Muğla İlinde Erişkin Acil Sağlık Hizmetleri Kullanım Epidemiyolojisi

The Epidemiology of Adult Emergency Medical Services Use in Muğla

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ÖZET

Amaç: Bu çalışma, acil servise başvuran erişkinlerde Acil Sağlık Hizmetleri (ASH) kullanımının epidemiyolojik özelliklerini araştırmayı amaçlamaktadır.

Yöntemler: Temmuz 2019-Ocak 2022 tarihleri arasında Türkiye'de bir üniversiteye bağlı Eğitim ve Araştırma Hastanesi'nin acil servisinde tek merkezli, kesitsel ve gözlemsel bir çalışma retrospektif olarak gerçekleştirildi.

Bulgular: Çalışma süresi boyunca, hastanenin elektronik sağlık veri sistemine toplam 280.691 yetişkin acil servis ziyareti kaydedildi ve 31.671 (%11.3) kritik hasta veya yaralı hasta ambulanslarla geldi. Çalışmaya alınan hastaların ortalama yaşı 57,1±21,8 (18-112 yıl) ve %56,4'ü erkekti. Bu hastaların %41'i (n=13.014) hastaneye yatırıldı (%30,4'ü servise, %10,6'sı yoğun bakıma) ve tüm nedenlere bağlı acil servis içi ölüm oranı %0,7 (n=223) idi. Vakaların %97,6'sında kamunun ambulans servisi, kalan %2,4'ünde ise özel ambulans hizmetleri kullanıldı. Kritik hastalık, trafik kazası ve iş kazası için ASH kullanım yüzdeleri sırasıyla %91,8, %6,5 ve %1,7 idi. Triyaj kodları sarı (%87,6), kırmızı (%12), siyah (%0,2) ve yeşil (%0,2) olarak kategorize edildi.

Sonuçlar: Yetişkin ASH kullanımının operasyonel, eğitim ve halk sağlığı üzerindeki etkilerini daha iyi anlamak için daha fazla araştırma gereklidir.

Anahtar Kelimeler: Acil sağlık hizmetleri, Hastane öncesi, Acil servis, Yetişkin, Epidemiyoloji

ABSTRACT

Aim: This study aims to investigate the epidemiological characteristics and patterns of Emergency Medical Services (EMS) use among adults who presented to the emergency department (ED).

Material and Methods: A single-center, cross-sectional, and observational study was retrospectively conducted at the ED of a university-affiliated training and research hospital in Muğla, Turkey from July 2019 to January 2022.

Results: During the study period, a total of 280,691 adult ED visits were recorded in the hospital's electronic health data system, with 31,671 (11.3%) consecutive critically ill or injured patients arriving via ambulances. The mean age of enrolled patients was 57.1±21.8 years (range, 18-112 years) and 56.4% of them were male. Of these, 41% (n=13,014) were admitted to the hospital (30.4% to wards and 10.6% to the intensive care unit), and the all-cause in-ED mortality rate was 0.7% (n=223). Public EMS was used in 97.6% of the cases, with the remaining 2.4% utilizing private ambulance services. EMS use percentages for critical illness, traffic accidents, and occupational accidents were 91.8%, 6.5%, and 1.7%, respectively. The triage codes were categorized as yellow (87.6%), red (12%), black (0.2%), and green (0.2%).

Conclusions: Further investigation is necessary to better understand the operational, training, and public health implications of adult EMS use.

Keywords: Emergency medical services, Prehospital care, Emergency department, Adult, Epidemiology

1. INTRODUCTION

Emergency Medical Services (EMS), refers to the entire system that coordinates all aspects of care for patients in a pre-hospital setting, outside of the hospital environment. As such, EMS is a vital element of healthcare systems and plays a crucial role in enhancing outcomes for injuries and other illnesses that require time-sensitive intervention (Van Milligan, Tucker, Arkedis, Caravalho, 2014).

The transition from "077 Hızır Acil" to "112 Emergency Aid and Rescue" for EMS occurred in Turkey in 1991, following which 112 teams were set up across provincial and district centers between 1991 and 1994, particularly in major cities such as Istanbul, Ankara, and Izmir (Özata, Toygar, Yorulmaz, 2011).

Severely critical or injured patients are typically transported to the hospital by ambulance through the EMS, but some patients may arrive at the Emergency Department (ED) by walking or using their personal vehicle, depending on their circumstances and available means of transportation Accurate and complete data on the utilization of EMS is crucial not only for ensuring high-quality patient transportation but also for optimizing the allocation of limited resources within the system (Park et al., 2021). Limited data is available on the demographics, utilization rates, and outcomes of adult EMS patients in Muğla. Therefore, our study aims to investigate the epidemiology of adult ED visits arriving by EMS in our city, with the goal of contributing to the existing literature and improving patient care.

2. METHODS

2.1. Study design and setting

This retrospective, single-center, observational, and cross-sectional study was conducted at the ED of university-affiliated training and research hospital in Muğla, Turkey. Data were collected from consecutive adult patients who were admitted to the ED via ambulances between July 1, 2019 and January 1, 2022. The hospital has more than 600 beds, and the annual number of ED patient visits is approximately 200,000 per year. Approval for the study was granted by the ethical committee of Muğla Sıtkı Koçman University (reference number 210079-64). Due to the retrospective design of the study, the requirement for written consent was waived.

2.2. Selection of participants

Only patients who were 18 years old or older and were transported to the ED via ambulance were eligible for inclusion in the study. The study excluded patients who were below 18 years of age, arrived at the ED via aeromedical transportation or private car, were outpatients, or had been lost to follow-up.

2.3. Data collection

The study collected the following parameters from patients: the mode of arrival (EMS or other means), age, gender, nationality, disease or injury, triage tag, arrival time, day, and month, as well as the outcome of the ED visit (discharge, hospitalization requirement, ward or ICU admission requirement, and all-cause in-ED mortality).

2.4. Statistical analysis

The normality of the data distribution was assessed using the Kolmogorov-Smirnov test. Continuous variables were presented as either mean±SD or median [interquartile range (IQR)] depending on their normality. Categorical variables were expressed as absolute values and percentages. Statistical significance was set at $P < 0.05$ for all tests. The analyses were conducted using SPSS for Windows (version 23.0, SPSS Inc, Chicago, IL).

3. RESULTS

During the study period, the electronic health data system recorded a total of 280,691 ED visits. Out of these visits, 31,671 consecutive adult patients with critical or injury conditions who arrived at the ED through ambulance transportation (97.6% via public EMS and 2.4% via private ambulance services) were enrolled in the study, representing 11.3% of all ED visits.

The study identified that 223 out of the 31,671 patients (0.7%) who arrived at the ED via ambulance died during their visit. Among these patients who died, 134 (60%) were male and 89 (40%) were female, with a mean age of 73.5±13.7 years. Furthermore, the study found that among the ambulance-transported patients who died in the ED, the majority had a red triage tag (57%, n=128) or a black triage tag (27%, n=60). Additionally, 41% of the included patients were admitted to the hospital after their ED visit (30.4% to wards and 10.6% to the ICU), while 59% were discharged from the ED. Table 1 presented the baseline characteristics of the enrolled patients and categorized them based on their admission or discharge status.

Table 1. Baseline characteristics of ED patients who arrived via ambulances, stratified by admission status (admitted vs. discharged).

Variables	Admitted to hospital (n= 12982)	Discharged from the ED (n= 18468)	P	Total	
Demographic data					
Age (y)	62,8±19,8	53,9±22,3	**<.001**	57,1±21,8	**n=31448**
Sex (Female/Male)	5274/7708	8436/10032		13710/17740	**n=31448**
Type of Ambulance					
Public EMS	12463	18222			**n=30685**
Private ambulance service	519	246			**n=765**
Labaratory results					
WBC, ×10³/µL	11,4±9,6	9,3±4,1	**<.001**	10,2±6,8	**n=25719**
Plt, ×10³/µL	240,7±105,6	242,2±84,5	**<.001**	241,5±94,2	**n=25719**
Hg, g/dL	12,2±2,5	12,9±2,0	**<.001**	12,6±2,3	**n=25719**
Glucose, mg/dL	148,8±76,2	129,5±55,6	**<.001**	138,0±66,1	**n=25706**
AST, U/L	53,2±193,4	24,7±49,1	**<.001**	37,2±133,8	**n=25725**
ALT, U/L	39,7±123,7	21,1±41,1	**<.001**	29,3±87,9	**n=25692**
Urea, mg/dL	52,7±47,2	36,8±24,1	**<.001**	43,8±36,9	**n=25727**
Creatinine, mg/dL	1,3±1,4	0,9±0,5	**<.001**	1,1±1	**n=25729**
Sodium, mmol/L	136,7±5,2	137,7±3,8	**<.001**	137,3±4,5	**n=25730**
Potassium, mmol/L	4,2±0,6	4,1±0,4	**<.001**	4,2±0,5	**n=25725**
CRP, mg/L	58,2±85,9	22,2±46,8	**<.001**	37,8±69,1	**n=18110**
Data are expressed as mean ± SD or count for categorical variables unless otherwise indicated					
Abbreviations: *WBC, White blood cell; Plt, Platelet; Hg, Haemoglobin; AST, Aspartateaminotransferase; ALT, Alanineaminotransferase; CRP, C-Reactive Protein*					

The mean age of the all adult patients included in the study was 57.2 ± 21.8 years (range, 18-112 years); with 56.4% were men. The analysis of age distribution revealed that 64.6% of the patients transported via ambulances were over 50 years old, while the subgroup of patients aged between 18 to 30 years old had the highest representation, accounting for 16% of all patients. EMS was used by 91.8%, 6.5%, and 1.7% of patients for critical disease, traffic accidents, and occupational accidents, respectively. The majority of patients (87.6%) were classified as yellow tags, followed by red tags (12%), and very few patients had green or black tags (0.2% each). The relation of triage tags and, file types to the age groups of the patients were described in Table 2.

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Table 2. The relationship between triage tags, type of ambulance, and file types according to age decades

Variables		18-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	>100	Total
Triage tags	**Red**	132	127	374	627	796	784	766	207	2	3815
	Yellow	4904	2892	3076	3607	4024	4108	4090	1024	17	27742
	Black	1	1	2	11	10	16	17	2	0	60
	Green	20	4	8	11	6	4	1	0	0	54
Type of ambulance	**Public EMS**	4962	2938	3369	4115	4706	4784	4792	1220	19	4962
	Private ambulance service	95	86	91	141	130	128	82	13	0	95
File types	**Critical disease**	4085	2463	3026	3932	4641	4818	4842	1228	19	29054
	Traffic accidents	806	414	290	254	177	93	32	5	0	2071
	Occupational accidents	166	147	144	70	18	1	0	0	0	546

When the triage tags were grouped by age, it was observed that the proportion of patients with red code increased as age advanced (Figure 1). The all-cause in-ED mortality rate for adult patients who arrived at the ED via ambulance was 0.7% (n=223).

As age increased, there was a corresponding increase in both hospital admissions and mortality. Figure 2 displays the outcome rates for different age groups, while the age distribution of patients who died is depicted in Figure 3.
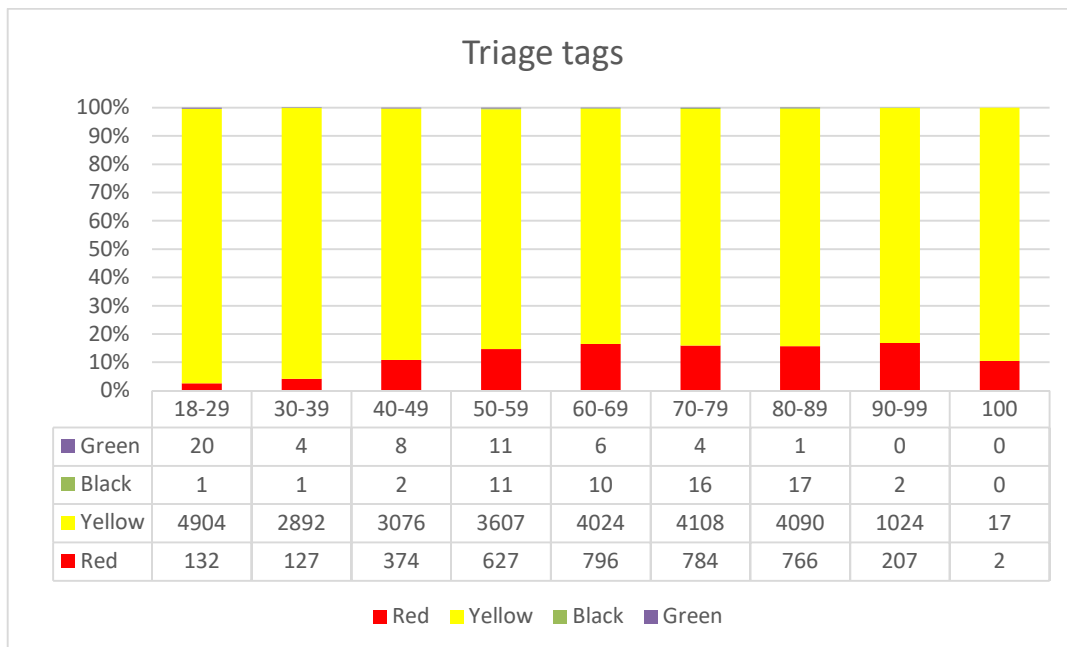

	18-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100
Green	20	4	8	11	6	4	1	0	0
Black	1	1	2	11	10	16	17	2	0
Yellow	4904	2892	3076	3607	4024	4108	4090	1024	17
Red	132	127	374	627	796	784	766	207	2

Figure 1. The proportion of patients assigned to each triage tag category, stratified by age group.

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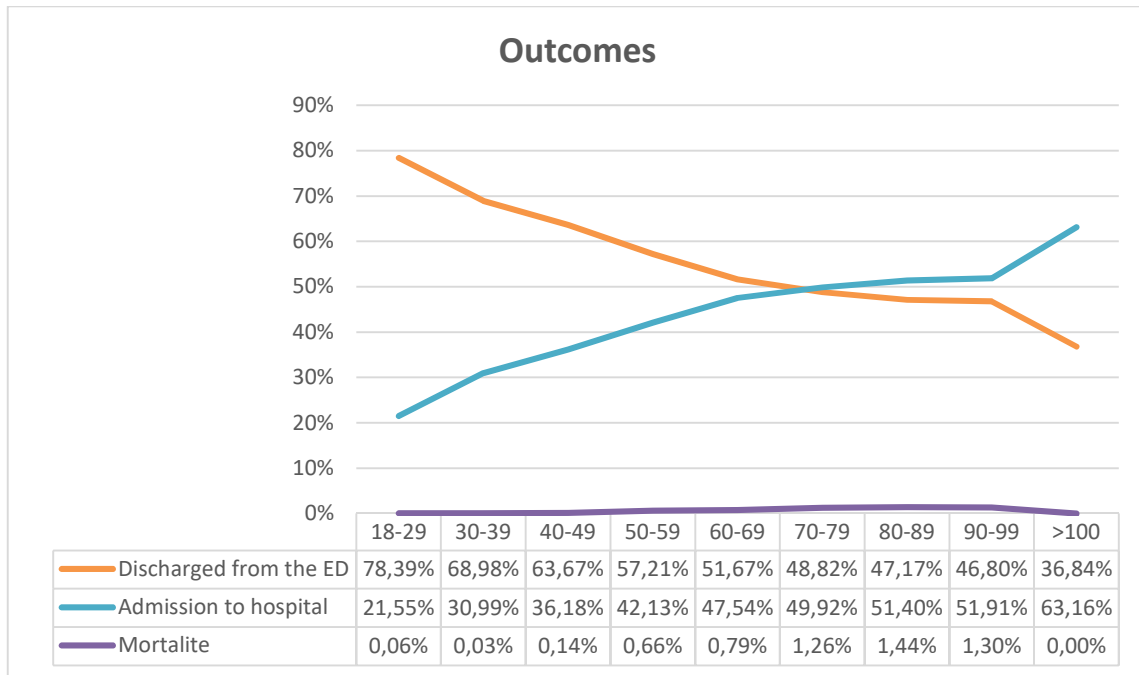
Figure 2. The outcomes for patients categorized by age groups.

	18-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	>100
Discharged from the ED	78,39%	68,98%	63,67%	57,21%	51,67%	48,82%	47,17%	46,80%	36,84%
Admission to hospital	21,55%	30,99%	36,18%	42,13%	47,54%	49,92%	51,40%	51,91%	63,16%
Mortalite	0,06%	0,03%	0,14%	0,66%	0,79%	1,26%	1,44%	1,30%	0,00%

	18-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	≥ 100
Mortality N	3	1	5	28	38	62	70	16	0
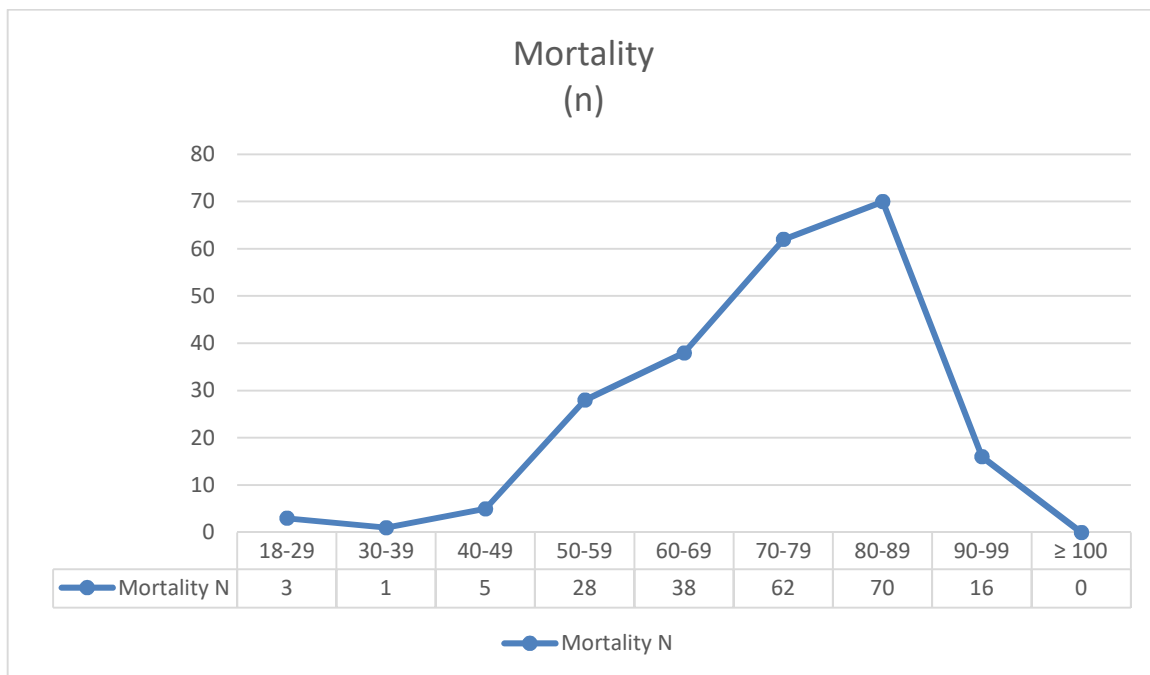
Figure 3. The association between patient age groups and mortality.

4. DISCUSSION

This study provides a detailed account of the usage of EMS by patients in Muğla, using a dataset that includes all ambulance applications to the only tertiary hospital in the region for a period of three years. Our findings have the potential to assist administrators and scientists in assessing and monitoring the outcomes of EMS system data, and in developing new policies.

According to bulletins released by the Ministry of Health, the number of ED admissions in Turkey has been on the rise for the past decade, accompanied by a gradual increase in the use of EMS services ("Ministry of Health. Health Statistics Yearbook", 2017). Factors such as patients' access to outpatient services, cultural structures, social support, and perceptions of EMS all play a role in the utilization of EMS services (Evans et al., 2017; Andrew, Nehme, Cameron, Smith, 2020; Park et al., 2021) . As our study was conducted retrospectively, we were unable to gather the patients' perspectives on their utilization of EMS services. Despite this, our findings indicated that the majority of EMS users were over 50 years old (64.6%).

Previous research has reported a high prevalence of EMS utilization among the elderly. Elderly patients, who are considered a unique patient group, have been extensively studied in the literature (Evans et al., 2017; Clark MJ, FitzGerald G, 1999, Keskinoglu, Sofuoglu, Özmen, Gündüz, Ozkan, 2010). Consistent with prior findings, our study revealed a high rate of EMS use in the elderly patient population. Our analysis revealed a mean patient age of 57.2 ± 21.8, which was lower than expected. This may be attributed to the greater use of EMS by those in the 18-30 age range. Existing literature reports an average age range of 33 to 38 years for EMS-managed traffic accident patients, whereas our research reveals a notable predominance of younger patients. This discrepancy underscores an elevated rate of ED admissions, particularly in cases of traffic accidents and work-related injuries (Huabbangyang et al., 2021; Saberian, Farhoud, Hasani-Sharamin, Moghaddami, Keshvari, Clark, FitzGerald, 2019).

In our study, we aimed to assess the appropriateness of EMS use by analyzing the triage and outcome data of the patients. A study conducted by Dejean et al. explored the qualitative definition of inappropriate ambulance use, and found that defining inappropriate use can be challenging for healthcare professionals. However, they highlighted that lack of knowledge about the EMS system, deficiencies in the healthcare system, inadequate social support, and patient age were some of the most significant factors contributing to inappropriate ambulance use (Dejean, Giacomini, Welsford, Schwartz, Decicca, 2016).

Consistent with prior research, we found significant differences in patient outcomes across all triage codes, age groups, and laboratory parameters in our study. Notably, however, none of the laboratory parameters emerged as a singularly predictive factor of patient outcomes. The literature places significant emphasis on age as a key factor in assessing the effectiveness of EMS use. Health professionals evaluating EMS use in elderly and young patients with similar medical complaints have noted that elderly patients tend to use EMS more appropriately, with fewer instances of unnecessary ambulance use (Keskinoglu et al., 2010; Dejean et al., 2016).

Platt-Mills et al. conducted a study assessing patients admitted to the ED across different age groups and found that ambulance usage was highest in the 19-34 age group. Nonetheless, hospitalization rates displayed an ascending trend with increasing patient age. Our study aligns with these findings, highlighting elevated rates of EMS utilization in younger age groups, predominantly attributed to traffic and occupational accidents, while observing higher hospitalization rates among older patients.

Our study showed that the youngest age group (18-30) had the highest frequency of EMS use for ED admissions, but the lowest percentage of hospitalizations. In line with cross-sectional studies in the literature, hospitalizations increased linearly with each decade of age. An investigation into EMS utilization among elderly patients revealed that while overall usage among this demographic was notable, specific factors such as living alone and being over 75 years of age were associated with reduced EMS

utilization within subgroups (Park, Sohn, 2020). Additionally, we found that mortality rates in the ED increased with each decade, with the exception of patients over 90 years old who had lower mortality rates. This may be attributed to the fact that patients over 90 years old had fewer ED visits.

Our study highlights the high utilization of EMS by young patients, but interestingly, their triage codes were mainly yellow-green, indicating that they did not require emergency care and could have been treated as outpatients. This highlights the growing issue of inappropriate use of EMS and the need for better allocation of EMS resources. Future EMS systems should be designed to effectively analyze patients' characteristics and triage them appropriately to ensure the most efficient use of resources (Andrew et al, 2020). Telephone counseling has been suggested in previous studies as a potential method to address the growing demand for EMS and to help differentiate inappropriate applications (Dale et al., 2004).Research has indicated that telephone triage can serve as a viable approach to managing the growing number of non-urgent requests for EMS services and separating inappropriate applications, thus helping to redirect limited resources to where they are most needed (Karakoyun, Golcuk, 2022).

Although this study provides valuable insights into the epidemiology of adult ED visits arriving via EMS, there are several potential limitations that should be considered. Firstly, the study used retrospective methods, which may introduce bias or limit the ability to control for confounding variables. Additionally, the study may only represent a specific population or demographic group, limiting its generalizability to other populations. Another limitation is that the study relied on data from electronic health records, which may not capture all relevant patient information or may have missing data. Moreover, the study focused on a specific time period or geographic region, which may not reflect current trends in EMS use. Furthermore, the study only included patients who arrived at the ED via EMS and did not include patients who arrived by other means, which may have led to an underestimation of the overall burden of ED visits. Importantly, the study did not evaluate the appropriateness of EMS use or the quality of care provided by EMS. Finally, the study did not evaluate the long-term outcomes of patients who received care through EMS, such as morbidity, mortality, or quality of life. These limitations should be considered when interpreting the findings of this study and highlight the need for further research to better understand the epidemiology of adult EMS use and its impact on patient outcomes.

5. CONCLUSION

In conclusion, the findings of this study highlight the importance of evaluating the use of EMS in the adult population, especially with respect to patient demographics, triage codes, ambulance types, and hospitalization rates. Further investigation into the epidemiology of adult EMS use is warranted, as it may have significant implications for operational, educational, and public health purposes. The development of guidelines regarding the appropriate use of EMS is essential for the efficient allocation of emergency medical resources and to ensure patient safety.

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