

Dynamics of geriatric emergency care: comprehensive assessment of emergency medical services utilization and its impact on healthcare resources in coastal India

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Abstract

Emergency Medical Services (EMS) transport significantly influences demographics, admission rates, and mortality among geriatric patients presenting to the Emergency Department (ED). The study evaluated geriatric patients aged 65 years and older, focusing on the impact of transport methods—EMS versus walk-

ins—on demographics, admission rates, and mortality outcomes, aiming to identify key areas for improving emergency care delivery for this vulnerable population. Of the total patients, 8.5% were transported by EMS who were predominantly male and more likely to arrive during weekends and nighttime hours. Admission rates were significantly higher in the EMS group, with 30.6% requiring ICU care compared to 5.9% of walk-ins. Mortality rates were also markedly elevated among EMS patients (4.7% vs. 0.3%). The reasons for ED visits varied, with trauma being more frequent in EMS arrivals. This study underscores the critical impact of transport methods on patient outcomes, emphasizing the need to optimize EMS protocols and triage practices. Addressing these factors can enhance care delivery and improve admission and mortality outcomes for geriatric patients in ED settings.

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Introduction

The increasing demands placed on healthcare systems by the geriatric population have garnered significant attention, particularly as older patients present more frequently to Emergency Department (ED) with acute and complex health problems. The global population is aging rapidly, with the proportion of people over 65 expected to nearly double by 2050, growing from 900 million people or 12 percent in 2015 to 2 billion people or 22 percent.¹

This trend is observed globally, with studies indicating that geriatric patients account for a significant proportion of ED visits, with ratios ranging from 9% to 24.3% worldwide.²⁻³ In the United States, individuals aged 65 and older account for the second-highest rate of ED visits, surpassed only by infants.⁴ In Southeast Asia, the proportion of geriatric utilization of ED ranges from 23.3% to 45.4%, while in India, they represent 27.5%.^{5,6}

significant attention, particularly as older patients present more frequently to ED with acute and complex health problems.¹

EDs serve a crucial role for this population, often functioning as the primary gateway to hospital admission or after-hours care when primary healthcare providers are unavailable. This reliance on EDs results in higher burden on healthcare resources compared to their younger counterparts. Additionally, the complex medical needs of this population, including the management of conditions such as ischemic heart disease, congestive heart failure, cerebrovascular accidents, and fall-related injuries, further intensify the challenges of ED overcrowding.²

This population also uses Emergency Medical Services (EMS) about 62% more frequently than the overall average.⁷ Additionally, advanced age has been recognized as an independent risk factor for mortality within seven days among patients transported by EMS.⁸

Our study aims to evaluate EMS utilization among patients aged 65 years and older presenting to the ED. It examines demo-

graphic factors, clinical reasons for ED visits, and patient outcomes in relation to their mode of arrival, whether via EMS or self-presentation. The findings seek to provide valuable insights for optimizing EMS usage and enhancing care delivery for this vulnerable geriatric population.

Materials and Methods

Study design and setting

This study was structured as a retrospective cross-sectional study. Data was collected from patients aged 65 years and older who arrived at the ED between 1st April 2019 and 31st March 2024. Our ED has an average annual visit of around 24,000 cases. All patients aged 65 years and older that arrived to our ED were selected for the study. We included patients aged 65 years and older who presented to the ED, regardless of the underlying condition or severity of their illness, during the study period were included. Exclusion criteria included: i) patients transferred from other healthcare facilities after receiving initial treatment were excluded to minimize bias related to the initial mode of arrival and treatment outcomes; ii) patients who left the ED without being seen by a healthcare provider; iii) patients with incomplete medical records were also excluded.

Study protocol

Upon arrival at the ED, geriatric patients were triaged by a senior nurse using the Manchester Triage System to prioritize patients based on the severity of their condition.⁹ Following this, an emergency physician evaluated them via primary and secondary survey, during which Airway, Breathing, Circulation, Disability, and Exposure (ABCDE) were systematically assessed, and stabi-

lization measures were implemented as required. Point-of-care investigations such as Arterial Blood Gas Analysis (ABG), Electrocardiography (ECG), and capillary glucose measurement were utilized to assist in clinical decision-making. Based on these a provisional diagnosis and initiated appropriate treatment was made. Patients were then managed in the ED or admitted to the general wards or critical care units under the relevant specialty, depending on the severity of their condition and clinical needs. We considered EMS services of both government-run and private providers, which were equipped with Basic Life Support (BLS) equipments consistently.

Data collection included demographic variables such as age, sex, and residence (categorized as rural or urban), as well as information on the mode, walk in or via EMS, time and day of arrival. Chief complains were documented and clinical outcomes, including hospitalization, ICU admission, ED observation, discharge, or mortality, were systematically recorded.

Outcomes

The primary outcomes assessed included rates of ICU admission, general ward admission, discharge from the ED, and in-ED mortality, comparing patients transported by EMS with those who arrived as walk-ins. ICU admissions were further categorized into the specialty which was admitted under. Secondary outcomes evaluated included differences in arrival times and the reasons for ED visits between EMS-transferred patients and those arriving independently.

Ethical consideration

The research obtained approval from the Kanachur Hospital

Table 1. Demographic profile of geriatric patients arriving to the emergency department.

Variables	EMS n (n%)	Walk in n (n%)	Total n (n%)
Sex			
Male	731 (55.0)	8304 (58.0)	9035 (57.8)
Female	597 (45.0)	6013 (42.0)	6610 (42.2)
Age (Years)			
65-70	385 (21.5)	5354 (37.4)	5639 (36.1)
70-75	470 (35.4)	4024 (28.1)	4494 (28.7)
75-80	225 (16.9)	2591 (18.1)	2816 (18.0)
80-85	256 (19.3)	1532 (10.7)	1788 (11.4)
85 and more	92 (6.9)	816 (5.7)	908 (5.8)
Pre-existing conditions			
HTN	1008 (75.90)	10407 (72.69)	11415 (72.96)
DM	1104 (83.13)	12612 (88.09)	13716 (87.67)
Heart diseases	451 (33.96)	1761 (12.30)	2212 (14.14)
Respiratory diseases	371 (27.94)	1478 (10.32)	1849 (11.82)
Cerebrovascular diseases	212 (15.96)	877 (6.13)	1089 (6.96)
Mental disorders	78 (5.87)	163 (1.14)	241 (1.54)
Weekend / Weekdays			
Weekends	931 (70.1)	7888 (55.1)	8819 (56.4)
Weekdays	397 (29.9)	6429 (44.9)	6826 (43.6)
Time of arrival			
8am to 8pm	889 (66.9)	12513 (87.4)	13402 (85.7)
8pm to 8am	439 (33.1)	1804 (12.6)	2243 (14.3)
Residence			
Rural	855 (64.4)	7502 (52.4)	8357 (53.4)
Urban	473 (35.6)	6815 (47.6)	7288 (46.6)

EMS, Emergency Medical Services; HTN, Hypertension; DM, Diabetes Mellitus.

Ethical Committee Board, ensuring compliance with the ethical guidelines set outlined in the Declaration of Helsinki regarding medical research ethics.

Statistical analysis

Data analysis was performed using SPSS version 23.0. Descriptive statistics included the calculation of frequencies and percentages for categorical variables and means with standard deviations or medians with interquartile ranges for continuous variables, as appropriate based on distribution. Inferential statistics were employed to compare outcomes between patients arriving by EMS and those arriving as walk-ins. The Mann-Whitney U test was utilized for non-parametric comparisons of continuous variables between the two groups. The chi-square test was applied to examine associations between categorical variables, such as reasons for ED visits and patient dispositions. The Z-value was computed to evaluate the statistical significance of differences in reasons for ED visits and outcomes between the two patient groups. A significance level of 5% was set for all statistical tests, with p-values <0.05 indicating statistical significance.

Results

A total of 15,645 geriatric patients were included in the final analysis. Among these patients, 1,328 arrived by EMS accounting for 8.5% of the total, while the remaining 14,317 arrived as walk-

ins (Figure 1). The gender distribution showed a slight male predominance in both groups, with males comprising 55.0% of EMS patients and 58.0% of walk-ins. While the majority of patients overall were aged 65 to 70 years (36.1%), EMS patients tended to be older, with a higher proportion falling in the 75-80 years age range. A larger percentage of EMS patients arrived on weekends (70.1%) and most (85.7%) arrived during morning hours. Additionally, rural patients were more likely to utilize EMS (64.4%) than walk-in services (52.4%; Table 1).

The most common reason for visiting the ED among both groups was breathlessness, accounting for 17.7% of EMS patients and 17.9% of walk-ins. Among EMS patients, trauma was the most common reason for visiting the ED, accounting for 39.9% of cases, followed by breathlessness. Other notable conditions observed in EMS arrivals included seizures (8.4%), poisoning (5.1%), and cardiac arrest (3.5%), all of which were significantly more frequent compared to walk-in patients ($p<0.001$). Chest pain was also prevalent among EMS patients, representing 11.4% of cases, although it occurred less frequently compared to walk-ins. In contrast, walk-in patients presented with a more diverse range of conditions. While breathlessness remained common (17.9%), other conditions such as chest pain (15.9%), vomiting (11.9%), acute gastroenteritis (14.0%), and fever (14.9%) were more frequently seen in walk-ins compared to EMS patients ($p<0.001$). Furthermore, syncope (9.0%) and palpitations (4.4%) were more prevalent among walk-ins compared to EMS arrivals (3.0% and 1.8%, respectively; Table 2).

EMS patients had a significantly higher rate of ICU admissions

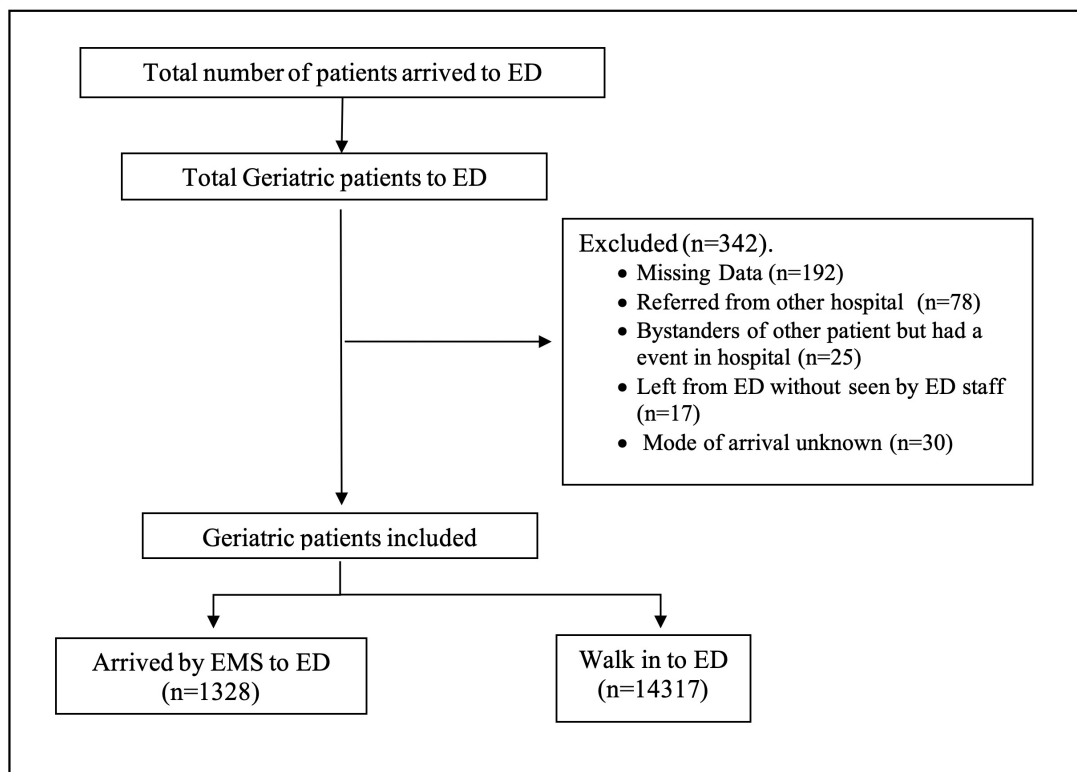


Figure 1. The flow diagram of the study. ED, emergency medicine, OPD, out patient department, EMS, emergency medical services

(30.6% vs. 5.9%, $p<0.001$) and ED mortality (4.7% vs. 0.3%, $p<0.001$) compared to walk-ins. Walk-in patients were more likely to be hospitalized in the general ward (39.9% vs. 19.8%) and leave against medical advice (17.5% vs. 7.6%, $p<0.001$). Additionally, referral from the ED was more common among walk-ins (6.3% vs. 1.8%, $p<0.001$; Table 3). Among EMS patients, medical ICU admissions were 16.1%, compared to 3.2% for walk-ins. Pulmonary ICU, cardiac ICU, and neural ICU admissions also

showed higher proportions in EMS patients at 5.4%, 8.8%, and 13.0%, respectively. Surgical ICU admissions were 14.1% for EMS patients, while walk-ins were 3.7%. For ward admissions, EMS patients had lower percentages in medicine and surgery wards, but slightly higher admissions in orthopedics, neural, and psychiatry wards. Pulmonary and cardiac ward admissions showed similar rates between both groups (Table 4).

Table 2. Presenting complaints for emergency department visits.

Variables	EMS n (n%)	Walk in n (n%)	Total n (n%)	Z value	p
Chest pain	152 (11.4)	2280 (15.9)	2432 (15.5)	1.32	0.195
Syncope	40 (3.0)	1286 (9.0)	1326 (8.5)	4.36	<0.001
Palpitation	24 (1.8)	633 (4.4)	657 (4.2)	4.34	<0.001
Cardiac Arrest	47 (3.5)	1 (.01)	48 (0.3)	14.13	<0.001
Breathlessness	235 (17.7)	2561 (17.9)	2796 (17.9)	0.23	0.8217
Seizure	112 (8.4)	16 (0.1)	128 (0.8)	10.92	<0.001
Altered mental status	80 (6.0)	572 (4.0)	652 (4.2)	1.77	0.08
Poisoning	68 (5.1)	204 (1.4)	272 (1.7)	6.59	<0.001
Trauma	530 (39.9)	41 (.02)	571 (3.6)	41.87	<0.001
Fever	15 (1.1)	2146 (14.9)	2161 (13.8)	22.61	<0.001
Vomiting	8 (0.6)	1710 (11.9)	1718 (11.0)	13.54	<0.001
Acute gastroenteritis	2 (0.2)	2009 (14.0)	2011 (12.9)	25.68	<0.001
Behavioral changes	8 (0.6)	852 (5.8)	860 (5.5)	7.42	<0.001
Others	7 (0.5)	6 (.04)	13 (0.1)	0.83	0.411

Table 3. Disposition of geriatric patient from the emergency department.

Variables	EMS n (n%)	Walk in n (n%)	Total n (n%)	Z value	p
Hospitalization					
ICU	406 (30.6)	852 (5.9)	1258 (8.1)	6.31	<0.001
Ward	263 (19.8)	5716 (39.9)	5979 (38.2)	1.14	0.257
Observed in ED	186 (14.0)	1735 (12.1)	1921 (12.3)	2.05	0.041
Discharged from ED	286(21.5)	2567 (17.9)	2853 (18.2)	6.24	<0.001
Leaving against advise	101 (7.6)	2512 (17.5)	2613 (16.7)	6.11	<0.001
Referred from ED	24(1.8)	896 (6.3)	920 (5.9)	13.84	<0.001
Dead in ED	62 (4.7)	39 (0.3)	101 (0.6)	6.31	<0.001

ED, Emergency Department; EMS, Emergency Medical Services; ICU, Intensive Care Unit.

Table 4. Admission to the hospital from the emergency department.

Variables	EMS (n=669)	Walk in (n=6568)	Total (n=7237)	Z value	p
Intensive Care Unit admission (ICU)	n (n%)	n (n%)	n (n%)		
Medical ICU	108 (16.1)	209 (3.2)	317 (4.4)	11.73	<0.001
Pulmonary ICU	36 (5.4)	120 (1.8)	156 (2.2)	4.72	<0.001
Cardiac ICU	59 (8.8)	136 (2.1)	195 (2.7)	9.6	<0.001
Renal ICU	22 (3.3)	76 (1.2)	98 (1.4)	4.7	<0.01
Neural ICU	87 (13.0)	71 (1.1)	158 (2.2)	18.66	<0.001
Surgical ICU	94 (14.1)	240 (3.7)	334 (4.6)	8.45	<0.001
Ward / Floor admission					
Medicine	64 (9.6)	2632 (40.1)	2696 (37.3)	35.35	<0.001
Pulmonary	45 (6.7)	424 (6.5)	469 (6.5)	0.19	0.855
Cardiac	33 (4.9)	248 (3.8)	281 (3.9)	1.9	0.061
Renal	20 (2.9)	173 (2.6)	193 (2.7)	0.6	0.553
Neural	12 (1.8)	33 (0.5)	45 (0.6)	2.95	0.003
Surgery	58 (8.7)	1822 (27.7)	1880 (25.9)	15.87	<0.001
Orthopedics	14 (2.1)	317 (4.8)	331 (4.6)	2.4	0.022
Psychiatry	17 (2.6)	67 (1.0)	84 (1.2)	2.77	0.006

Discussion

Emergency medicine in India is still in its early developmental stages, with EMS services lacking the standardization and uniformity as seen in many Western countries. Significant disparities exist between public and private EMS systems. Public EMS units often operate with limited resources and inadequate equipment, while private EMS providers are generally better equipped with advanced technology, such as ventilators and ACLS ambulances, and staffed with trained Emergency Medicine Technicians (EMTs).¹⁰ Despite their crucial role in prehospital care, the concept of EMTs is relatively new in India. It is gradually gaining recognition in metropolitan areas but remains largely inaccessible in rural regions, leaving a considerable gap in emergency care delivery.

The COVID-19 pandemic starkly highlighted these disparities. Public EMS services faced severe shortages of essential resources such as oxygen cylinders and Personal Protective Equipment (PPE), leaving them ill-prepared to manage the surge in critically ill patients. Conversely, private EMS providers, with their superior infrastructure and advanced capabilities, were better positioned to meet the demands of the crisis.¹¹ The nationwide lockdown further exacerbated these challenges, causing disruptions in EMS availability due to restricted movement and logistical hurdles. This situation resulted in a substantial reduction in access to timely and effective prehospital care, particularly for vulnerable populations in far living, rural and underserved areas.

In this study geriatric visits accounted for 16.3% of total ED visits, which is comparable to a 2018 study conducted in California that reported a rate of 21.2% for all ED visits.¹² EMS arrivals in our study accounted for 8.5% of the total geriatric cohort, predominantly male, and frequently presented with critical conditions such as trauma, seizures, and cardiac arrest. Similarly, the EDEN cohort (Emergency Department and Elder Needs) study conducted in Spain in 2022 reported that 6.9% of geriatric patients utilized EMS services, which aligns closely with our findings.¹³ This can be due to similar cultural factors, such as a strong emphasis on family care giving, thus contributing to lower EMS utilization rates among the older, alongside infrastructural limitations in rural areas affecting accessibility.¹⁴

In a study conducted in Tokyo in 2010, it was found that 64% of geriatric women were transported via ambulance to the ED, highlighting a significant gender difference in EMS usage.¹⁵ In contrast, our study observed only a slight male predominance among EMS patients. This difference could be attributed to demographic variations, particularly the higher proportion of older females, which reached 56.63% in 2016 in Japan according to the United Nations.¹⁶

In rural areas, EMS plays a vital role as the first line of emergency care. Well-trained personnel and well-equipped ambulances can reduce delays inherent in rural healthcare. Our study shows a balanced distribution of EMS services between urban and rural regions, but improvements in rural EMS response times remain essential. A systematic review highlights that while EMS coverage is greater in rural areas, urban regions benefit from shorter response, transport, and on-scene times due to better infrastructure and proximity to healthcare facilities.¹⁷ The disparity highlights the geographic variability in EMS effectiveness, with urban areas enjoying quicker access to care due to better infrastructure, proximity to healthcare facilities, and optimized resource allocation.¹⁸

The limited availability of primary care and outpatient services on weekends often makes the ED the primary option for older patients. Additionally, the increased presence of family members

or caregivers during weekends facilitates these visits. In our study, the majority of geriatric patients sought care on weekends, with most arriving during the daytime and evening hours. This pattern is consistent with a 2017 study from the Netherlands, which found that 54.2% of geriatric patients presented to the ED during daytime hours on weekends, with only 13.8% arriving via EMS.¹⁹

The variation in presentation patterns between EMS and walk-in geriatric patients to ED likely reflects the severity and urgency of their clinical conditions. Trauma-related emergencies, which often involve life-threatening injuries requiring immediate intervention and specialized transport, predominated among EMS arrivals in our study. In contrast, patients experiencing non-traumatic conditions, such as shortness of breath or chest pain, may perceive their symptoms as less immediately critical, leading them to rely on alternative transportation and present as walk-ins. Additionally, the gradual onset of symptoms like dyspnea may afford patients and caregivers more time to decide to visit the ED without using EMS. In our study, shortness of breath and chest pain were the most common complaints among walk-ins, mirroring findings from a study conducted in Karachi that also observed similar ED presentation patterns in the elderly.²⁰

Disposition planning for geriatric patients in the ED is inherently challenging due to the diversity of clinical presentations, accompanying co morbidities and the lack of standardized protocols. In our study, 50.37% of geriatric patients arriving by EMS required hospitalization, of which 30.6% required admission to the Intensive Care Unit (ICU) and 14%, were placed under observation for 6-8 hours. The higher ICU admission rates among EMS patients underscore the severity of their clinical conditions, whereas walk-ins were more frequently admitted to general wards. Additionally, EMS patients exhibited a greater incidence of adverse outcomes, including ED mortality, emphasizing the critical importance of timely triage and effective resource allocation to enhance the care and outcomes of older patients in emergency settings.²¹

In comparison, a study conducted in Switzerland reported similar rates of hospitalization at 58%, with 32% of patients requiring ICU admission.²² This may be due to both countries having aging populations with similar healthcare challenges, including the need for timely access to emergency services for critical conditions. The accuracy of hospitalization decisions in our study was likely enhanced by the collaborative approach in the observation unit, where multidisciplinary team discussions were integral to determining the best course of action. This «wisdom of the crowd» approach ensured that patients with acute morbidity received appropriate care, whether through admission or targeted observation.²³

In our study, the majority of EMS-transported patients required admission to the internal medical ICU (16.1%) and wards (9.6%), reflecting the severity of their conditions and the complexity of managing older arriving via EMS. These patients are typically admitted under internal medicine services, necessitating the involvement of teams with geriatric expertise. However, a recent survey across 22 countries revealed that half of the respondents reported a shortage of geriatricians, with many advocating for a doubling of current specialist numbers.²⁴ While efforts are underway in several countries to recognize geriatrics as a distinct clinical specialty and encourage medical students to specialize in this field, progress remains insufficient. Additionally, the shortage of nurses with geriatric expertise further complicates the management of elderly patients, particularly in emergency and critical care settings. This highlights the urgent need for expanding geriatric expertise within multidisciplinary teams to ensure optimal care for

this vulnerable population.

While numerous scoring systems have been developed to predict patient disposition and adverse outcomes, such as mortality, their effectiveness in busy and high-pressure ED settings remains controversial.²⁵ The traditional ED model emphasizes rapid assessment and referral, but transitioning towards a geriatric-specific ED care model, which accommodates the complexities of older patients, is becoming more important. This approach would not only focus on immediate care but also ensure continuity of care following the ED visit, whether the patient is admitted or discharged. Such initiatives are crucial for improving outcomes by providing comprehensive follow-up and minimizing the risk of adverse events after discharge.²⁶ Incorporating geriatric expertise into this framework is essential for addressing the unique challenges faced by older patients in both acute and post-acute care. Nevertheless, the findings from both our study and the Swiss study emphasize the need for robust, evidence-based protocols to ensure the timely and appropriate disposition of geriatric patients in the ED.²²

Older adults often present to EDs with atypical symptoms, polypharmacy, and multiple comorbidities, making diagnosis and treatment more challenging. Without geriatric-specific training, physicians may miss subtle yet critical signs of serious conditions, leading to delayed or inappropriate interventions. Geriatric education is essential for enhancing diagnostic accuracy, refining management strategies, and improving communication with older patients, resulting in better outcomes, fewer hospital admissions, and more patient-centered care. A Belgian study highlights the gap in geriatric training, with ED staff receiving an average of only 2.9 hours of geriatric education per year, and only few hospitals offering structured geriatric training, limiting the ability of ED teams to meet the unique needs of older patients.²⁷

Geriatric patients arriving via EMS add further complexity, often presenting with more severe conditions that require urgent attention. Without proper geriatric training, ED teams may struggle to effectively triage and manage these patients, who are generally frailer and more likely to have acute exacerbations of chronic illnesses. Integrating geriatric education into ED practices, along with collaboration between EDs and geriatric expert teams, is critical for improving outcomes and ensuring efficient, high-quality care for this vulnerable population.

The study had several limitations. Its retrospective design and single-center nature restrict the generalizability of the findings. Furthermore, significant disparities between well-equipped private EMS providers and resource-limited government services, along with inconsistent training and preparedness of EMS personnel, may have influenced patient outcomes. Additionally, the distance between the pick-up location and our ED was not accounted for, which could have affected the timeliness and quality of care provided during transport. The lack of standardized geriatric triage protocols across EDs in India, along with reliance on subjective clinical assessments, introduced variability in documentation and patient disposition, which may have further influenced the results.

Conclusions

This study highlights the association between EMS transport and higher ICU admissions and mortality rates among geriatric patients in the ED. While patient outcomes are primarily influenced by clinical factors such as disease severity and comorbidities, EMS utilization patterns suggest that transported patients

often present in critical condition, requiring intensive care. These findings emphasize the need for standardized EMS protocols, improved triage practices, and better resource allocation, particularly in resource-limited settings. Further research incorporating comprehensive geriatric assessments, including functional status and comorbidities, is essential to fully understand the impact of EMS transport on patient outcomes.

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