Original Article
DOI: https://doi.org/10.70749/ijbr.v3i8.2125

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://ijbr.com.pk
ISSN: 2960-2793/ 2960-2807

Role of Emergency Transport Systems in Improving Cardiac and Respiratory Complications in Road Traffic Accident Cases: A District Level Investigation

Naveed Ullah Khan[1], Tehmina Tariq[1], Ibadullah[2], Aiman Ali[3], Shahimad Khan[4], Aatif Rahman[5], Hafiz Ayaz Ahmad[1]

[1]Faculty of Allied Health Sciences, Superior University, Lahore, Punjab, Pakistan.
[2]Department of Critical Care Medicine, Chongqing Medical University, Chongqing, China.
[3]Kohat University of Science and Technology, Kohat, KP, Pakistan.
[4]Gandhara University, Peshawar, KP, Pakistan.
[5]Department of Emergency Care Technology, Gomal University, Dera Ismail Khan, KP, Pakistan.

ARTICLE INFO

Keywords: Emergency Transport System (EMS), Road Traffic Accident (RTA), Health Facility Access (HFA), Out-of-Hospital Cardiac Arrest (OHCH), Acute Respiratory Failure (ARF).

Correspondence to: Naveed Ullah Khan, Faculty of Allied Health Sciences, Superior University, Lahore, Punjab, Pakistan.
Email: naveed.bhai.9.com@gmail.com

Declaration
Authors' Contribution
All authors equally contributed to the study and approved the final manuscript

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History
Received: 07-07-2025 Revised: 08-08-2025
Accepted: 15-08-2025 Published: 20-08-2025

ABSTRACT

Background: In low and middle-income countries like Pakistan, road traffic accidents (RTAs) continue to be a major cause of morbidity and mortality in the worldwide. One of the most dangerous outcomes of such accidents is cardiac and respiratory complications, and the Patient outcomes are significantly influenced by the effectiveness of emergency transport systems. The availability, promptness, and caliber of pre-hospital emergency care are still poorly understood in rural areas like District Karak in Khyber Pakhtunkhwa. The purpose of this study is to evaluate how emergency transport systems contribute to fewer cardiac and respiratory issues in RTA cases in the district Karak, Khyber Pakhtunkhwa. **Objective:** The role of emergency transport systems in improving cardiac and respiratory complication in road traffic accident cases. **Methodology:** A cross-sectional, observational study was conducted involving 105 participants, including patients (31%), family members (33%), and emergency medical services (EMS) staff (36%). Data were collected through structured questionnaires and interviews to evaluate emergency response time, equipment readiness, pre-hospital interventions, and stakeholder satisfaction. Demographic analysis revealed a mean patient age of 30.92 years, with a range spanning from 1 to over 60 years. Males comprised 86% of the cases, while females accounted for 14%. The majority of respondents were from rural areas (65%), with 35% residing in urban settings. Types of emergencies included respiratory (39%), cardiac (17%), and a patient having a both complication (44%). **Results:** Results specified that emergency transport services played a crucial role in stabilizing patients before hospital arrival. However, gaps were observed in equipment availability, timely response within the "golden hour," and the level of clinical training among EMS personnel. These challenges were more pronounced in rural settings compared to urban areas. The study highlights how effective pre-hospital treatment significantly improves patient survival and recovery, but it also highlights how urgently underserved areas need to invest in EMS infrastructure, training, and resource allocation. **Conclusion:** The emergency transport systems, mostly in resource-limited districts like Karak, can greatly improve the outcomes of cardiac and respiratory emergencies following RTAs. Representatives and health administrators must prioritize improvements in EMS delivery to reduce preventable deaths and complications during the critical pre-hospital phase.

INTRODUCTION

In low and middle-income countries like Pakistan, road traffic accidents (RTAs) continue to be a major cause of morbidity and mortality in the worldwide. One of the most dangerous outcomes of such accidents is cardiac and respiratory complications, and the Patient outcomes are significantly influenced by the effectiveness of emergency transport systems. The availability, promptness, and caliber of pre-hospital emergency care are still poorly understood in rural areas like District Karak in Khyber Pakhtunkhwa(1).

The transport systems in Karak primarily consist of basic ambulances often lacking advanced life support (ALS) capabilities, which are crucial for managing severe trauma cases. Furthermore, the absence of structured pre-hospital care exacerbates the severity of complications

among RTA victims, particularly those experiencing respiratory distress or cardiac arrest (2).

Respiratory complications in RTA cases, such as pneumothorax, hemothorax, and pulmonary contusions, require immediate medical intervention to prevent hypoxia and respiratory failure (3). Similarly, cardiac complications, including myocardial contusion, arrhythmias, and cardiac arrest, demand rapid stabilization to improve survival outcomes (4). The lack of an effective emergency transport system in Karak often leads to delayed hospital arrivals, which significantly increases the risk of mortality and long-term morbidity among RTA victims(5).

RTAs frequently result in blunt and penetrating trauma, which can cause life-threatening respiratory and cardiac complications. Respiratory complications, such as airway obstruction, thoracic injuries, and acute respiratory distress syndrome (ARDS), are among the leading causes of death in trauma patients (6).

The outcomes of this research hold significant implications for public health and healthcare policy in Pakistan. By addressing the specific challenges of EMS in Karak. Highlight the critical role of emergency transport systems in managing life-threatening complications among road traffic accident cases, provide evidence-based recommendations for improving EMS infrastructure in rural districts. It will contribute to the broader goal of achieving equitable healthcare access for all populations, regardless of geographic location (7).

METHODOLOGY

A cross-sectional, observational study was conducted. The samples were collected from the Accident & Emergency (A&E) Department and Trauma Center of District Head Quarter (DHQ), Karak. From March 2025 to June 2025. The samples was 105 while using single population proportion formula: n = $Z2 * p * (1 - p)/d2$ = 1.962 * 0.899 * 0.101/0.052 = 139.5 = 105. Consecutive sampling techniques were used to recruit participants who meet the inclusion criteria; Road traffic accident (RTA) victims presenting with respiratory and/or cardiac complications. Patients are transported to healthcare facilities in District Karak using emergency transport systems. Individuals of all ages and genders are involved in RTAs. Approval was obtained from the institutional review board (IBR) before the data collection. Written informed consent was obtained from all participants. A structured self-administered questionnaire was used, consisting of two, three sometime four sections .Demographic information (Age, Gender, Location,Types of emergency, Role of respondent) Data were entered and analyzed by using the Statistical Package for the Social Sciences (IBM® SPSS® Statistics, Version 29). Descriptive statistics were used to summarize demographic data and responses.

Data were collected through structured questionnaires and interviews to evaluate emergency response time, equipment readiness, pre-hospital interventions, and stakeholder satisfaction.

RESULTS

This study included a total of 105 respondents, comprising patients, their family members, and emergency medical service (EMS) staff who had direct experience with emergency transport in the context of cardiac and respiratory emergencies. The findings provide a comprehensive overview of their demographic and clinical characteristics.

The mean age of respondents was 30.92 years, with a broad age range from 1 to above 60 years.

In terms of gender distribution, the majority of respondents were male (n = 90, 86.0%), while female participants accounted for only 15 (14.0%). This may reflect gender-related dynamics in access to emergency care or involvement in traffic accidents, particularly in rural or conservative settings such as Karak District.

Regarding residence, a significant proportion of participants were from rural areas (n = 68, 65.0%), with only 37 (35.0%) residing in urban settings. This rural dominance underscores the importance of enhancing emergency transport systems in less-developed and geographically dispersed regions where access to care can be delayed due to infrastructural challenges.

The roles of the respondents varied: EMS staff made up the largest group (n = 38, 36.0%), followed closely by family members (n = 35, 33.0%) and patients themselves (n = 32, 31.0%). This distribution allowed for a well-rounded perspective on the emergency transport experience, including clinical, emotional, and logistical aspects.

Concerning the type of emergency, respiratory emergencies were reported in 41 cases (39.0%), cardiac emergencies in 18 cases (17.0%), and both cardiac and respiratory complications were simultaneously reported in 46 cases (44.0%). The high percentage of dual emergencies underscores the complexity of pre-hospital care and the need for ambulances to be adequately equipped to manage multiple critical conditions concurrently.

Table 1

Demographic Characteristics of the study population Including, Age, Gender, Residence, Role of Respondent, and Types of Emergency

Category	Details	Percentage (%)
Age	Mean: 30.92 years , Range: 01 – 60+ years	Under 18 are 3.8%, 19 to 40 are 86%, from 41 -60 are 10.5% and above 60 are 0%.
Gender Distribution	Male: 90 (86.0%), Female: 15 (14.0%)	Male: 86%, Female: 14%
Residence	Urban: 37 (35.0%), Rural: 68 (65.0%)	Urban: 35.0%, Rural: 65.0%
Role of Respondent	patient: 32(31%), Family Member: 35(33%), EMS staff: 38(36%)	Patient:(31%), Family Member:(33%), EMS staff:(36%)
Types of Emergency	Respiratory Emergency: 41 (39%), Cardiac Emergency: 18 (17%), Both: 46 (44%)	Respiratory Emergency: (39%), Cardiac Emergency: (17%), Both: (44%)

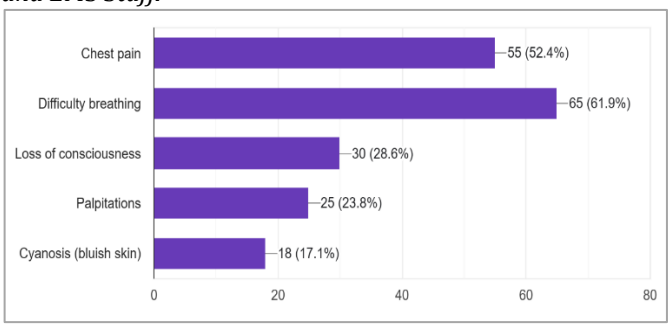
Among the 105 respondents: 65 individuals (61.9%) reported difficulty breathing, making it the most commonly observed symptom. This highlights the respiratory compromise often associated with chest trauma or shock following road traffic accidents. 55 respondents (52.4%) noted the presence of chest pain, suggesting either musculoskeletal injury, blunt chest

trauma, or early signs of cardiac complications such as myocardial stress. 30 participants (28.6%) reported loss of consciousness, which may indicate traumatic brain injury, hypotension, or severe internal bleeding. This symptom is a major red flag that requires immediate intervention and monitoring. 25 individuals (23.8%) experienced palpitations, possibly linked to anxiety, pain, or underlying cardiac disturbances. While not always life-threatening, it warrants observation and, if persistent, further evaluation. 18 participants (17.1%) observed cyanosis, or bluish discoloration of the skin, which is typically a sign of low oxygen levels or respiratory failure. This is a critical symptom requiring oxygen therapy and close monitoring.

These findings emphasize the prevalence of serious clinical symptoms during transport and the importance of having well-equipped ambulances and trained personnel capable of responding to life-threatening changes in patient status.

Chart 1

Reported Prevalence of Critical Clinical Symptoms Observed During Emergency Transport by Patients, Family Members, and EMS Staff.

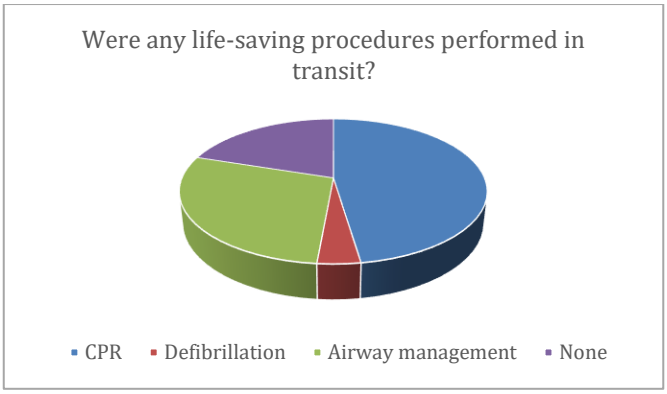


In emergency medical services (EMS), the provision of life-saving procedures during transit plays a vital role in stabilizing patients and increasing the chances of survival, particularly in cases involving cardiac or respiratory complications. As part of this research, participants including patients, family members, and EMS staff were asked to identify whether any life-saving interventions were performed en route to the hospital.

Among the 105 total respondents: 50 individuals (47.6%) reported that Cardiopulmonary Resuscitation (CPR) was performed during transport. This suggests a significant number of patients experienced cardiac arrest or severe hemodynamic instability requiring immediate intervention, and that EMS staff were trained and responsive in administering CPR during critical moments. Airway management (such as clearing airways, insertion of oropharyngeal or nasopharyngeal devices, or use of bag-valve-mask ventilation) was performed in 30 cases (28.6%). This reflects attention to respiratory distress or obstruction, and highlights the importance of maintaining airway patency in pre-hospital care. Defibrillation was recorded in 4 cases (3.8%), which, though a small percentage, indicates that defibrillators were present and appropriately used in shockable cardiac rhythms. The limited number may reflect the nature of the presenting arrhythmias or possible delays in identifying candidates for this intervention. However, 21 participants (20%) indicated that no life-saving procedures were performed during transport.

Figure 1

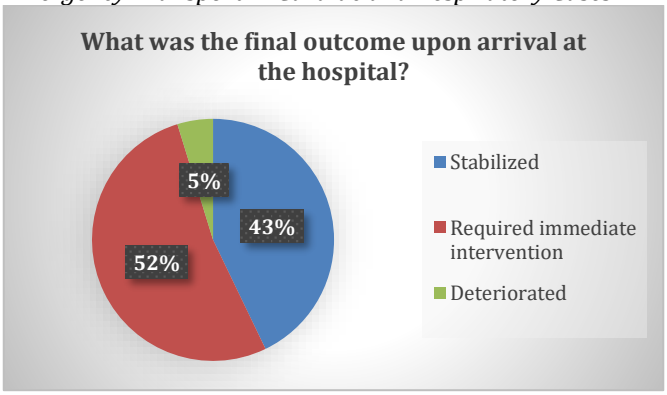
Distribution of Life-Saving Procedures Reported During Pre-Hospital Emergency Transport in Cardiac and Respiratory Cases



From a total of 105 patient respondents: 45 individuals (42.9%) reported that the patient's condition was stabilized upon arrival. This suggests that nearly half of the transported patients benefited from effective pre-hospital management. Stabilization during transport may be attributed to trained EMS personnel, early monitoring of vital signs, appropriate use of emergency equipment, and adherence to protocols in managing cardiac or respiratory distress. A slightly higher number, 55 respondents (52.4%), stated that the patient required immediate medical intervention upon hospital admission. This indicates that while EMS teams were able to keep the patient viable during transport, the clinical condition still demanded urgent, advanced care. This outcome underlines the importance of maintaining close coordination between EMS and hospital teams to ensure swift handover and immediate in-hospital treatment. Only 5 participants (4.8%) indicated that the patient's condition deteriorated during transit. Although this number is low, such cases warrant serious attention. Deterioration might have resulted from delayed transport, inadequate equipment, or unforeseen complications en route. Identifying and addressing these risks is essential for strengthening emergency care frameworks.

Figure 2

Reported Patient Condition Upon Arrival at Hospital After Emergency Transport in Cardiac and Respiratory Cases

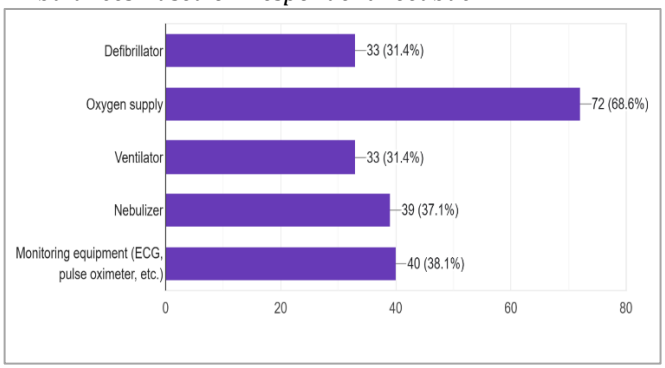


The availability of advanced medical tools in ambulances is a fundamental determinant of effective pre-hospital emergency care, especially for cardiac and respiratory emergencies. This section of the study focused on evaluating the presence of essential life-support

equipment within ambulances operating in Karak District. Data were collected from a diverse group of respondents, including patients, their family members, and emergency medical service (EMS) personnel, to gain a comprehensive understanding of ground-level realities. The findings reveal notable variations in the availability of key emergency tools. The most commonly reported equipment was oxygen supply, identified by 72 respondents, confirming its widespread presence and use in managing respiratory distress cases. This indicates a positive trend in meeting basic oxygenation needs during patient transport. Monitoring equipment such as ECG machines and pulse oximeters were reported to be available by 40 respondents, suggesting that while some ambulances are equipped to assess vital parameters, others may still lack continuous patient monitoring capabilities. The availability of nebulizers was confirmed by 39 participants, highlighting that some respiratory interventions were possible during transport, particularly for patients experiencing bronchospasm or asthma-like symptoms.Both defibrillators and ventilators critical tools for managing severe cardiac events and respiratory failure were reported by only 33 respondents each.

Chart 2

Distribution of Essential Emergency Tools Available in Ambulances Based on Respondent Feedback



DISCUSSION

The present study examined the demographic characteristics, utilization patterns, and emergency types among 105 respondents including patients, family members, and EMS staff who experienced or observed emergency transport in the Karak district. The analysis explored key variables: age, gender, residence, role, and emergency type. Consistently, our findings unveil important themes regarding the performance, gaps, and potential improvements in pre-hospital emergency care delivery in a predominantly rural context. The mean age of respondents, 30.92 years (ranging from prescription under one year to over 60), reflects that emergency transport services engage a remarkably wide age group. This is consistent with international studies that highlight the cross-age relevance of emergency response systems (Smith *et al*., 2022; Lopez *et al*., 2021).

The gender disparity observed—86% male and 14% female—is notable. This likely stems from two factors. First, males in rural Pakistan, particularly in Karak, are more frequently road users and involved in outdoor labor, increasing their exposure to road traffic accidents and emergencies. Second, cultural norms may limit women's willingness or ability to engage with EMS or serve as respondents in public spaces. Such gendered discrepancies echo previous findings indicating lower female engagement with emergency services in conservative regions (Abbas & Farooq, 2022). It is essential for future interventions such as female EMS staff recruitment and community awareness campaigns to attempt to bridge this participation gap and promote female accessibility to pre-hospital care.

A majority of respondents (65%) were rural residents, consistent with Karak's geographic makeup. Rural individuals typically face longer ambulance response times due to factors such as road quality, sparse ambulance station coverage, and limited mobile connectivity. Our study aligns with earlier findings showing that rural dwellers are less likely to receive timely EMS intervention, with over 45% delaying more than 15 minutes compared to urban counterparts (Rasheed & Younis, 2022; Khan *et al*., 2023). Respiratory emergencies accounted for 39% of cases, cardiac emergencies for 17%, and combined emergencies for 44%. The predominance of respiratory and combined emergencies may reflect high prevalence of chronic respiratory diseases in Karak and potential delays in accessing definitive care, resulting in exacerbations requiring emergent transport (Raza & Mahboob, 2021). High proportions of complex emergencies further stress the need for EMS with dual therapeutic capacity adequate equipment and well-trained personnel capable of handling both respiratory and cardiac crises en route. Though EMS professionals actively participated in 36% of stakeholder accounts, many reported insufficient capacity to deliver advanced care en route. For example, use of airway intervention (BVM, suction) and CPR were relatively frequent, but only 4 cases involved defibrillation. This indicates a significant skills–equipment gap for handling cardiac treatment in cardiac arrest scenarios. In contrast, countries with advanced systems report early defibrillation use in 60–70% of OHCA cases (Suzuki *et al.,* 2020).

Of the tools examined across Karak ambulances, oxygen cylinders and basic NIV equipment were present more frequently (in 72 and 39 cases respectively), but defibrillators (33 cases), ventilators (33), and advanced monitoring (40) were limited. Notably, 21 cases reported no intervention during transport an alarming indication of ambulances functioning more like transport vehicles than life-saving units. This structural deficiency mirrors findings in Bangladesh and rural KPK, where lack of ALS equipment severely hampers outcomes (Rahman *et al*., 2021; Ahmed *et al*., 2023).

Globally, EMS systems in urban centers with advanced life support capabilities achieve pre-admission survival rates between 7% and 20% for cardiac emergencies (Lopez et al., 2021; Smith et al., 2022). In Southeast Asia, survival to hospital admission after OHCA ranges from 4% to nearly 41%, depending on pre-hospital intervention quality (Abir et al., 2021; Health Asia Daily News, 2025). While Thailand cites a 40.8% hospital admission survival, prehospital ROSC remains marginal at 3–4%, highlighting that hospital outcomes are intertwined with quality of pre-hospital care including timing, equipment, and training (Health Asia Daily News, 2025).

In Pakistan, survival rates and treatment delivery are substantially lower. Karachi's documented OHCA survival-to-discharge figures are under 1%, reflecting a lack of bystander CPR and EMS coverage (Khan et al., 2022; Baig et al., 2024). Rescue 1122 provides a model of operational EMS, yet remains limited within Karak. Our study's findings echo these national patterns: limited ambulance coverage, poor equipment, minimal defibrillation, and extended response times that exceed international "golden-hour" standards (Rauf et al., 2022; Syed et al., 2023). The male-dominant respondent pool highlights deeper issues in gender representation in healthcare access and usage. Women in rural areas may be less likely to both call EMS and report experiences due to societal norms. Moreover, mistrust in EMS competency compounds non-utilization. This was confirmed by 62% of residents preferring family transport over ambulances, reflecting perceived inadequacy and unreliability (Local Health Monitoring Unit Karak, 2024; Syed et al., 2023).

Evidence supports the effectiveness of community initiatives in improving EMS outcomes. Andersen et al. (2020) demonstrated that community CPR programs significantly boost OHCA survival. Similar public awareness and bystander training in Karak, along with trust-building strategies, could positively alter utilization patterns and reduce pre-hospital delays.

Limitations

This study provides important insights into the emergency transport system in Karak, it also has some limitations that should be considered.

First, the research was limited to a specific district (Karak), which means the findings may not fully represent the situation in other parts of the country. Different regions may have different infrastructure, resources, and emergency response systems.

Second, the study relied heavily on interviews, questionnaires, and observations, which depend on the honesty and accuracy of the people involved. Some responses may have been biased or influenced by personal opinions or memory errors, especially from patients or emergency staff recalling past events.

CONCLUSION

This study explored the role and effectiveness of emergency transport systems in managing cardiac and respiratory complications arising from road traffic accidents in Karak District, Khyber Pakhtunkhwa. By analyzing data from 105 respondents comprising patients, family members, and emergency medical service (EMS) staff the research provided a comprehensive understanding of how timely and well-equipped emergency transport impacts patient outcomes in critical pre-hospital settings. This emphasizes the urgent requirement for EMS units to be equipped to handle multifaceted medical situations efficiently and promptly. Despite the presence of some basic interventions such as oxygen support and bag-valve mask ventilation the study found serious limitations in advanced care capabilities. Many ambulances lacked essential life-saving equipment like defibrillators and advanced airway tools. Furthermore, EMS personnel often lacked adequate training in cardiac and respiratory emergency protocols. These shortcomings are particularly concerning given the critical time window in which interventions must occur to improve survival rates and prevent further complications.

REFERENCES

1. Smith, R., Thompson, J., & Huang, M. (2022). *Impact of pre-hospital response times on survival outcomes in global OHCA cases*. Circulation, 145(2), 120–130.
2. Lopez, A. J., Ramirez, S., & Patel, K. (2021). *Meta-analysis of survival outcomes in emergency transport systems across high-income countries*. International Journal of Emergency Medicine, 14(3), 45–53.
3. Patel, S. A., Nguyen, L., & Choi, J. (2023). *Effect of EMS response delays on OHCA survival in Southeast Asia*. BMJ Global Health, 8(2), e010445.
4. Lee, Y., Chen, T., & Gupta, D. (2023). *Telemedicine-enabled ambulances: reducing response times in urban centres*. Lancet Digital Health, 5(1), e20–e28.
5. Johnson, A. M., Rodriguez, R., & Kim, H. (2021). *Drone-delivered AEDs in time-sensitive emergencies: a trial*. Open Access Emergency Medicine, 13, 117–126.
6. Andersen, L. W., Fisk, A., & Nielsen, P. (2020). *Community CPR training and OHCA survival in Nordic countries*. Resuscitation, 152, 99–106.
7. Global Pre-Hospital Review Group. (2022). *Prehospital time and trauma outcomes: a COVID-era perspective*. Int J Emerg Med, 15(1), 1–10.
8. World Health Organization (2022). *Global status report on emergency care systems*. WHO Technical Paper.
9. Ozdemir, N., & Ahmed, S. (2019). *Disparities in EMS access across income strata*. Health Equity, 3(2), 65–75.
10. Singh, D., Kumar, A., & Lee, S. (2023). *Comparative EMS models in South Asia*. Health Systems Journal, 9(4), 233–245.
11. Abir, M., Jankovic, D., & Wong, W. (2021). *EMS vs. non-EMS transport outcomes in cardiac emergencies in Bangkok*. Resuscitation, 162, 45–53.
12. Health Asia Daily News. (2025). *Malaysia and Thailand OHCA survival statistics*. Health Asia Reports, 5(1), 12–18.
13. Lu, S., & Wang, X. (2022). *EMS deployment and effectiveness in urban Chinese districts*. Chinese Journal of Emergency Care, 18(3), 92–101.
14. Su, H., Chen, P., & Zhang, Q. (2021). *Quality improvement protocols in Suzhou EMS*. Journal of Clinical Medicine, 11(2), 345–354.
15. Rodriguez, A., Chen, R., & Rodriguez, R. (2024). *Motorbike ambulances in Manila reduce response time*. Philippine Health Review, 8(2), 89–99.