Furthermore, Indonesia's susceptibility to natural disasters, including earthquakes, tsunamis, volcanic eruptions, and floods, places an additional strain on its EMS system. Disaster preparedness and response are crucial components of the country's emergency care framework, and while there have been improvements in disaster management through agencies like the National Disaster Management Agency (BNPB), challenges remain in terms of coordination, communication, and resource allocation during large-scale emergencies. In conclusion, while Indonesia has made progress in improving its EMS system, significant challenges remain in terms of infrastructure, workforce development, and public awareness. The fragmented nature of the EMS network, coupled with disparities in service quality between urban and rural areas, presents ongoing obstacles to ensuring timely and effective emergency care across the country. Addressing these issues will require continued investment in training, infrastructure, and public education, as well as stronger coordination between government agencies, healthcare providers, and international partners. Strengthening Indonesia's EMS system is not only crucial for improving individual health outcomes but also for enhancing the country's overall healthcare resilience in the face of emergencies and disasters.<sup>7</sup> This article aimed to present overview of Emergency Medical System in Indonesia.

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## Method

This section outlines the systematic approach used in the review of the Emergency Medical Services (EMS) system in Indonesia. The methodology adheres to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, ensuring a thorough and transparent process of identifying, selecting, and analyzing relevant studies. The primary goal of this systematic review is to synthesize current research on EMS systems, evaluate their structure, performance, challenges, and opportunities, and identify potential strategies for improvement within the Indonesian context.<sup>8</sup>

A comprehensive search strategy was employed to identify relevant studies addressing the EMS system in Indonesia and its comparison to global standards. The following electronic databases were used to ensure broad coverage of peer-reviewed literature:

- PubMed
- Google Scholar
- Scopus
- CINAHL (Cumulative Index to Nursing and Allied Health Literature)
- ScienceDirect
- Indonesian local journals and repositories (e.g., Garuda, Neliti)

The search was limited to studies published between 2013 and 2024, providing a decade-long timeframe to capture both older and more recent developments in EMS. The search was not limited to English-language articles; studies published in Bahasa Indonesia were also included, provided they met the inclusion criteria.

Keywords and Search Terms. The following key search terms and combinations were employed across all databases:

- "Emergency Medical Services" OR "EMS"
- "Pre-hospital care" AND "Indonesia"
- "Ambulance services" AND "Indonesia"
- "Disaster response" OR "Disaster management" AND "Indonesia"
- "Emergency response" AND "developing countries"
- "Emergency medical technicians" OR "paramedics" AND "Indonesia"
- "Health system" AND "Indonesia" AND "emergency care"

Manual searches were also conducted by screening the references of selected articles to identify additional studies that may have been missed during the initial search.

The inclusion and exclusion criteria were developed to ensure that only studies directly relevant to the EMS system in Indonesia, or those that offered meaningful comparisons to other global EMS systems, were selected for review.

#### Inclusion Criteria

- Study Focus: Articles must specifically discuss the EMS system, pre-hospital care, or emergency response in Indonesia. Articles that include global comparisons and lessons that can be applied to Indonesia were also considered.
- Study Type: Peer-reviewed research articles, government reports, policy briefs, and reviews that provide empirical data or in-depth analysis of EMS systems. Studies discussing innovations in EMS, such as digital health applications or community paramedicine, were also included.
- Publication Date: Articles published between 2013 and 2024 to ensure the relevance of the findings to the current EMS landscape in Indonesia.
- Language: Articles published in English and Bahasa Indonesia were included.
- Study Design: Qualitative studies, quantitative studies, mixed-method research, case studies, program evaluations, and systematic reviews were all eligible for inclusion.

#### Exclusion Criteria

- Studies that were not peer-reviewed, such as opinion pieces, editorials, or anecdotal reports.
- Articles that focused exclusively on EMS in countries other than Indonesia without providing a regional or comparative analysis.
- Studies that did not focus on the healthcare sector or EMS-related outcomes (e.g., purely logistical or technical assessments without healthcare implications).
- Conference abstracts, as they often lack the detail required for systematic analysis.

#### Screening and Selection

The study selection process involved three stages: title screening, abstract screening, and full-text review.

1. Title Screening: All identified articles were first screened by their titles to ensure relevance to the EMS system. Articles that were clearly unrelated to EMS in Indonesia or did not meet the basic inclusion criteria were excluded at this stage.
2. Abstract Screening: For the remaining studies, the abstracts were reviewed in detail to confirm the study's focus on EMS systems, pre-hospital care, or disaster management in Indonesia. Any study that appeared to meet the eligibility criteria proceeded to the next stage.
3. Full-Text Review: The full text of the selected articles was retrieved and thoroughly reviewed to ensure that they met all the inclusion criteria. Any discrepancies regarding inclusion were resolved through discussion among the reviewers until consensus was reached.
4. Data Extraction

Once the studies were selected, data extraction was performed using a standardized data collection form developed specifically for this review. The following key information was extracted from each study:

- Study Information: Author(s), year of publication, study location, and journal.

- Study Design and Methods: Type of study (e.g., qualitative, quantitative, mixed methods), sample size, data collection methods, and analytical techniques.
- EMS System Description: Overview of the EMS system described, including the structure, governance, and operational protocols in place.
- Key Findings: Major findings related to the performance of the EMS system, such as response times, patient outcomes, training levels of EMS personnel, and the adequacy of equipment.
- Challenges and Barriers: Identified obstacles to effective EMS delivery, including geographic, financial, human resource, and infrastructural barriers.
- Opportunities for Improvement: Recommendations offered by the study for strengthening EMS systems, such as policy changes, technological innovations, or increased funding for training programs.
- Comparative Elements: If the study included comparisons between Indonesia's EMS system and other global systems, these comparisons were also noted.

The extracted data were then categorized into thematic groups for analysis. To ensure the reliability and validity of the included studies, a quality assessment was conducted using the following criteria:

- Study Rigor: Evaluation of the research design, sampling methods, data collection, and analytical techniques to determine the rigor of the study.
- Relevance: Assessment of the relevance of the study's findings to the EMS system in Indonesia, including applicability to policy and practice.
- Bias: Identification of any potential biases in study design or reporting, and assessment of how these biases might affect the study's findings.
- Reporting Clarity: Evaluation of how clearly the study's objectives, methods, and findings were reported.

Each study was graded on a scale of low, medium, or high quality based on these criteria. Only studies rated as medium or high quality were included in the final synthesis.

After data extraction and quality assessment, a narrative synthesis was conducted to combine and interpret the findings from the selected studies. A thematic analysis was used to organize the findings into key areas:

1. Current Structure and Performance of EMS in Indonesia: This theme focused on describing the structure of Indonesia's EMS system, including key actors, service delivery models, and operational characteristics.
2. Challenges in EMS Delivery: This theme explored the barriers to effective EMS in Indonesia, particularly in terms of geographic disparities, human resources, funding, and public awareness.
3. Opportunities for Strengthening EMS: This theme synthesized recommendations from the literature on improving EMS systems, with a particular focus on policy reform, digital innovations, training, and public education.

Quantitative data were analyzed descriptively, summarizing key metrics such as response times, patient outcomes, and EMS coverage. Qualitative findings were integrated into the analysis to provide a deeper understanding of the systemic challenges and potential solutions.

Since this study involved the review of existing literature and did not involve human subjects, formal ethical approval was not required. However, the ethical standards of systematic review methodology were followed, including transparency in reporting and acknowledging all sources of data. While this review provides a comprehensive overview of the EMS system in Indonesia, several limitations should be noted. First, the inclusion of only studies published between 2013 and 2024 may have excluded older yet relevant studies that could have provided additional insights. Second, the reliance on English and Bahasa Indonesia studies may have led to the exclusion of relevant articles published in other languages. Finally, the variability in study quality and methodology made it challenging to directly compare findings across studies. These limitations were considered when drawing conclusions and making recommendations.

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## Result

This section presents the findings from the selected studies and articles, organized by themes that emerged during the data synthesis. The results provide a detailed examination of the current state of the Emergency Medical Services (EMS) system in Indonesia, including its structure, performance, challenges, and areas of potential improvement. The findings are drawn from a total of 45 studies that met the inclusion criteria after screening 153 articles. These studies covered various aspects of EMS systems, from pre-hospital care delivery to disaster response and the integration of digital health technologies. The Indonesian EMS system is characterized by a mixture of public and private providers, with government hospitals and private health institutions playing critical roles. Public EMS services are mainly coordinated through government hospitals, local health centers (Puskesmas), and regional health offices, while private EMS providers are usually linked to private hospitals and clinics. In urban areas like Jakarta, Surabaya, and Bandung, EMS is relatively more developed, with government-supported emergency response systems such as the Jakarta 112 emergency hotline, providing centralized coordination for ambulance dispatch.<sup>9</sup>

Private providers play a significant role in supplementing EMS, especially in urban areas where demand for emergency services often exceeds public sector capacity. However, in rural and remote regions, reliance on private providers is less feasible due to limited availability and high costs. Studies

indicate that approximately 65% of EMS services in Indonesia are hospital-based, primarily in urban centers, with 35% being operated by private or community initiatives. The introduction of SIJANTAR (Sistem Informasi dan Jaringan Terpadu Ambulans dan Emergency Response) marked a key effort by the government to centralize and improve EMS coordination across Indonesia. SIJANTAR functions as an integrated information and ambulance network designed to streamline emergency response by connecting various EMS providers and dispatch services. While SIJANTAR has been successful in improving coordination in large metropolitan areas, studies show that its implementation remains limited in smaller cities and rural areas, where connectivity and infrastructure pose significant barriers. Data from urban centers suggest that SIJANTAR has contributed to improved response times, reducing delays in ambulance dispatch and pre-hospital care delivery. However, response times in rural areas continue to be a challenge due to the lack of centralized coordination and geographic difficulties. For example, one study noted that EMS response times in urban Jakarta averaged 15-20 minutes, while in rural provinces such as West Papua and East Nusa Tenggara, response times could exceed 60 minutes, depending on the terrain and distance from the nearest healthcare facility.<sup>10</sup>

A critical issue identified across studies is the shortage of adequately trained emergency care personnel. Pre-hospital care in Indonesia remains largely underdeveloped, with a significant gap between urban and rural regions. Paramedics and emergency medical technicians (EMTs) in Indonesia are often inadequately trained, with many lacking formal certification in Basic Life Support (BLS) or Advanced Life Support (ALS). According to a recent evaluation of paramedic training programs in Indonesia, only 40% of ambulance staff in urban areas have undergone formal ALS training, while in rural areas, this figure drops to 10-15%. This lack of standardized training and certification hinders the effectiveness of pre-hospital care, especially in critical emergencies such as cardiac arrests, trauma, and strokes.<sup>3,11</sup>

Several studies emphasized the need for expanded education and certification programs to build workforce capacity. Recommendations include government support for paramedic schools and increased access to continuing education for EMS personnel. One successful initiative has been the establishment of short-term training programs in collaboration with international partners such as the American Heart Association (AHA), which has contributed to an increase in BLS-certified staff in some regions. Many ambulances in Indonesia function as basic transport vehicles rather than fully equipped mobile medical units. Studies revealed that ambulances in rural and remote regions are often under-equipped, lacking critical lifesaving equipment such as defibrillators, oxygen tanks, and advanced monitoring devices. One study reported that only 25% of ambulances in rural areas were equipped with ALS-capable equipment, compared to 80% of ambulances in urban centers.<sup>12</sup>

Additionally, the fleet of ambulances in Indonesia is aging, with some vehicles being over a decade old and prone to mechanical failures. This disparity between urban and rural ambulance services contributes to delays in care, particularly in remote areas where healthcare facilities are sparse. Studies emphasize the need for investment in modernizing the ambulance fleet and ensuring that all vehicles are equipped with basic and advanced medical equipment. Public awareness and understanding of EMS services in Indonesia are generally low. Several studies highlighted that many Indonesians are unfamiliar with the concept of calling for an ambulance in an emergency, often opting to use taxis, motorbikes, or private cars to transport patients to hospitals. This results in significant delays in receiving appropriate pre-hospital care, particularly for time-sensitive conditions. One study surveying emergency room admissions across three hospitals in Jakarta found that 45% of patients arrived at the hospital via private vehicles rather than ambulances. A lack of public trust in the EMS system, coupled with concerns about the cost of ambulance services, further discourages utilization. For example, in some rural areas, ambulance services are perceived as expensive, and there is a cultural tendency to rely on informal community transport networks.<sup>13</sup>

Access to EMS services is particularly limited in rural and remote regions due to both geographic and infrastructural barriers. For instance, Indonesia's archipelagic nature creates significant challenges in reaching remote islands where road infrastructure is inadequate. One study reported that in the Mentawai Islands, emergency response could take over six hours, depending on the availability of boats or helicopters for patient transport. The lack of roads, combined with minimal healthcare facilities, exacerbates delays in care, leading to poorer outcomes in emergency cases. Given Indonesia's vulnerability to natural disasters such as earthquakes, tsunamis, and volcanic eruptions, the role of EMS in disaster management is critical. Studies indicate that the National Disaster Management Agency (BNPB) has made significant strides in improving disaster preparedness, including the establishment of emergency command centers and the deployment of rapid response teams.<sup>13,14</sup>

However, EMS capacity during disasters remains a concern, particularly in terms of coordination, resource allocation, and personnel training. For example, the 2018 Palu earthquake and tsunami revealed critical gaps in EMS disaster response, including shortages of medical supplies, overwhelmed local hospitals, and communication breakdowns between agencies. Post-disaster evaluations showed that many EMS personnel lacked specialized training in disaster medicine, which hindered their ability to provide effective care during large-scale emergencies. Telemedicine and mobile health technologies have emerged as promising solutions to bridge the gaps in EMS, especially in remote areas. Studies report that telemedicine platforms are being piloted in some rural provinces, allowing paramedics to consult with specialists in real-time during emergencies. These innovations have shown promise in improving pre-hospital care, particularly in regions where access to specialized healthcare is limited. However, telemedicine infrastructure remains underdeveloped in much of Indonesia. Only 15% of rural health centers reported having access to reliable internet connections necessary for telemedicine platforms, and many paramedics lack training in the use of such technology.<sup>13,15</sup>

#### Key Challenges and Opportunities for Improvement

##### Challenges

- Geographic and Infrastructural Barriers: Indonesia's vast and diverse geography presents significant challenges in ensuring equitable access to EMS across the archipelago.

- **Workforce Shortages:** The lack of trained EMS personnel, particularly those with ALS certification, hinders the ability to provide high-quality pre-hospital care, especially in rural areas.
- **Inconsistent Funding:** Inadequate and inconsistent funding for EMS services, especially in underdeveloped regions, leads to disparities in care quality and resource allocation.
- **Public Awareness:** Low levels of public awareness and trust in the EMS system result in underutilization of ambulance services, which delays emergency care.

#### Opportunities

- **Expansion of Training Programs:** Investment in paramedic training and certification programs, including BLS and ALS, could significantly improve workforce capacity and the quality of pre-hospital care.
- **Digital Health Integration:** Strengthening telemedicine and mobile health solutions could improve access to emergency care, particularly in remote and underserved regions.
- **Policy and Infrastructure Development:** Developing standardized national EMS protocols and improving infrastructure, including modernizing the ambulance fleet, can address some of the systemic issues in the EMS network.
- **Public Education Campaigns:** Increasing public education on the importance of utilizing EMS services and emergency hotlines could improve response times and patient outcomes.

The findings from this systematic review highlight both the progress and ongoing challenges faced by Indonesia's EMS system. While urban centers have seen improvements in ambulance coordination and response times, rural and remote regions continue to struggle with access to timely and appropriate care due to geographic, infrastructural, and workforce limitations. The review underscores the need for continued investment in training, infrastructure, and public education to build a more robust and equitable EMS system across Indonesia. Further research and policy reforms are necessary to ensure that all Indonesians, regardless of location, can access the critical emergency services they need.

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## Discussion

The discussion section of this systematic review focuses on interpreting the key findings of the Emergency Medical Services (EMS) system in Indonesia and their implications. It also compares these findings with global EMS systems, explores the challenges and opportunities identified, and provides recommendations for strengthening Indonesia's EMS system. Finally, this section discusses the limitations of the review and suggests areas for future research.

### 1. Interpretation of Key Findings

The results of this systematic review demonstrate that Indonesia's EMS system has made significant strides, particularly in urban areas, but still faces substantial challenges, especially in rural and remote regions. These challenges are common in developing countries with vast geographical areas and diverse populations.

#### 1.1. Urban-Rural Divide in EMS Accessibility

The most glaring issue identified is the disparity between urban and rural access to EMS services. This divide reflects broader systemic issues within Indonesia's healthcare infrastructure, where rural areas often lack the resources, trained personnel, and equipment needed for effective emergency care. Urban areas like Jakarta, Surabaya, and Bandung have benefited from improved coordination and infrastructure through systems like SIJANTAR, yet these advancements have not been extended to rural areas.<sup>16</sup>

This divide is not unique to Indonesia. Similar challenges have been observed in other developing countries such as India and Nigeria, where EMS systems struggle to meet the needs of rural populations due to geographic isolation, limited infrastructure, and workforce shortages. In contrast, high-income countries such as the United States, Canada, and the United Kingdom have developed more integrated EMS networks that utilize telemedicine, air ambulances, and robust training programs to mitigate rural access issues. For Indonesia, the key to addressing this divide lies in expanding infrastructure and training initiatives in rural areas, as well as utilizing technology to bridge gaps in access.<sup>15</sup>

#### 1.2. Workforce Shortages and Training Gaps

A significant issue revealed in the review is the shortage of trained EMS personnel, particularly those with advanced certifications in Basic Life Support (BLS) and Advanced Life Support (ALS). Studies consistently indicated that the lack of standardized training programs, particularly in rural areas, hinders the capacity of the EMS system to deliver high-quality pre-hospital care. In many cases, ambulance personnel are limited in their ability to provide critical care, which results in poorer outcomes for emergency patients, especially those experiencing life-threatening conditions such as cardiac arrest or severe trauma. Comparing Indonesia's EMS workforce development to global standards, the shortage of adequately trained EMS personnel is a common issue in low- and middle-income countries. For example, a study on EMS in South Africa also highlighted a lack of formal paramedic training and certification, leading to gaps in pre-hospital care. On the other hand, high-income countries like Germany and Australia have well-established EMS education and

certification programs, which include mandatory continuing education and frequent re-certification. Implementing such programs in Indonesia could have a transformative impact on the quality of emergency care provided nationwide.<sup>17</sup>

## 2. Comparison with Global EMS Systems

Indonesia's EMS system is still in its developmental stage, particularly when compared to more established EMS systems in high-income countries. One of the critical differences between Indonesia and countries like the United States or the United Kingdom is the level of centralization and standardization in EMS protocols. In these countries, national EMS systems operate under a unified framework with standardized training, protocols, and response guidelines.<sup>13</sup>

### 2.1. Centralized Coordination

Countries with successful EMS systems, such as Germany and the UK, have centralized coordination that facilitates faster response times and more efficient use of resources. The UK, for instance, operates a fully centralized EMS system under the National Health Service (NHS), which ensures that every region, including rural and remote areas, is integrated into a unified emergency response framework. In contrast, Indonesia's EMS system is still fragmented, with significant regional variation in the quality of services provided.<sup>7,8</sup>

While SIJANTAR has made strides toward centralizing emergency response coordination in urban areas, its reach is still limited. Extending centralized systems like SIJANTAR to rural areas could lead to more efficient resource allocation and improved response times. Additionally, lessons from Japan's EMS system, which employs real-time data tracking and monitoring to optimize ambulance dispatch, could be applied to Indonesia to enhance the efficiency of pre-hospital care delivery.<sup>8</sup>

### 2.2. Disaster Response Capabilities

Indonesia, given its location on the Pacific Ring of Fire, faces unique challenges in disaster response due to its frequent exposure to natural disasters such as earthquakes, tsunamis, and volcanic eruptions. The role of EMS in disaster management is critical, yet the review found that Indonesia's EMS system often struggles to meet the demands of large-scale disasters. This is due to a combination of inadequate training, resource shortages, and poor coordination between EMS providers and disaster response agencies. Countries like Japan and Chile, which also face high disaster risks, have developed specialized disaster response EMS teams with advanced training in disaster medicine. These teams are equipped to provide rapid medical response in the aftermath of disasters and are integrated into national disaster preparedness frameworks. Indonesia could benefit from establishing similar specialized EMS units, particularly in regions most vulnerable to natural disasters, and ensuring that these units are well-equipped and trained to handle large-scale emergencies.<sup>18</sup>

## 3. Challenges and Barriers to EMS System Development

### 3.1. Geographic and Infrastructure Challenges

Indonesia's archipelagic geography presents one of the most significant barriers to developing a fully integrated EMS system. Many rural and remote areas are difficult to access, with limited road infrastructure and significant distances between healthcare facilities. These geographic challenges are compounded by the lack of adequately equipped ambulances and trained personnel in rural regions. Infrastructure issues are particularly evident in the eastern provinces of Indonesia, where mountainous terrain and remote islands make it difficult to establish efficient emergency response networks. The review found that in some of these areas, response times could exceed several hours, which severely impacts patient outcomes. These geographic challenges are similar to those faced by countries like the Philippines, which also has a dispersed archipelagic geography. Solutions implemented in the Philippines, such as utilizing air ambulances and maritime emergency response units, could potentially be adapted for Indonesia to improve access to EMS in remote areas.<sup>18,19</sup>

### 3.2. Inconsistent Funding and Resource Allocation

Inconsistent funding was identified as another significant barrier to the development of Indonesia's EMS system. Studies consistently pointed to a lack of adequate financial resources for purchasing medical equipment, maintaining ambulance fleets, and training EMS personnel. Funding disparities between urban and rural areas exacerbate existing inequalities in healthcare access and contribute to the uneven quality of EMS services.

International comparisons show that countries with successful EMS systems often rely on consistent and substantial government funding to maintain high standards of care. In the United States, for example, EMS is typically funded through a combination of federal, state, and local sources, along with reimbursement from insurance providers. In contrast, Indonesia's EMS system depends largely on limited regional budgets, with rural areas receiving far less financial support than urban centers. Addressing these funding disparities will be crucial for ensuring that all regions of Indonesia have access to high-quality emergency care.

## 4. Opportunities for Improvement

Despite the challenges, the review identified several opportunities for strengthening Indonesia's EMS system. These opportunities are centered around workforce development, infrastructure expansion, and the integration of digital health technologies.

### 4.1. Expanding Training and Certification Programs

Expanding training and certification programs for EMS personnel is one of the most critical steps toward improving the quality of pre-hospital care in Indonesia. Establishing more paramedic schools, particularly in rural areas, and creating standardized training protocols could help bridge the gap between urban and rural emergency care. Additionally, partnerships with international organizations, such as the American Heart Association (AHA), could provide Indonesian EMS personnel with access to advanced training in BLS and ALS. Countries like Thailand and Malaysia have successfully implemented nationwide paramedic training programs that emphasize continuous education and re-certification. By adopting a similar approach, Indonesia could build a more skilled EMS workforce capable of delivering high-quality care across the archipelago.

#### 4.2. Telemedicine and Mobile Health Technologies

Telemedicine and mobile health technologies represent a significant opportunity for improving EMS in remote regions of Indonesia. By leveraging digital health platforms, paramedics in rural areas can consult with specialists in real-time, enabling them to deliver more accurate and timely care. Although telemedicine is still in its infancy in Indonesia, early pilot projects have shown promise in improving pre-hospital care outcomes. Countries like Australia and Canada, with vast rural areas, have successfully integrated telemedicine into their EMS systems. These countries provide valuable models for Indonesia as it seeks to expand telemedicine infrastructure. Scaling up telemedicine in Indonesia would require investment in internet connectivity, particularly in remote regions, as well as training EMS personnel in the use of digital health tools.<sup>20</sup>

#### 5. Recommendations for Policy and Practice

Based on the findings of this review, several recommendations are proposed to strengthen the EMS system in Indonesia:

- Standardize Training and Certification: Develop nationwide certification standards for EMS personnel, focusing on BLS and ALS training. Expand paramedic schools and continuing education programs, particularly in rural areas.
- Increase Public Awareness: Implement public education campaigns to raise awareness about the importance of utilizing EMS services during emergencies, including how to access ambulance services and the role of pre-hospital care in improving outcomes.
- Improve Infrastructure and Equipment: Invest in modernizing the ambulance fleet and ensuring that all ambulances are equipped with advanced medical equipment. Expand EMS infrastructure in rural and remote areas to reduce response times and improve patient outcomes.
- Expand Telemedicine: Promote the adoption of telemedicine and mobile health technologies, particularly in rural regions, to improve access to specialized care during emergencies.
- Strengthen Disaster Preparedness: Establish specialized EMS disaster response units with advanced training in disaster medicine. Integrate these units into national disaster management frameworks to ensure a rapid and coordinated response to natural disasters.<sup>19,20</sup>

#### Conclusion

This systematic review provides a comprehensive overview of Indonesia's EMS system, identifying both its progress and ongoing challenges. The findings indicate that while urban areas have benefited from improved coordination and infrastructure, rural and remote regions continue to face significant barriers to accessing timely and effective emergency care. The shortage of trained EMS personnel, inadequate infrastructure, and limited public awareness are critical issues that must be addressed to improve the overall quality and accessibility of EMS services in Indonesia.

International comparisons suggest that Indonesia can learn valuable lessons from other countries' EMS systems, particularly in the areas of centralized coordination, workforce development, and disaster preparedness. Expanding training programs, modernizing ambulance fleets, and leveraging digital health technologies represent significant opportunities for improvement. To achieve a more equitable and robust EMS system, Indonesia must invest in infrastructure, policy reforms, and public education, ensuring that all Indonesians, regardless of location, can access lifesaving emergency services. As the country continues to develop its EMS system, further research is essential to guide evidence-based policies and practices that will strengthen emergency medical care across the archipelago.

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