ISSN: 2651-4311

VOLUME CİLT: 8 ISSUE SAYI: 2 YEAR YIL: 2025

ANATOLIAN

JOURNAL OF EMERGENCY MEDICINE

ANADOLU ACİL TIP DERGİSİ

@AnatolianJEM

TÜRKİYE ACİL TIP DERNEĞİ
Emergency Medicine Association of Turkey
Issued by The Emergency Medicine Association Of Turkey
anatolianjem.com

TECHNICAL REVIEW BOARD

ADVISORY BOARD

İÇİNDEKİLER/CONTENTS

Anatolian Journal of Emergency Medicine 2025;8(2):47-53

ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Evaluation of Work-Related Anxiety and Associated Factors Among Sixth-Year Medical Students in the Emergency Department

Tıp Fakültesi Altıncı Sınıf Öğrencilerinin Acil Serviste Çalışma Anksiyetesinin ve İlişkili Faktörlerin Değerlendirilmesi

Gülten Kara[1], Mehmet Birkan Korgan[2], Kemal Gökçek[3], Rezan Karaali[4], Hakan Gülmez[5], Erkan Güvenç[1], Mustafa Küçük[1]

ABSTRACT

Aim: This study aims to evaluate work-related anxiety among sixth-year medical students in the emergency department (ED), identify associated factors, and analyze their relationship with anxiety levels.

Material and Methods: This cross-sectional survey study was conducted following approval from the ethics committee. Data were collected via the Emergency Department Work Anxiety Questionnaire (EDWAQ) and State-Trait Anxiety Inventory (STAI TX-2) and the necessary analyses were performed.

Results: A total of 151 sixth-year medical students participated in the study. The mean STAI TX-2 score was 44.7 ± 9.1, indicating moderate anxiety. Female students reported higher trait anxiety than males (p=0.002). The main anxiety triggers were fear of violence, managing multiple trauma patients, and handling pregnant patients with non-obstetric complaints. No significant anxiety difference was found between those who completed the ED internship and those who did not (p=0.87). However, internship experience improved confidence in specific clinical situations.

Conclusion: Sixth-year students experience moderate anxiety, with females reporting higher levels. While ED internships do not reduce overall anxiety, they improve skills in certain clinical situations. Fear of violence remains the primary concern. Pre-internship orientation, psychological support, and violence prevention policies could lower anxiety and enhance competence.

Keywords: Anxiety, medical students, medical education, emergency department, intern doctor.

ÖZ

Amaç: Bu çalışmada, tıp fakültesi 6.sınıf öğrencilerinin acil serviste çalışma anksiyete düzeylerinin değerlendirilmesi, acil serviste anksiyeteyle ilişkili olabilecek faktörlerin belirlenmesi ve bu faktörlerle anksiyete düzeyi arasındaki ilişkinin incelenmesi amaçlanmıştır.

Gereç ve Yöntemler: Kesitsel tasarımlı bu anket çalışması, etik kurul onayı sonrasında yürütülmüştür. Veriler, Acil Serviste Çalışma Kaygı Anketi (ASÇKA) ve Durumluk-Sürekli Kaygı Ölçeği (STAI TX-2) kullanılarak çevrimiçi toplanmış ve gerekli analizler gerçekleştirilmiştir.

Bulgular: Çalışmaya 151 6.sınıf tıp öğrencisi katılmıştır. Katılımcıların ortalama STAI TX-2 puanı 44,7 ± 9,1 olup, orta düzeyde sürekli kaygıyı göstermektedir. Kadın öğrenciler, erkeklere kıyasla daha yüksek sürekli kaygı bildirdi (p=0,002). Acil serviste şiddete uğrama korkusu, çoklu travma ve doğum dışı bir nedenle başvuran gebe hasta yönetimi, en fazla kaygı yaratan durumlardır. Acil servis stajını tamamlamış ve tamamlamamış öğrenciler arasında genel kaygı düzeyinde fark görülmedi (p=0,87). Ancak staj deneyiminin belirli klinik durumlarda özgüven kazandırdığı görülmüştür.

Sonuç: Altıncı sınıf tıp öğrencilerinin kaygı düzeyi orta seviyede olup, kadınlar daha yüksek kaygı bildirdi. Acil servis stajı, genel kaygıyı değiştirmezken, bazı klinik becerileri geliştirdi. Şiddet görme korkusu acil serviste başlıca anksiyete kaynağıdır. Staj öncesi uyum programları, psikolojik destek ve şiddet önleme tedbirleri, öğrencilerin mesleki yeterliliklerini artırarak kaygı düzeylerini azaltmada önemli bir rol oynayabilir.

Anahtar Kelimeler: Anksiyete, tıp öğrencileri, tıp eğitimi, acil tıp, intörn doktor.

Received: 28 March 2025 Accepted: 15 April 2025

[1]Buca Seyfi Demirsoy Training and Research Hospital, Department of Emergency Medicine, Izmir, Türkiye

[2]Marmara University Pendik Training and Research Hospital, Department of Emergency Medicine, Istanbul, Türkiye.

[3]Dokuz Eylül University School of Medicine, Department of Emergency Medicine, Izmir, Türkiye.

[4]Izmir Democracy University Faculty of Medicine, Department of Emergency Medicine, Izmir, Türkiye.

[5]Izmir Democracy University Faculty of Medicine, Department of Family Medicine, Izmir, Türkiye.

Corresponding Author: Mehmet Birkan Korgan, MD **Adress:** Marmara University Pendik Training and Research Hospital, Department of Emergency Medicine, Muhsin Yazicioglu St. No:10, 34899 Pendik/Istanbul, Türkiye. **Telephone:** +90 5447980601 **e-mail**: birkankorgan@gmail.com.

Atıf için/Cited as: Kara G, Korgan MB, Gokcek K, et al. Evaluation of Work-Related Anxiety and Associated Factors Among Sixth-Year Medical Students in the Emergency Department. Anatolian J Emerg Med 2025;8(2):47-53. https://doi.org/10.54996/anatolianjem.1666585.

Introduction

Anxiety is a distressing condition characterized by excessive worry, fear, or unease, often accompanied by physical symptoms, and can interfere with daily life. Unlike normal stress, anxiety often involves exaggerated fears or a perceived inability to cope, leading a persistent expectation of disaster in the individual's mind. Anxiety and related disorders are significant public health issues due to their high prevalence and potential to cause other mental illnesses (1–3). In healthcare, anxiety can impair critical cognitive functions—such as attention, memory, and motor skills-essential for physicians to provide safe and effective patient care (1).

Medical education, known for its academic and emotional demands, frequently exposes students to anxiety-provoking situations (1,4,5). While moderate anxiety can enhance adaptation, excessive levels can impair functionality, leading to poor academic performance, cognitive impairment, and communication difficulties. Studies show that anxiety and depression are prevalent among medical students, yet many avoid seeking help due to stigma or professional concerns, risking long-term effects on their careers and patient care (1,6–8).

The internship period, as the final phase of medical education, is a critical stage where students apply theoretical knowledge through practical experience, effectively preparing them for their professional roles. During this period, students realize that their knowledge is not just for exams but essential skills for their future careers. After six years of medical education, most physicians aim for specialization, but with only about 10% entering residency, the majority become general practitioners, often assigned to emergency departments (ED) (9). Students preparing to start their professional careers in emergency departments gain hands-on experience during emergency medicine rotations by managing critical cases—such as cardiopulmonary arrest, myocardial infarction, stroke, and multiple trauma—actively participating in diagnosis and treatment, which equips them to handle medical conditions requiring rapid intervention in real-world practice.

While general anxiety among medical students is well-documented, ED-specific triggers remain underexplored, particularly among intern doctors. This study aims to evaluate work-related anxiety among sixth-year medical students in the emergency department, identify potential contributing factors, and analyze their relationship with anxiety levels.

Material and Methods

This cross-sectional survey study was conducted with the approval of the Buca Seyfi Demirsoy Hospital Non-Interventional Research Ethics Committee (Decision No:2024/295). Sixth-year medical students in [City İzmir] were targeted, contacted via academic coordinators, students were informed about the study's purpose, and those who voluntarily agreed to participate, regardless of their emergency medicine rotation status, received an online survey form via Google Forms to complete.

This study was conducted anonymously, collecting no identifying participant information. Alongside demographic data, participants completed the Emergency Department Work Anxiety Questionnaire (EDWAQ), developed by the researchers, and the 20-item trait anxiety section (STAI TX-2) of the State-Trait Anxiety Inventory (STAI), which assesses trait anxiety. The online survey ran from July to September 2024, spanning three months.

The Emergency Department Work Anxiety Questionnaire (EDWAQ) is a 20-item survey created by researchers based on the "Acil Çalışma Ölçeği (AÇÖ)" questions, which were previously designed and studied considering common situations encountered in emergency departments (10). The questionnaire includes questions related to factors that may contribute to anxiety, such as the work environment and communication, professional competence, specific patient groups, job satisfaction, and future career preferences. Participants responded using a four-point Likert scale(0:Not anxious, 1:Slightly anxious, 2:Moderately anxious, 3:Highly anxious) to identify factors contributing to anxiety in the emergency department.

The State-Trait Anxiety Inventory 2 (STAI TX-2), developed by Spielberger in 1970, assesses trait anxiety, which reflects an individual's tendency to perceive situations as stressful and experience discomfort even in neutral situations (11). This inventory aims to determine an individual's general emotional state, independent of their current circumstances or conditions. Adapted into Turkish by Öner and Le Compte with validated reliability (12), scores ranging from 20 to 80, with higher scores indicating higher anxiety. Scores are categorized as low (20-39), moderate (40-59), and high anxiety (60-80) (13).

Statistical Analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 24.0 software. The normality of the data distribution was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Numerical data were summarized as mean $\pm$ standard deviation and median (minimum-maximum), while categorical data were presented as frequencies (n) and percentages (%). Differences between numerical variables were analyzed with Student's t-test and one-way analysis of variance (ANOVA) for groups showing normal distribution and using nonparametric equivalent tests for groups not showing normal distribution. Relationships between categorical variables were analyzed using the Chi-square test. Spearman's rank correlation analysis was used to evaluate the relationships between variables. In all statistical analyses, the significance level was set at $p<0.05$.

Results

A total of 151 sixth-year medical students participated, with a median age of 24 (IQR:24-25) and 49% (n=74) female. Of these, 78.1% (n=118) had completed their emergency medicine rotation, while 21.9% (n=33) had not. Sociodemographic details are presented in Table 1.

Based on the STAI TX-2 inventory, the participants' mean anxiety score was 44.7±9.1 (min:21, max:73), indicating a moderate level of anxiety. Among them, 31.1% (n=47) had low anxiety, 62.9% (n=95) had moderate anxiety, and 6% (n=9) had high anxiety. Gender-based analysis showed that female participants had a mean anxiety score of 47±8.1 (min:31, max:65), while males scored 42.4±9.7 (min:21, max:73), with a significant difference between groups

Variable		n (%)
Gender	Female	74 (49.0)
	Male	75 (49.7)
	Not specified	2 (1.3)
Age	22	7 (4.6)
	23	30 (19.9)
	24	65 (43.0)
	25	36 (23.8)
	26	12 (7.9)
	52	1 (0.7)
Marital Status	Single	148 (98.0)
	Married	2 (1.3)
	Not specified	1 (0.7)
Completion of emergency medicine rotation	Yes	118 (78.1)
	No	33 (21.9)
Total		151 (100.0)

Table 1. Sociodemographic data of participants

(p=0.002). However, no significant difference was found between those who completed the emergency medicine rotation and those who had not (p=0.87). STAI TX-2 responses, anxiety scores, and p-values are summarized in Table 2.

EDWAQ responses identified “experiencing violence in the emergency department” as the most anxiety-inducing situation, followed by “managing multiple trauma patients” and “managing pregnant patients presenting with non-obstetric complaints”. The least anxiety-provoking situations were “difficulty in communicating with support staff” and “difficulty in communicating with patients”. Additionally, choosing surgical or non-surgical specialties in the medical residency exam was associated with lower anxiety levels. Analysis of EDWAQ responses revealed no significant difference in mean anxiety scores between response groups for “managing pregnant patients presenting with non-obstetric complaints” and “choosing a non-surgical specialty in the medical residency exam” (p=0.41 and p=0.18, respectively). However, all other variables showed significant differences in mean anxiety scores between response groups (p<0.05). Correlation analysis indicated a weak positive correlation between these variables and anxiety levels.

Comparison of participants’ emergency medicine rotation status and EDWAQ responses revealed significant differences in three situations. Those who completed the rotation reported lower anxiety when managing acute pulmonary edema and resuscitation patients (p=0.031 and p=0.028, respectively) but higher anxiety when dealing with patients' agitated relatives (p=0.024). No significant differences were found for other questions (p>0.05).

The distribution of responses to the EDWAQ questions, the mean anxiety scores of the groups, intergroup differences, and correlation coefficients between each parameter and STAI TX-2 scores are summarized in Table 3.

STAI TX-2 Items	Almost never (1) n (%)	Sometimes (2) n (%)	Often (3) n (%)	Almost always (4) n (%)
I feel fine	5 (3.3)	82 (54.3)	52 (34.5)	12 (7.9)
I tire quickly	25 (16.5)	82 (54.3)	35 (23.2)	9 (6.0)
I feel like crying	75 (49.7)	52 (34.4)	19 (12.6)	5 (3.3)
I wish I could be as happy as others seem to be	25 (16.5)	59 (39.1)	45 (29.8)	22 (14.6)
I am losing opportunities because I cannot make decisions fast	38 (25.2)	85 (56.3)	21 (13.9)	7 (4.6)
I feel rested	59 (39.1)	77 (51)	12 (7.9)	3 (2.0)
I am calm	10 (6.6)	59 (39.1)	55 (36.4)	27 (17.9)
I feel that difficulties are piling up in such a way that I cannot overcome them	53 (35.1)	79 (52.3)	12 (7.9)	7 (4.6)
I worry too much about things that do not really matter	32 (21.2)	77 (51)	30 (19.9)	12 (7.9)
I am happy	16 (10.6)	70 (46.4)	54 (35.7)	11 (7.3)
I am inclined to take things hard	44 (29.1)	75 (49.7)	20 (13.3)	12 (7.9)
I lack self-confidence	69 (45.7)	67 (44.4)	12 (7.9)	3 (2.0)
I feel secure	17 (11.3)	84 (55.6)	47 (31.1)	3 (2.0)
I try to avoid facing a crisis or difficulty	32 (21.2)	69 (45.7)	38 (25.2)	12 (7.9)
I feel blue	37 (24.5)	80 (53)	28 (18.5)	6 (4.0)
I am content	18 (11.9)	65 (43)	51 (33.8)	17 (11.3)
Some unimportant thoughts run through my mind and bother me	25 (16.6)	86 (56.9)	27 (17.9)	13 (8.6)
I take disappointments so keenly that I cannot get them out of my mind	56 (37.1)	65 (43)	25 (16.6)	5 (3.3)
I am a steady person	3 (2.0)	47 (31.1)	71 (47)	30 (19.9)
I become tense and upset when I think about my current concerns	22 (14.6)	73 (48.3)	38 (25.2)	18 (11.9)

Variable		STAI TX-2 Score Mean (Standard Deviation)	p
Gender	Female	47 (8.1)	0.002
	Male	42.4 (9.7)	
Completion of Emergency Medicine Rotation	Yes	44.8 (9.5)	0.87
	No	44.5 (7.7)	
Total		44.7 (9.1)	

Table 2. State-Trait Anxiety Inventory2 (STAI TX-2), Participants' Responses, Anxiety Scores, and p-values.

ED Stressors	Not anxious		Slightly anxious		Moderately anxious		Highly anxious		p	Spearman's rho	p
	n (%)	Anxiety Level Score Mean (SD)	n (%)	Anxiety Level Score Mean (SD)	n (%)	Anxiety Level Score Mean (SD)	n (%)	Anxiety Level Score Mean (SD)			
Working alone in an emergency department	19 (12.6)	40.7 (9.02)	49 (32.5)	42.4 (7.80)	47 (31.1)	44.0 (8.21)	36 (23.8)	51.1 (9.33)	<0.001	0.372	<0.001
Experiencing violence while working in the emergency department	21 (13.9)	39.2 (7.49)	30 (19.9)	42.5 (9.62)	42 (27.8)	45.1 (7.84)	58 (38.4)	47.7 (9.30)	0.001	0.296	<0.001
Difficulty in communicating with support staff	91 (60.3)	43 (9.04)	39 (25.8)	46.9 (8.60)	18 (11.9)	48.7 (9.29)	3 (2)	45.7 (10.0)	0.031	0.236	0.004
Difficulty in communicating with patients	79 (52.3)	42.5 (8.78)	52 (34.4)	45.9 (8.49)	13 (8.6)	49.4 (5.06)	7 (4.6)	52.7 (15.1)	0.004	0.276	<0.001
Dealing with patients' agitated relatives	42 (27.8)	41.1 (9.27)	59 (39.1)	44.6 (8.05)	32 (21.2)	46.1 (7.85)	18 (11.9)	51.2 (10.9)	<0.001	0.304	<0.001
Informing the patient's relatives of the death news	27 (17.9)	42.4 (8.14)	49 (32.5)	43 (9.94)	40 (26.5)	45.1 (7.91)	35 (23.2)	48.6 (9.17)	0.020	0.228	0.005
Managing a resuscitation patient	48 (31.8)	41.2 (8.62)	51 (33.8)	45.6 (8.66)	35 (23.2)	46.2 (9.23)	17 (11.3)	49.7 (8.95)	0.002	0.295	<0.001
Managing a patient with acute myocardial infarction	31 (20.5)	41.9 (8.96)	59 (39.1)	43.9 (8.35)	45 (29.8)	45.5 (8.16)	16 (10.6)	51.4 (11.9)	0.005	0.256	0.002
Managing a patient with acute pulmonary edema	22 (14.6)	40.2 (7.56)	69 (45.7)	43.8 (8.52)	44 (29.1)	45.8 (8.73)	16 (10.6)	52 (10.76)	<0.001	0.318	<0.001
Managing a patient with multiple trauma	16 (10.6)	39.7 (8.93)	38 (25.2)	43.1 (7.84)	58 (38.4)	44.4 (8.79)	39 (25.8)	49 (9.56)	0.001	0.293	<0.001
Managing a patient with anaphylaxis	47 (31.1)	41.8 (8.78)	58 (38.4)	44.7 (8.09)	34 (22.5)	45.3 (8.28)	12 (7.9)	55 (11.07)	<0.001	0.289	<0.001
Managing a patient with intoxication	33 (21.9)	42.1 (8.55)	53 (35.1)	43.6 (8.84)	47 (31.1)	47.7 (9.94)	18 (11.9)	45.1 (7.28)	0.033	0.218	0.007
Managing a patient with stroke	22 (14.6)	40.7 (9.96)	59 (39.1)	42.7 (8.07)	52 (34.4)	47.1 (7.93)	18 (11.9)	49.6 (11.3)	<0.001	0.326	<0.001
Administer sedation-analgesia to patients	32 (21.2)	41.3 (7.03)	56 (37.1)	44.5 (8.89)	47 (31.1)	45.9 (10.7)	16 (10.6)	49.3 (6.76)	0.024	0.249	0.002
Managing a patient with Chronic Obstructive Pulmonary Disease	63 (41.7)	42 (8.36)	67 (44.4)	46.2 (9.90)	17 (11.3)	47.8 (5.87)	4 (2.6)	50.5 (10.4)	0.011	0.277	<0.001
Managing pregnant patients presenting with non-obstetric complaints	27 (17.9)	41.7 (11.5)	50 (33.1)	44.7 (8.69)	52 (34.4)	46.5 (8.86)	22 (14.6)	44.4 (6.98)	0.18	0.134	0.1
Managing a patient with gastrointestinal bleeding	42 (27.8)	40.3 (7.54)	71 (47.1)	46.1 (9.41)	31 (20.5)	45.9 (8.78)	7 (4.6)	53.1 (6.12)	<0.001	0.335	<0.001
The absence of the professional satisfaction I expected when choosing medical school.	41 (27.2)	41.4 (8.56)	45 (29.8)	45 (8.27)	27 (18.9)	43.5 (7.75)	38 (25.2)	48.9 (10.3)	0.002	0.251	0.002
Choosing a surgical specialty in the medical residency exam	55 (36.4)	42 (9.37)	26 (17.2)	44 (7.83)	26 (17.2)	45 (7.26)	44 (29.1)	48.5 (9.56)	0.005	0.283	<0.001
Choosing a non-surgical specialty in the medical residency exam	63 (41.7)	44.2 (8.74)	48 (31.8)	43.8 (8.79)	20 (13.2)	47.2 (10.1)	20 (13.2)	46.3 (10.3)	0.41	0.082	0.31

Table 3. Distribution of responses to the Emergency Department Work Anxiety Questionnaire (EDWAQ), anxiety scores, intergroup differences, correlation coefficients and p-values with STAI TX-2 scores.

Discussion

In our study, the participants' mean anxiety score indicated a moderate level of trait anxiety, with 62.9% of the participants exhibiting moderate levels of trait anxiety. The most anxiety-inducing situations in the emergency department were identified as experiencing violence during work, managing patients with multiple trauma, and managing pregnant patients with non-obstetric reasons. Completing the emergency medicine rotation did not significantly affect trait anxiety levels; however, specific situations were found to influence anxiety responses.

Numerous studies have reported high anxiety levels among pregraduate medical students (1,5,7,14,15). Key factors include high self-expectations, heavy academic workload, exam pressure, and, notably, fear of failure during preparation for the medical residency exam (5). Approaching graduation, professional concerns, mandatory service, and working as a general practitioner further contribute to

anxiety (5,16). Although our study focused on anxiety related to working in the emergency department and did not directly evaluate the causes of anxiety among them, the anxiety levels observed were consistent with those reported in the literature.

Previous studies have identified a significant association between trait anxiety and both depression and burnout, demonstrating that these symptoms are more prevalent among individuals with high anxiety levels (7,15,17). Healthcare workers are reported to experience higher anxiety and depression levels compared to the general population (18,19). Considering these findings, it can be concluded that early interventions to address the high levels of anxiety experienced during medical school may have a positive impact, not only on individuals' future lives but also on their contributions to society. Our study found higher anxiety in females than males, aligning with most literature (7,15,17,20), though Öncü et al. noted no gender difference in anxiety levels, only greater willingness among females to seek psychological support (21). This difference may be due to women's higher anxiety responses to stress and men's tendency to suppress such expressions, viewing them as a weakness.

Emergency departments, often the starting point for new physicians, are major anxiety sources due to their chaotic, stressful nature, constant service demands, frequent violence against healthcare workers, and need for rapid decision-making (10). The emergency medicine rotation is a key part of pre-graduate training, as it exposes students to these challenges for the first time. Although our study did not assess pre- and post-rotation anxiety, no significant relationship was found between completing the rotation and trait anxiety levels. However, EDWAQ findings suggest that the rotation experience reduces anxiety in specific situations. Those who completed the rotation reported lower anxiety when managing critical situations like acute pulmonary edema and resuscitation, likely stems from enhanced self-confidence, awareness, and competence gained during the rotation for handling critical emergencies requiring effective and accurate intervention and prompt response.

According to EDWAQ responses, "experiencing violence while working in the emergency department" was the most anxiety-inducing situation. Violence against healthcare workers is a significant global issue (22,23), with studies in our country highlighting emergency departments as the primary setting for such incidents (24,25). The emergency medicine rotation, which serves as preparation for professional life after graduation, provides medical students with direct exposure to this reality, and leads to a more tangible perception of the risk of experiencing violence than anticipated, thereby increasing anxiety related to this issue. The threat of violence, a well-known anxiety source for healthcare workers, is also a significant factor contributing to anxiety among medical students. And this fear also contributes to avoidance of emergency medicine careers (26).

Managing multiple trauma patients in the emergency department, a major anxiety source for participants, requires a multidisciplinary approach involving rapid decision-making, effective interventions, coordination with specialties, and communication with families (27). Students facing such complex situations for the first time may feel inadequate and anxious due to limited knowledge and experience. Managing pregnant patients with non-obstetric complaints in the emergency department is a significant anxiety source for medical students. Effective management requires assessing the health of both mother and fetus, selecting appropriate diagnostic tests, and planning treatment. The possibility of the complaint involving the fetus complicates decision-making, necessitating greater caution and increasing anxiety among students who may feel inadequate due to limited experience.

Participants exhibited less anxiety about communication difficulties with patients and staff compared to concerns like clinical situations and professional competence. This aligns with Ergin et al.'s findings, which ranked communication-related anxiety lower among professional concerns (14). However, an earlier study by Yeniçeri et al. identified communication anxiety as more significant than issues like professional competence, emergency management, and misdiagnosis (5). These differences suggest a shift in occupational anxiety among healthcare workers, possibly linked to increasing concerns about malpractice. In contrast, participants who completed the emergency medicine rotation reported higher anxiety when dealing with patients' agitated family members. This finding is thought to be related to the possibility of experiencing violence, which was identified as one of the most anxiety-inducing factors in our study. Directly witnessing or experiencing agitation in the emergency department may have heightened their awareness that the risk of encountering violence could be higher than they anticipated. Although students did not report significant communication difficulties with patients and staff, the rotation experience heightened anxiety about interacting with agitated relatives, possibly due to this perceived threat.

Anxiety related to choosing surgical or non-surgical specialties in the medical specialty exam was less prominent compared to clinical situations and professional competence. While medical specialty exams are noted as major anxiety sources in the literature (5,14,16), our study found that specialty choice was not a significant anxiety factor compared to clinical and professional competence concerns. This may be explained by students with predominant concerns about professional inadequacy viewing residency as an opportunity to gain competence and as a strategy to avoid more anxiety-inducing situations. Additionally, choosing surgical specialties provoked more anxiety than non-surgical ones. Although surgical fields are often thought to offer greater job satisfaction, studies show no significant difference in job satisfaction between the two (19,28). However, anxiety levels have been reported to be higher in surgical specialties (19). This may be linked to the increasing concern about malpractice cases in recent years, which may cause more anxiety within surgical fields. This malpractice-related anxiety may overshadow professional satisfaction, causing hesitation in choosing surgical specialties.

In the EDWAQ, anxiety scores rose with increasing concern across response groups for all questions except "Managing pregnant patients presenting with non-obstetric

complaints" and "Choosing a non-surgical specialty in the residency exam". This aligns with higher-anxiety individuals reporting greater concern, as anticipated. The absence of a significant difference in anxiety scores among the response groups for the question "Managing pregnant patients presenting with non-obstetric complaints" suggests that this issue represents a general source of anxiety for medical students, independent of individual anxiety levels. This finding indicates the need for developing training and support programs focused on the management of pregnant patients presenting with non-obstetric emergencies. "Choosing a non-surgical specialty in the medical residency exam", which caused less anxiety than other EDWAQ parameters, showed no significant difference in anxiety scores across response groups. This suggests that choosing a non-surgical specialty is not a major anxiety source for all students and varies based on individual factors. Non-surgical specialties are thought to induce less anxiety due to their lower risk and more predictable working conditions. However, personal preferences, experiences, and expectations may influence anxiety levels. Medical education should offer tailored support during specialty selection, considering students' expectations and anxiety levels. Furthermore, in-depth exploration of anxieties related to specialty choice represents an important area for future research.

The anxiety-inducing factors associated with the emergency medicine, as mentioned above, combined with the fact that students encounter these conditions for the first time during their emergency medicine internship, are significant contributors to increased anxiety levels. However, over time, students' adaptation to the emergency department environment, the reinforcement of theoretical knowledge through practical applications, and the development of competence through managing various emergency medical situations may have provided opportunities to overcome anxiety related to lack of knowledge or experience. This could explain why no significant change in overall anxiety levels was observed in our study, suggesting that students were able to balance their anxiety through the experience gained during this process. Developing orientation programs for students prior to the emergency medicine rotation, enhancing psychological support services for anxiety management, and providing professional assistance when needed under the principles of confidentiality could help students cope more effectively with the challenges they may face in emergency departments. Such supportive interventions are believed to not only positively influence students' professional development but also enhance the quality of healthcare services they provide, thereby benefiting public health.

Conclusion

This study showed that sixth-year medical students experience moderate anxiety, with the most prominent triggers being fear of violence, managing multiple trauma patients, and treating pregnant patients with non-obstetric complaints. While emergency department rotations did not significantly reduce overall anxiety levels, they helped improve confidence in managing specific clinical scenarios. Female students reported higher anxiety levels than males. These findings highlight the need for structured pre-rotation orientation, psychological support services, and workplace violence prevention strategies to reduce anxiety and support professional development in future physicians.

Conflict of Interest: The authors declare that there is no conflict of interest.

Financial Support: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' Contribution: GK: Data curation, investigation, methodology, project administration, visualization, writing – original draft (lead) **MBK:** Data curation, formal analysis, software, investigation, writing – original draft (lead) **KG:** Conceptualization, data curation, formal analysis, investigation, methodology, project administration, supervision, writing – review & editing **RK:** Data curation, investigation, visualization, writing – original draft (supporting) **HG:** Data curation, investigation, methodology, formal analysis, software, writing – original draft (supporting) **EG:** Data curation, investigation, writing – original draft (supporting) **MK:** Data curation, Investigation, writing – original draft (supporting)**.** All authors read and approved the final version of the manuscript.

Ethical Approval: Ethical approval was obtained from the Buca Seyfi Demirsoy Hospital Non-Interventional Research Ethics Committee before the study (Decision No: 2024/295).

References

1. Quek TTC, Tam WWS, Tran BX, et al. The Global Prevalence of Anxiety Among Medical Students: A Meta-Analysis. Int J Environ Res Public Health. 2019;16(15):2735. doi:10.3390/ijerph16152735.
2. Özakkaş, T. (2014). Anksiyete Bozuklukları ve Tedavisi. Psikoterapi Enstitüsü Eğitim Yayınları.19:1-26.
3. Kessler RC, Ruscio AM, Shear K, Wittchen HU. Epidemiology of anxiety disorders. Curr Top Behav Neurosci. 2010;2:21-35. PMID: 21309104
4. Radcliffe C, Lester H. Perceived stress during undergraduate medical training: a qualitative study. Med Educ. 2003;37(1):32-38. doi:10.1046/j.1365-2923.2003.01405.x.
5. Yeniçeri N, Mevsim V, Özçakar N, Özan S, Güldal D, Başak O. Tıp Eğitimi Son Sınıf Öğrencilerinin Gelecek Meslek Yaşamları İle İlgili Yaşadıkları Anksiyete İle Sürekli Anksiyetelerinin Karşılaştırılması. DEU Tıp Derg. 2007;21(1):19-24.
6. Rotenstein LS, Ramos MA, Torre M, et al. Prevalence of Depression, Depressive Symptoms, and Suicidal Ideation Among Medical Students. JAMA. 2016;316(21):2214-2236. doi:10.1001/jama.2016.17324.
7. Yıldırım Öztürk EN, Uyar M, Yücel M, Şahin TK, Türker S. Tıp Fakültesi Öğrencilerinin Depresyon ve Anksiyete Düzeylerinin Saptanması ve Bu Düzeyleri Etkileyen Faktörlerin Belirlenmesi. ESTÜDAM Halk Sağlığı Dergisi. 2020;5(3):418-29.
8. Moreira de Sousa J, Moreira CA, Telles-Correia D. Anxiety, Depression and Academic Performance: A Study Amongst Portuguese Medical Students Versus Non-Medical Students. Acta Med Port. 2018;31(9):454-462. doi:10.20344/amp.9996.
9. Mayda A, Yılmaz M, Bolu F, et al. Bir Tıp Fakültesi 4, 5 ve 6. Sınıf Öğrencilerinde Gelecek ile İlgili Kaygı Durumunun Değerlendirilmesi. DÜ Sağlık Bil Enst Derg. Kasım 2014;4(3):7-13.
10. Koçak AO. Acil Tıp Stajının Tıp Fakültesi 6. Sınıf Öğrencilerinde Mesleki Anksiyete ve Depresyon Üzerine Etkisinin Araştırılması. Available at: https://tez.yok.gov.tr/UlusalTezMerkezi/tezDetay.jsp?id=zaqCkotWF0

GczY1L1YPG6g&no=XyqQ3c8KqNNpZ2CuTqh3dg. Accessed 20 March 2025.
11. Spielberger CD, Gorsuch RL, Lushene RE. The State-Trait Anxiety Inventory (Test Manual). Consulting Psychologists Press; 1970.
12. Öner N, Le Compte A. Süreksiz Durumluk / Sürekli Kaygı Envanteri El Kitabı. 2. Basım. Boğaziçi Üniversitesi Yayınevi; 1982.
13. Sesti AM. State Trait Anxiety Inventory (STAI) in medication clinical trials. Qual Life Newsl. 2000;(25):15-16.
14. Ergin A, Uzun SU, Topaloğlu S. Pamukkale Üniversitesi Tıp Fakültesi 5. ve 6. Sınıf Öğrencilerinin Sürekli Kaygı ve Mesleki Kaygı Düzeyleri ve Bunları Etkileyen Etkenler. MMJ. 2016;3(3):16-21.
15. Capdevila-Gaudens P, García-Abajo JM, Flores-Funes D, et al. Depression, anxiety, burnout and empathy among Spanish medical students. PLOS One. 2021;16(12):e0260359. doi:10.1371/journal.pone.0260359.
16. Yasin YK, Öztürk S, Dereboy Ç, et al. A Qualitative Research on the Occupational Anxieties Final Year Medical Students in Medical Faculty, Aydın. Tıp Eğitimi Dünya. 2018;17(52):35-49. doi:10.25282/ted.377160
17. Brenneisen Mayer F, Souza Santos I, Silveira PSP, et al. Factors associated to depression and anxiety in medical students: a multicenter study. BMC Med Educ. 2016;16(1):282. doi:10.1186/s12909-016-0791-1.
18. Caplan RP. Stress, anxiety, and depression in hospital consultants, general practitioners, and senior health service managers. BMJ. 1994;309(6964):1261-1263.
19. Demiral Y, Akvardar Y, Ergör A, et al. Üniversite Hastanesinde Çalışan Hekimlerde İş Doyumunun Anksiyete ve Depresyon Düzeylerine Etkisi. DEU Tıp Derg. 2006;20(3):157-164.
20. Tunç AY, Yapıcı G. Bir tıp fakültesindeki öğrencilerin depresyon, anksiyete ve stres düzeylerinin değerlendirilmesi. Turk J Public Health. 2019;17(2):153-168. doi:10.20518/tjph.423636.
21. Öncü B, Şahin T, Özdemir S, et al. Tıp fakültesi öğrencilerinde depresyon, anksiyete ve stres düzeyleri ve ilişkili etmenler. Kriz Derg. 2013;21(1):1-10. doi:10.1501/Kriz_0000000333.
22. Lu L, Dong M, Wang SB, et al. Prevalence of Workplace Violence Against Health-Care Professionals in China: A Comprehensive Meta-Analysis of Observational Surveys. Trauma Violence Abuse. 2020;21(3):498-509. doi:10.1177/1524838018774429.
23. Taylor JL, Rew L. A systematic review of the literature: workplace violence in the emergency department. J Clin Nurs. 2011;20(7-8):1072-1085. doi:10.1111/j.1365-2702.2010.03342.x.
24. Devebakan N, Bağci H, Sariçam H, et al. A Retrospective Comparative analysis of “code white” Reporting in a university hospital on the extent of violence in healthcare settings. Prizren Soc Sci J. 2024;8(2):35-42. doi:10.32936/pssj.v8i2.537.
25. Eğici MT, Öztürk GZ. Beyaz Kod Verileri Işığında Sağlık Çalışanlarına Yönelik Şiddet. Ank Med J. 2018;18(2):224-231. doi:10.17098/amj.436537.
26. Göksu MM, Taslidere B. Tıp Fakültesi Son Sınıf Öğrencilerin Tıpta Uzmanlık Sınavında Tercihlerini Etkileyen Faktörler ve Acil Tıp Uzmanlığı Dalı Hakkında Tutumları. Anatol J Emerg Med. 2021;4(1):6-11.
27. 10th Edition of the Advanced Trauma Life Support® (ATLS®) Student Course Manual. Chicago (IL): American College of Surgeons; 2018.
28. Uyar M, Eren G, Yücel M. Bir Üniversite Hastanesinde Araştırma Görevlisi Olarak Çalışan Hekimlerin Tükenmişlik Düzeyi ve İş Doyumu Durumlarının Belirlenmesi ve Etkileyen Faktörlerin Değerlendirilmesi. Turk Klin J Med Sci. 2021;41(3):234-241. doi:10.5336/medsci.2021-81673.

Anatolian Journal of Emergency Medicine 2025;8(2):54-58

ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Can Previous D-Dimer Levels Predict Future Elevations in Emergency Department Patients?

Acil Servis Hastalarında Önceki D-Dimer Seviyeleri Gelecekteki Yükselmeleri Tahmin Edebilir mi?

Yeşim Eyler[1], Murat Yeşilaras[2], Turgay Yılmaz Kılıç[1], İnanç Karakoyun[3], Deniz İlhan Topçu[3]

ABSTRACT

Aim: Excluding or confirming pulmonary embolism in the emergency department requires an effective and rapid strategy. The D-dimer cut-off value adjusted for age and clinical probability has been determined in prospective studies, allowing safe exclusion in more patients. However, no recommendations exist for predicting new test results based on the previous D-dimer values. This study aimed to investigate the risk of high d-dimer test results in patients undergoing D-dimer testing in the emergency department, based on patient characteristics and previous test results.

Material and Methods: This retrospective study used data from patients who underwent D-dimer testing between January 1, 2009, and December 31, 2019, in a tertiary hospital ED. Patients with an interval between two D-dimer results of 30 days to 1095 days were included in the study. The D-dimer value to be estimated was expressed as the index D-dimer value, and the D-dimer value used to estimate this value was expressed as the previous D-dimer value. The upper limit value of D-dimer was determined according to the patient's age at the test date. Binary logistic regression analysis was used in the analysis of factors associated with high D-dimer values. All analyses were performed at a 95% confidence interval. p-values below 0.05 were considered significant.

Results: The median age of the 358 patients included in the study was 61 years, and 60.6% were female. If the previous D-dimer value was above the normal value, the odds of an elevated index value increased 4.170-fold. In addition, If the previous D-dimer value exceeded 1,000 µg/L FEU, the odds increased 4.704-fold.

Conclusion: In patients with previously elevated D-dimer values within the past three years, the new D-dimer value is likely to be high. In such cases, performing advanced diagnostic tests instead of waiting for the test results may save time.

Keywords: D-dimer, emergency department, emergency medicine, pulmonary embolism, venous thromboembolism

ÖZ

Amaç: Acil serviste pulmoner emboliyi dışlamak veya doğrulamak etkili ve hızlı bir strateji gerektirir. Daha önceki prospektif çalışmalarda; yaş ve klinik olasılık için ayarlanmış D-dimer kesme değerleri belirlenmiştir ve daha fazla hastayı güvenli bir şekilde dışlamamızı sağlamıştır. Ancak, önceki test sonuçlarına dayanarak yeni test sonucu hakkında bir tahminde bulunma önerisi yoktur. Bu çalışma, acil serviste D-dimer test istemi yapılacak hastalarda, önceki test sonuçlarına ve hasta özelliklerine dayanarak, D-dimer test sonuçlarının yüksek çıkma riskini araştırmayı amaçlamıştır.

Gereç ve Yöntemler: Bu çalışma, üçüncü basamak bir hastanenin acil servisinde 01.01.2009-31.12.2019 tarihleri arasında, D-dimer değerleri bakılan hastaların verileriyle retrospektif olarak yapılmıştır. İki D-dimer sonucu arasındaki süre 30 gün ile 1095 gün arasında olan hastalar çalışmaya dahil edildi. Hesaplanması gereken D-dimer değeri indeks D-dimer değeri olarak ifade edildi ve bu değeri tahmin etmek için kullanılan D-dimer değeri önceki D-dimer değeri olarak ifade edildi. D-dimerin üst sınır değeri hastanın test tarihindeki yaşına göre belirlendi. Yüksek D-dimer değerleriyle ilişkili faktörlerin analizinde ikili lojistik regresyon analizi kullanıldı. Tüm analizler %95 güven aralığında yapıldı. 0,05'in altındaki p değerleri anlamlı kabul edildi.

Bulgular: Çalışmaya dahil edilen 358 hastanın median yaşı 61 yıl olup, %60,6'sı kadındı. Önceki D-dimer değeri normal değerden yüksek ise, indeks D-dimer değerinin de yüksek olma olasılığı 4,170 kat daha fazla bulundu. Ayrıca, önceki D-dimer değeri 1.000 µg/L FEU'den yüksek ise, indeks D-dimer değerinin de yüksek olma olasılığı 4,704 kat daha fazla tespit edildi.

Sonuç: Son üç yıldır D-dimer değerleri sınır değerin üstünde olan hastalarda yeni D-dimer değerinin yüksek olma olasılığı yüksektir. Bu gibi durumlarda test sonuçlarını beklemek yerine ileri tanı testleri yapmak zamandan tasarruf sağlayabilir.

Anahtar Kelimeler: D-dimer, acil servis, acil tıp, pulmoner emboli, venöz tromboembolizm

Received: 11 March 2025 Accepted: 10 May 2025

[1]İzmir City Hospital, Department of Emergency Medicine, İzmir, Türkiye

[2]University of Health Sciences, Tepecik Training and Research Hospital, Department of Emergency Medicine, İzmir, Türkiye.

[3]İzmir City Hospital, Department of Medical Biochemistry, İzmir, Türkiye

Corresponding Author: Yeşim Eyler, MD **Address:** İzmir City Hospital, Department of Emergency Medicine, İzmir, Türkiye. **Telephone:** +90 505 561 5560 | **E-mail:** dryesimeyler@gmail.com.

Atıf için/Cited as: Eyler Y, Yesilaras M, Kılıç TY, Karakoyun İ, Topçu Dİ. Can Previous D-Dimer Levels Predict Future Elevations in Emergency Department Patients?. Anatolian J Emerg Med 2025;8(2):54-58. https://doi.org/10.54996/anatolianjem.1655313.

Introduction

D-dimer is a soluble fibrin product resulting from the breakdown of vascular thrombi via the fibrinolytic mechanism. This molecule is a biomarker of hemostatic abnormalities as well as an indicator of intravascular thrombosis. Therefore, it is used as a marker of coagulation and fibrinolysis activation in many clinical conditions (1). D-dimer values increase for many reasons (venous/arterial thrombosis, disseminated intravascular coagulation, inflammation, age, surgery, trauma/burn, aortic dissection, cancer, infection/sepsis, pregnancy, liver diseases, thrombolytic therapy, renal diseases, cardiovascular diseases) (2). However, elevated values are not diagnostic of any disease.

Excluding or confirming pulmonary embolism in emergency department (ED) patients presenting with shortness of breath and/or chest pain requires an effective and rapid strategy. The pulmonary embolism diagnostic algorithm is based on clinical risk scores, D-dimer measurement, and computed tomography pulmonary angiography (CTPA) imaging. The efficacy and reliability of this sequential diagnostic algorithm have been confirmed in large prospective studies (3,4). Additionally, D-dimer has been studied extensively to exclude the diagnosis of venous thromboembolism (VTE) and is routinely used for this indication (5). While D-dimer allows accurate exclusion of thromboembolic diseases, its positive predictive value is limited and is heavily influenced by age and comorbidities (6).

Many diseases and clinical features have been reported to affect D-dimer values. The most important of these are age, renal failure, presence of malignancy, and previous thromboembolic events (7-9). The D-dimer cut-off value adjusted for age and clinical probability has been determined in prospective studies, allowing us to safely exclude more patients (10-12). However, there is no recommendation to predict the new test result based on the previous test results. In our clinical experience, in patients whose previous D-dimer value was high for any reason, the new D-dimer value is also found to be elevated. In patients in the low-risk group, D-dimer is requested to exclude the diagnosis of pulmonary embolism, and most physicians do not estimate that the test result will be high, yet they still wait for new test outcomes. Waiting for test results due to diagnostic algorithms not only negatively impacts ED crowding but also causes a delay in the diagnosis of venous thromboembolism.

This study aimed to investigate the risk of high D-dimer test results in patients undergoing D-dimer testing in the ED, based on patient characteristics and previous test results.

Material and Methods

This retrospective study was conducted with data from patients whose D-dimer values were obtained between 01.01.2009 and 31.12.2019 in the ED of a tertiary hospital. Since it has been reported that D-dimer values increase in COVID-19 infection (13), the research was conducted with patients who applied prior to the COVID-19 pandemic. All D-dimer test results during the study period were obtained from the hospital electronic information system (HIS). Ethichal approval was obtained from the University of Health Sciences Tepecik Training and Research Hospital Ethics Committee (Decision No: 2023/06-37, dated July 13, 2023).

Patients with two or more D-dimer results recorded in HIS within the specified 11-year period were included in the study. Patients were excluded from the study if the interval between two D-dimer results was shorter than 30 days or longer than 1095 days. If a patient had more than two D-dimer results, only the last consecutive measurements were considered. The interval between d-dimer measurements is at the discretion of the researchers. We chose an interval that was neither excessively frequent nor infrequent. Demographic data of the patients and the presence of active malignancy were determined from HIS and recorded.

D-dimer levels were measured using latex particle-enhanced turbidimetric immunoassay method by Sysmex CS-2500™ automated blood coagulation analyzer. The D-dimer value to be estimated was expressed as the “index D-dimer value”, and the D-dimer value used to estimate this value was expressed as the “previous D-dimer value”. Cut-off values for D-dimer was defined according to the patient's age at the test date. In the literature, the upper limit value for D-dimer is accepted as 500 µg/L FEU for those under 50 years of age and as age×10 µg/L FEU for those over 50 years of age (10).

Statistical Analysis

Data were obtained from HIS in excel format. SPSS (v20; IBM, Armonk, NY) was used in the analysis of the obtained data. The distribution of the data was evaluated with Kolmogorov-Smirnov and Shapiro-Wilk tests. It was determined that the data did not follow a normal distribution. Therefore, qualitative data were expressed as frequency, quantitative data as median and interquartile range. Binary logistic regression analysis was used in the analysis of factors associated with high D-dimer values. All analyses were performed at a 95% confidence interval. p-values below 0.05 were considered significant.

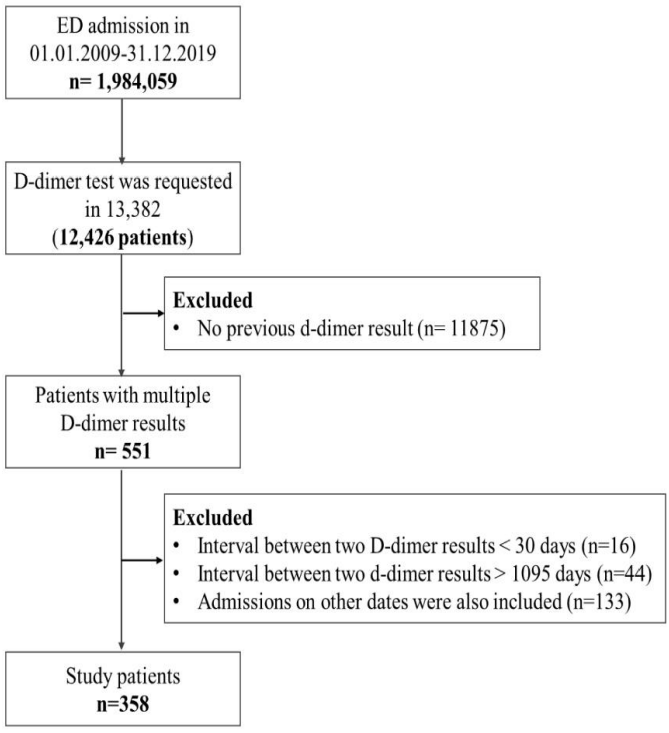

Figure 1. Patient Flow Diagram

Results

Of the 1,984,059 admissions to the ED in an 11-year period, D-dimer test was requested in 13,382 (0.67%) (12,426 patients). Of the 12,426 patients, 12,068 were excluded on the exclusion criteria (Figure 1). All analyses in this study were performed using data from the remaining 358 patients. The median age of the patients included in the study was 61 years, and 60.6% (217) were female. The median value of the index D-dimer test was 300 µg/L FEU. The patients' ages and D-dimer test results are shown in Table 1.

In 94 (26.3%) of the patients, the index D-dimer value was above the limit value determined according to age. Index D-dimer value was >1,000 µg/L FEU in 66 patients (18.4%). 90 (25.1%) of the patients, had the previous D-dimer value was above the limit value. The previous D-dimer value was >1,000 µg/L FEU in 56 patients (15.6%). The previous D-dimer value was obtained in 47.8% of patients within 1 year, 33% within 2 years, and 19.3% within 3 years.

When the index test was requested, 20 (5.6%) patients had malignancy. Factors associated with higher-than-normal levels of the index D-dimer test results are shown in Table 2.

Variables	Median value	(IQR; minimum-maximum)
Index D-dimer value (µg/L FEU)	330	(533; 30-16,504)
Patient age at the date of the index D-dimer test	61	(31;19-109)
Previous D-dimer value (µg/L FEU)	300	(499; 0-6,880)
Patient age at the date of the previous D-dimer test	60	(31;17-107)

Table 1. The ages and D-dimer test values of the patients
IQR: Interquartile Range.

Variables	p	OR	CI (%95)
Sex	0.802	0.940	0.580-1.524
Age	0.233	1.008	0.995-1.021
Malignancy	0.696	1.218	0.454-3.266
Previous D-dimer value > the limit value	<0.001	4.170	2.492-6.980
Previous D-dimer value >1,000 µg/L FEU	<0.001	4.704	2.593-8.533

Table 2. Binary logistic regression analyses for factors associated with high index D-dimer values
OR: Odds ratio, CI: confidence interval

Discussion

In this retrospective study, we found that D-dimer test was requested in 0.67% of ED visits. In 26.3% of the patients included in our study, the index D-dimer value was above the limit value determined by age, and in 25.1%, the previous D-dimer value was also above the limit value determined by age. In 18.4% of patients, the index D-dimer value was >1,000 µg/L FEU, and in 15.6%, the previous D-dimer value was also >1,000 µg/L FEU. If the previous D-dimer value was higher than the normal value, the odds of an elevated index value increased 4.170-fold. In addition, If the previous D-dimer value exceeded 1,000 µg/L FEU, the odds increased 4.704-fold.

However, in ED patients undergoing D-dimer testing, the patient's sex, age, and presence of a malignancy diagnosis were not significant predictors of high D-dimer test results.

Infections have been reported as the most common cause of elevated D-dimer levels in patients admitted to a large urban ED (14). A recent study reported that elevated D-dimer levels in ED patients were frequently (78.3%) caused by non-thrombotic factors, such as infections, inflammation, or chronic diseases (15). Additionally, elevated D-dimer levels are known to be associated with mortality and prognosis in patients without clinical evidence of thrombosis (16, 17). Given these findings, it is clear that this test, which has low specificity, should be used selectively in patients. In many patients, elevated D-dimer levels can create diagnostic uncertainty for emergency physicians. In our study conducted at a tertiary education and research hospital over an 11-year period prior to the Covid-19 pandemic, we found that D-dimer testing was requested in only 0.67% of ED patients. We believe that ED physicians may be hesitant to order this test. Further studies are needed to determine the clinical significance of elevated D-dimer levels and their impact on patient management, particularly in non-thrombotic conditions.

The ED physician aims to diagnose PE without missing any cases, reduce unnecessary CTPA, and do so as quickly as possible. To achieve this, emergency medicine clinics use the current European Society of Cardiology (ESC) guidelines (5) for patient management. D-dimer levels obtained to exclude thromboembolic diseases may be elevated due to various other conditions, often necessitating advanced diagnostic tests (5). During this period, waiting for the D-dimer test result may take a long time due to overcrowding in the ED and various technical issues. Therefore, to save time, we sought to determine whether the index D-dimer test value could be predicted based on the previous D-dimer test result

in ED patients. As a result, the probability of the index D-dimer value exceeding the age-determined limit is 4.170 times higher if the previous D-dimer value was above the limit and 4.704 times higher if the previous D-dimer value exceeded 1,000 µg/L FEU. In these cases, we believe that employing alternative diagnostic strategies, rather than waiting for the D-dimer result, may save time.

In our study, the probability of the D-dimer test result exceeding the age-adjusted threshold was not associated with the patient's gender, age, or malignancy status. The median age of the population was 61 ± 31 years, and 60.6% were female. There are conflicting data regarding the frequency of VTE between genders. While some studies suggest that gender is not an independent risk factor, others indicate that female gender may be protective against VTE (18). Additionally, many studies have reported a higher frequency of VTE recurrence in men than in women, leading to recommendations for gender-specific cut-off values (19, 20). In this study, while the relationship between gender and VTE was not investigated, no association was found between gender and elevated D-dimer levels. Since we used age-adjusted D-dimer thresholds, the lack of association between age and elevated D-dimer levels is consistent with the literature (10-12). Patients with malignancy often present to the ED with signs and symptoms suggestive of acute PE, and D-dimer levels are frequently elevated (10). It is also well-established that patients with malignancy have a four to seven times higher risk of VTE compared to those without malignancy (7,21). These patients typically have high clinical risk scores, which explains why D-dimer testing is rarely requested for malignancy patients in the ED. In our study population, only 20 (5.6%) patients had a diagnosis of malignancy. We believe that our findings are not statistically significant due to the small number of cases. Current guidelines provide clear recommendations for the diagnostic approach in non-malignant patients with suspected PE (15). However, recommendations for the diagnostic approach in patients with malignancy and suspected PE remain limited. Changes in D-dimer levels across different populations, factors influencing its elevation, and its prognostic significance should continue to be investigated.

Important limitations include the single-center, retrospective design and small sample size. Although the study covered a large time period of 11 years, the number of patients included in the study was relatively small. This was due to the fact that patients had not had previous D-dimer results within three years. This may be because different patients visited, and a new D-dimer test was not requested since the patients' previous D-dimer results were high. For some reason, D-dimer testing is rarely requested in emergency departments. This suggests that D-dimer has many aspects that need to be investigated. Other limitations are the small number of elderly patients and those with malignancy.

Conclusion

Thanks to widespread electronic record systems, patients' previous laboratory results have become more accessible. In patients whose D-dimer values have been above the limit value in the last three years, the new D-dimer value is likely to be high. In such cases, performing advanced diagnostic tests instead of waiting for the test results may save time.

Conflict of Interest: The authors declare no conflicts of interest related to this study.

Financial Support: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' Contribution: YE: Substantial contributions to the conception and design of the work; the acquisition, analysis, or interpretation of data for the work, drafting the work or reviewing it critically for important intellectual content **MY**: Substantial contributions to the conception and design of the work; the acquisition, analysis, or interpretation of data for the work, drafting the work or reviewing it critically for important intellectual content **TYK**: Substantial contributions to the conception and design of the work; the acquisition, analysis, or interpretation of data for the work, drafting the work or reviewing it critically for important intellectual content. **IK:** Substantial contributions to the conception and design of the work; the acquisition, analysis, or interpretation of data for the work, drafting the work, or reviewing it critically for important intellectual content. **DIT:** Substantial contributions to the conception and design of the work; the acquisition, analysis, or interpretation of data for the work, drafting the work, or reviewing it critically for important intellectual content.

All authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work, ensuring that any questions related to the accuracy or integrity of any part of the study are appropriately investigated and resolved.

Ethical Approval: Ethichal approval was obtained from the University of Health Sciences Tepecik Training and Research Hospital Ethics Committee (Decision No: 2023/06-37, dated July 13, 2023).

References

1. Olson JD. D-dimer: An Overview of Hemostasis and Fibrinolysis, Assays, and Clinical Applications. Adv Clin Chem. 2015;69:1-46. doi: 10.1016/bs.acc.2014.12.001.
2. Johnson ED, Schell JC, Rodgers GM. The D-dimer assay. Am J Hematol. 2019;94(7):833-839. doi:10.1002/ajh.25482.
3. Wells PS, Anderson DR, Rodger M, et al. Excluding pulmonary embolism at the bedside without diagnostic imaging: management of patients with suspected pulmonary embolism presenting to the emergency department by using a simple clinical model and d-dimer. Ann Intern Med. 2001;135(2):98-107. doi:10.7326/0003-4819-135-2-200107170-00010.
4. Van Belle A, Büller HR, Huisman MV, et al. Effectiveness of managing suspected pulmonary embolism using an algorithm combining clinical probability, D-dimer testing, and computed tomography. JAMA. 2006;295(2):172-179. doi:10.1001/jama.295.2.172.
5. Konstantinides SV, Meyer G, Becattini C, et al. 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS): The Task Force for the diagnosis and management of acute pulmonary embolism of the European Society of Cardiology (ESC). Eur Respir J. 2019;54(3):1901647. doi:10.1093/eurheartj/ehz405.

6. Vögeli A, Ghasemi M, Gregoriano C, et al. Diagnostic and prognostic value of the D-dimer test in emergency department patients: secondary analysis of an observational study. Clin Chem Lab Med. 2019;57(11):1730-1736. doi:10.1515/cclm-2019-0391.
7. Stals MAM, Klok FA, Huisman MV. Diagnostic management of acute pulmonary embolism in special populations. Expert Rev Respir Med. 2020;14(7):729-736. doi:10.1080/17476348.2020.1753505.
8. Sohne M, Kruip MJ, Nijkeuter M, et al. Accuracy of clinical decision rule, D-dimer and spiral computed tomography in patients with malignancy, previous venous thromboembolism, COPD or heart failure and in older patients with suspected pulmonary embolism. J Thromb Haemost. 2006;4(5):1042-1046. doi:10.1111/j.1538-7836.2006.01918.x.
9. Mos IC, Douma RA, Erkens PM, et al. Diagnostic outcome management study in patients with clinically suspected recurrent acute pulmonary embolism with a structured algorithm. Thromb Res. 2014;133(6):1039-44. doi:10.1016/j.thromres.2014.03.050.
10. Douma RA, le Gal G, Söhne M, et al. Potential of an age adjusted D-dimer cut-off value to improve the exclusion of pulmonary embolism in older patients: a retrospective analysis of three large cohorts. BMJ. 2010;340:c1475. doi:10.1136/bmj.c1475.
11. Righini M, Van Es J, Den Exter PL, et al. Age-adjusted D-dimer cutoff levels to rule out pulmonary embolism: the ADJUST-PE study [published correction appears in JAMA. 2014 Apr 23-30;311(16):1694]. JAMA. 2014;311(11):1117-1124. doi:10.1001/jama.2014.2135.
12. Righini M, Robert-Ebadi H, Le Gal G. Age-Adjusted and Clinical Probability Adapted D-Dimer Cutoffs to Rule Out Pulmonary Embolism: A Narrative Review of Clinical Trials. J Clin Med. 2024;13(12):3441. doi:10.3390/jcm13123441.
13. Lippi G, Mullier F, Favaloro EJ. D-dimer: old dogmas, new (COVID-19) tricks. Clin Chem Lab Med. 2022;61(5):841-850. doi:10.1515/cclm-2022-0633.
14. Lippi G, Bonfanti L, Saccenti C, Cervellin G. Causes of elevated D-dimer in patients admitted to a large urban emergency department. Eur J Intern Med. 2014;25(1):45-48. doi:10.1016/j.ejim.2013.07.012.
15. Alshalhoub M, Alhusain F, Alsulaiman F, Alturki A, Aldayel S, Alsalamah M. Clinical significance of elevated D-dimer in emergency department patients: a retrospective single-center analysis. Int J Emerg Med. 2024;17(1):47. doi:10.1186/s12245-024-00620-6.
16. Lippi G, Franchini M, Targher G, Favaloro EJ. Help me, Doctor! My D-dimer is raised. Ann Med. 2008;40(8):594-605. doi:10.1080/07853890802161015.
17. Wakai A, Gleeson A, Winter D. Role of fibrin D-dimer testing in emergency medicine. Emerg Med J. 2003;20(4):319-325. doi:10.1136/emj.20.4.319.
18. Montagnana M, Favaloro EJ, Franchini M, Guidi GC, Lippi G. The role of ethnicity, age and gender in venous thromboembolism. J Thromb Thrombolysis. 2010;29(4):489-496. doi:10.1007/s11239-009-0365-8.
19. Legnani C, Cini M, Cosmi B, et al. Age and gender specific cut-off values to improve the performance of D-dimer assays to predict the risk of venous thromboembolism recurrence. Intern Emerg Med. 2013;8(3):229-236. doi:10.1007/s11739-011-0608-5.
20. Palareti G, Legnani C, Antonucci E, et al. D-dimer testing, with gender-specific cutoff levels, is of value to assess the individual risk of venous thromboembolic recurrence in non-elderly patients of both genders: a post hoc analysis of the DULCIS study. Intern Emerg Med. 2020;15(3):453-462. doi:10.1111/ijlh.12426.
21. Timp JF, Braekkan SK, Versteeg HH, Cannegieter SC. Epidemiology of cancer-associated venous thrombosis. Blood. 2013;122(10):1712-1723. doi:10.1182/blood-2013-04-460121.

Anatolian Journal of Emergency Medicine 2025;8(2):59-65

ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

The Prognostic Value of MELD-XI Score in Emergency Department Patients with ST-Segment Elevation Myocardial Infarction

Acil Serviste ST-Segment Yükselmeli Miyokard Enfarktüsü Geçiren Hastalarda MELD-XI Skorunun Prognostik Değeri

Şirin Ertuğrul Esen[1], Yalcin Golcuk[2]

ABSTRACT

Aim: Effective risk stratification is essential for patients with acute ST-elevation myocardial infarction (STEMI) to enable timely and appropriate interventions. Liver dysfunction has emerged as a significant predictor of poor cardiovascular outcomes. The Model for End-stage Liver Disease (MELD)-XI score, initially designed to assess liver disease severity, has demonstrated prognostic value in cardiovascular contexts; however, its application to STEMI patients in emergency department (ED) settings remains underexplored.

Material and Methods: This retrospective study was conducted at Mugla Training and Research Hospital from July 2019 to January 2021. It included adult STEMI patients diagnosed per the European Society of Cardiology criteria. The primary outcome was 28-day all-cause mortality. Statistical analyses included univariate and Cox regression for mortality predictors and Receiver Operating Characteristic and Kaplan-Meier analyses to assess the MELD-XI score's predictive accuracy.

Results: Among 237 patients, 8.4% (n=20) died within 28 days. Non-survivors had significantly higher MELD-XI scores (10.72 vs. 9.44, p<0.001) and lower left ventricular ejection fractions (LVEF) (35% vs. 50%, p<0.001). A MELD-XI score threshold of 9.76 predicted mortality with 80% sensitivity and 70.5% specificity (AUC=0.813) and was negatively correlated with LVEF (r=-0.223, p<0.001). Kaplan-Meier analysis showed that patients with MELD-XI scores above 9.76 had significantly higher 28-day mortality (Log-rank test = 5.43, p<0.001). Independent predictors of mortality included MELD-XI score ≥9.76, age, cardiac arrest on admission, glucose, and hemoglobin levels.

Conclusion: The MELD-XI score is a valuable prognostic tool for assessing 28-day mortality risk in STEMI patients in EDs. By incorporating liver and renal function indicators, the MELD-XI score enhances conventional risk stratification and facilitates more targeted clinical interventions.

Keywords: Emergency department, MELD-XI score, mortality, risk stratification, STEMI.

ÖZ

Amaç: Akut ST-elevasyonu miyokard infarktüsü (STEMI) hastalarında etkili risk stratifikasyonu, zamanında ve uygun müdahalelerin yapılabilmesi için kritik öneme sahiptir. Karaciğer fonksiyon bozukluğu, kötü kardiyovasküler sonuçların güçlü bir prediktörü olarak öne çıkmaktadır. Başlangıçta karaciğer hastalığının şiddetini değerlendirmek amacıyla geliştirilen Model for End-stage Liver Disease (MELD)-XI skoru, kardiyovasküler hastalıklar açısından prognostik değer taşıdığı gösterilmiş olmasına rağmen, acil servis ortamında STEMI hastaları üzerindeki rolü henüz yeterince araştırılmamıştır.

Gereç ve Yöntemler: Bu retrospektif çalışma, Temmuz 2019 ile Ocak 2021 tarihleri arasında Muğla Eğitim ve Araştırma Hastanesi'nde gerçekleştirilmiştir. Çalışmaya, Avrupa Kardiyoloji Derneği kriterlerine göre tanı almış yetişkin STEMI hastaları dâhil edilmiştir. Birincil sonuç, 28 günlük tüm nedenlere bağlı mortalitedir. İstatistiksel analizler, mortalite prediktörlerini değerlendirmek için univariate ve Cox regresyonu, MELD-XI skorunun prediktif doğruluğunu belirlemek için ise Receiver Operating Characteristic ve Kaplan-Meier analizlerini içermektedir.

Bulgular: Çalışmaya dâhil edilen 237 hastadan %8,4'ü (n=20) 28 gün içinde hayatını kaybetmiştir. Ölen hastaların MELD-XI skorları (10,72 vs. 9,44, p<0,001) ve sol ventrikül ejeksiyon fraksiyonları (LVEF) (35% vs. 50%, p<0,001) anlamlı şekilde daha yüksek bulunmuştur. MELD-XI skoru 9,76'nın üzerinde olan hastalar, %80 duyarlılık ve %70,5 özgüllükle mortalite açısından yüksek risk taşıyan grup olarak belirlenmiştir (AUC=0,813). Ayrıca, MELD-XI skoru ile LVEF arasında negatif korelasyon saptanmıştır (r=-0,223, p<0,001). Kaplan-Meier analizi, MELD-XI skoru 9,76'nın üzerinde olan hastaların 28 günlük mortalitesinin anlamlı şekilde daha yüksek olduğunu göstermiştir (Log-rank testi = 5,43, p<0,001). Mortalitenin bağımsız prediktörleri arasında MELD-XI skoru ≥9,76, yaş, acil servise kabulde kardiyak arrest, glukoz ve hemoglobin seviyeleri yer almaktadır.

Sonuç: MELD-XI skoru, acil servislerde STEMI hastalarında 28 günlük mortalite riskini tahmin etmek için değerli bir prognostik araçtır. Karaciğer ve böbrek fonksiyonlarını göz önünde bulundurarak yapılan değerlendirmeler, geleneksel risk stratifikasyonunu geliştirir ve daha hedeflenmiş klinik müdahaleleri mümkün kılar.

Anahtar Kelimeler: Acil servis, MELD-XI skoru, mortalite, risk sınıflandırması, STEMI

Received: 25 November 2024 Accepted: 17 May 2025

[1]Alasehir State Hospital, Emergency Medicine Service, Manisa, Türkiye

[2]Mugla Sitki Kocman University, Department of Emergency Medicine, Mugla, Türkiye.

Corresponding Author: Yalcin Golcuk, Assoc Prof. **Address:** Mugla Sitki Kocman University, Department of Emergency Medicine, Mugla, Türkiye. **Telephone:** +90 252 214 1323 **e-mail**: yalcingolcuk@mu.edu.tr.

Atıf için/Cited as: Ertugrul Esen S, Golcuk Y. The Prognostic Value of MELD-XI Score in Emergency Department Patients with ST-Segment Elevation Myocardial Infarction. Anatolian J Emerg Med 2025;8(2):59-65. https://doi.org/10.54996/anatolianjem.1590841.

Introduction

Accurate risk stratification is crucial for patients presenting with acute ST-elevation myocardial infarction (STEMI), as timely and appropriate interventions are essential to improving clinical outcomes (1). Liver dysfunction, often associated with heart failure, is a significant predictor of adverse outcomes in cardiovascular diseases. Emergency Physicians frequently encounter the dual challenge of managing both cardiac and hepatic dysfunction, particularly in conditions such as congestive hepatopathy, which arises from reduced cardiac output and right ventricular failure. Elevated right atrial pressures and compromised hepatic perfusion lead to liver congestion and hypoxia, further worsening the patient's condition (2). Therefore, incorporating hepatic impairment into risk assessment models for acute coronary syndromes (ACS) is vital for optimal patient management.

The Model for End-stage Liver Disease (MELD) score was originally developed for patients with cirrhosis awaiting liver transplantation. It was later modified to the MELD-XI score by excluding the international normalized ratio, making it more suitable for patients on anticoagulation therapy (3,4). The MELD-XI score has demonstrated prognostic relevance in various cardiac conditions (5-10); however, its role in the emergency department (ED) for STEMI patients remains underexplored. This study aims to evaluate the prognostic significance of the MELD-XI score upon ED admission in STEMI patients, specifically assessing its predictive accuracy for 28-day all-cause mortality.

Material and Methods

Study Design and Setting

This retrospective, single-center, cross-sectional cohort study was conducted in the ED of Mugla Training and Research Hospital, a university-affiliated institution, between July 1, 2019, and January 1, 2021. The hospital has a capacity of 500 beds and the ED receives approximately 100,000 patient visits annually. Ethical approval was obtained from the Local Institutional Review Board (Protocol No: 220113-1), and the study was conducted in accordance with the Declaration of Helsinki. Due to the retrospective nature of the study, the requirement for obtaining written informed consent from participants was waived.

Selection of Participants

The study included adult patients aged 18 years and older who were diagnosed with STEMI upon presentation to the ED. Exclusion criteria included: individuals under 18 years of age; patients with inaccessible or incomplete medical records; those transferred to other healthcare facilities; individuals with conditions that mimic STEMI; patients who declined percutaneous coronary intervention (PCI); and those with end-stage liver cirrhosis, severe renal impairment requiring dialysis, malignant tumors, or a history of liver or kidney transplantation. All patients were diagnosed and managed according to the European Society of Cardiology (ESC) guidelines for STEMI (1), with follow-up conducted after 28 days.

Definitions and MELD-XI Score

STEMI was defined using the ESC diagnostic criteria, which included acute chest pain lasting more than 20 minutes and ST-segment elevation in at least two contiguous leads: ≥2.5 mm in men under 40 years, ≥2 mm in men aged 40 and above, or ≥1.5 mm in women in leads V2–V3, and/or ≥1 mm in other leads. A newly developed left bundle branch block was also considered indicative of STEMI. Significant coronary artery lesions identified during PCI were defined as stenosis of ≥50% in the infarct-related artery. Multivessel coronary artery disease was defined as significant stenosis in two or more major coronary arteries, including the left anterior descending artery (LAD), right coronary artery (RCA), and circumflex artery (CX) (1). The MELD-XI score was calculated using the formula: MELD-XI = [5.11 × ln(bilirubin)] + [11.76 × ln(creatinine)] + 9.44. Admission serum levels of creatinine and bilirubin were used, and in cases where multiple values were recorded on the day of admission, the highest values were selected. The minimum value for both bilirubin and creatinine was set at 1.0 mg/dL to ensure consistency in scoring (4).

Data Collection

Demographic characteristics (e.g., gender, age), clinical features (e.g., arterial blood pressure, pulse rate, ECG findings, left ventricular ejection fraction [LVEF]), and medical history (e.g., prior PCI, comorbidities, smoking status, and medication use) were meticulously recorded using a standardized electronic spreadsheet. The presence of cardiac arrest upon ED presentation was also documented. Initial laboratory results (e.g., complete blood count, serum chemistry, blood gas analysis, Troponin T, CK-MB, and lipid profiles) were systematically extracted. Significant coronary artery lesions and multivessel coronary artery disease identified during PCI were noted for both the infarct-related artery and other major coronary arteries. Hospital admission status, length of stay (LOS), and patient survival status at 28 days post-admission were comprehensively recorded. MELD-XI scores were calculated for all patients. Survival status and dates of death were obtained through telephone interviews with patients or their relatives during the 28-day follow-up and validated by reviewing hospital medical records. For deaths outside the hospital, the local civil registration database was consulted to confirm daily reported fatalities within the study area.

Statistical Analysis

The normality of quantitative variable distributions was evaluated using the Kolmogorov-Smirnov test. Descriptive statistics were reported as mean ± standard deviation for normally distributed variables and as median (minimum–maximum) for non-normally distributed variables. Frequency counts and percentages were used for categorical variables. Differences in mean values of quantitative variables were compared using the Student's t-test for normally distributed data and the Mann-Whitney U test for non-normally distributed data. Categorical variables were compared using the χ^2 test or Fisher's exact test, as appropriate. Univariate analysis was applied to all demographic, clinical, laboratory, and outcome variables, with significant variables subsequently included in a Cox regression analysis to identify independent predictors of 28-day all-cause mortality. The Receiver Operating Characteristic (ROC) analysis was used to assess the predictive value of the MELD-XI score for 28-day mortality, and a Kaplan–Meier survival curve was constructed and compared using the log-rank test. Statistical significance was

defined as P <0.05. All statistical analyses were conducted using SPSS version 20 software (SPSS Inc., Chicago, IL, USA).

Results

During the study period, a total of 315 patients diagnosed with STEMI who presented to the ED were reviewed through hospital electronic health records for eligibility in the final analysis. Exclusions included 25 patients with unavailable 28-day mortality data and 48 patients with missing critical admission data for serum bilirubin or creatinine. Additionally, two patients died before undergoing PCI, one patient refused treatment, and two cases involved conditions mimicking STEMI, specifically Kounis syndrome and vasospastic angina. After these exclusions, a final cohort of 237 patients was analyzed.

Among the 237 patients, 199 (84%) were male, with a mean age of 60.41 ± 12.67 years. Notably, 20 patients (8%) died within the 28-day follow-up period. ECG findings indicated that 49.8% presented with inferior, 46.8% with anterior, 10.1% with lateral, 8.9% with posterior, and 7.2% with right-sided infarctions. Angiographic findings revealed that the majority of patients had significant lesions in the LAD (75.5%), followed by the RCA (59.5%) and the CX (43.0%). Additionally, 22.4% of the cohort had multivessel coronary artery disease. A significant association between critical stenosis of the LAD and mortality was identified (P = 0.032). Thirteen patients (5.5%) presented to the ED in cardiac arrest, and the overall 28-day all-cause mortality rate was 8.4% (n = 20). The median LOS was 3 days (ranging from 1 to 30 days). Detailed demographic, laboratory, and clinical characteristics of the cohort are provided in Tables 1 and 2.

Characteristics	Survivors (n = 217)	Nonsurvivors (n = 20)	*p* value
Age, years	59.3 ± 12.2	72.3 ± 11.2	<0.001
Men/Women, n	185/32	14/6	0.104
Previous medical history, n (%)			
Myocardial infarction	26 (12)	4 (20)	0.295
Chronic pulmonary disease	19 (8.8)	2 (10)	0.693
Diabetes mellitus	42 (19.4)	7 (35)	0.144
Hypertension	72 (33.2)	12 (60)	0.031
Heart failure	6 (2.8)	2 (10)	0.139
Hyperlipidaemia	19 (8.8)	3 (15)	0.410
Cerebrovascular disease	5 (2.3)	1 (5)	0.414
Atrial fibrillation	6 (2.8)	1 (5)	0.465
Smoking	155 (71.4)	15 (75)	0.936
Previous PCI	39 (18)	4 (20)	0.766
Medications used, n (%)			
Aspirin	38 (17.5)	4 (20)	0.762
P2Y12 inhibitors	12 (5.5)	3 (15)	0.121
Anticoagulant	3 (1.4)	1 (5)	0.299
ACE/ARB inhibitor	48 (22.1)	6 (30)	0.411
Diuretic	5 (2.3)	2 (10)	0.110
Statin	27 (12.4)	6 (30)	0.042
Laboratory results			
White blood cell count (x10^3/µL)	10.6 (2.2-29.6)	14.0 (5.5-33.6)	0.014
Red blood cell count (x10^3/µL)	494 (285-728)	450 (205-549)	0.002
Hemoglobin (g/dL)	14.8 (8.0-19.6)	13.1 (5.6-16.7)	0.002
Platelet count (x10^3/µL)	245 (91-523)	193 (84-392)	0.041
Glucose (mg/dL)	132 (85-687)	236 (127-531)	<0.001
Urea (mg/dL)	30.4 (3.3-97.5)	40.8 (8.9-154.8)	0.004
Creatinine (mg/dL)	0.92 (0.37-2.68)	1.26 (0.55-8.50)	<0.001
Sodium (mEq/L)	138 (128-144)	139 (120-149)	0.365
Potassium (mEq/L)	4.2 (3.1-6.0)	4.2 (2.9-9.0)	0.642
Calcium (mg/dL)	9.2 ± 0.5	8.8 ± 0.8	0.038
Chlorine (mg/dL)	100.2 ± 3.1	98.0 ± 7.9	0.229
Albumin (g/L)	41 (27-49) ± 5.6	39 (18-46)	0.003
Aspartate transaminase (IU/L)	29 (5-644)	40 (12-372)	0.101
Alanine transaminase (IU/L)	20 (5-753)	30 (5-517)	0.235
Total bilirubin (mg/dL)	0.49 (0.14-2.18)	0.75 (0.15-1.77)	0.075
Troponin T (pg/mL)	85 (3-10085)	289 (9-10096)	0.056
CK-MB (ng/mL)	9.47 (0.77-300.0)	16.3 (1.6-300.0)	0.237
Total cholesterol (mg/dL)	182 (83-312)	178 (103-366)	0.958
HDL (mg/dL)	39 (20-93)	39 (19-61)	0.976
LDL (mg/dL)	110 (12-250)	100 (48-265)	0.514
Triglycerides (mg/dL)	133 (39-1598)	134 (60-462)	0.650

Table 1. Demographic and laboratory characteristics of study patients

ACE/ARB, Angiotensin-converting enzyme / Angiotensin II receptor blocker; CK-MB, Creatine kinase-muscle/brain, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, PCI: Percutaneous coronary intervention.

Characteristics	Survivors (n = 217)	Nonsurvivors (n = 20)	*p* value
Hemodynamic parameters			
Systolic blood pressure (mm Hg)	131 (58-224)	110 (45-150)	<0.001
Diastolic blood pressure (mm Hg)	83 (40-133)	65 (20-95)	<0.001
Heart rate (beats/min)	80 (36-163)	81 (32-150)	0.913
Cardiac arrest on presentation, n (%)	5 (2.3)	8 (40)	<0.001
LVEF, %	50 (15-65)	35 (15-45)	<0.001
Thrombolytic treatment prior to PCI, n (%)	28 (12.9)	1 (5)	0.482
PCI lesion location, n (%)			
Left anterior descending	160 (73.7)	19 (95)	0.032
Right coronary artery	128 (59)	13 (65)	0.775
Circumflex artery	92 (42.4)	10 (50)	0.674
Multivessel disease	45 (20.7)	8 (40)	0.087
Length of stay, days	3.7 ± 2.6	4.2 ± 5.6	0.263
MELD-XI score	9.44 (9.44-14.47)	10.72 (9.44-20.77)	<0.001

Table 2. Clinical characteristics of study patients

LVEF: Left Ventricular ejection fraction, MELD-XI: Model for end-stage liver disease excluding international normalized ratio, PCI: Percutaneous coronary intervention.

The mean MELD-XI score for the study population was 9.98 ± 1.29. Non-survivors had significantly higher MELD-XI scores compared to survivors, at 10.72 (range: 9.44–20.77) versus 9.44 (range: 9.44–14.47). Spearman correlation analysis revealed a significant negative correlation between MELD-XI scores and LVEF (r =-0.223, P <0.001). As illustrated in Figure. 1, the ROC analysis identified a MELD-XI score of 9.76 as the optimal cutoff for predicting 28-day all-cause mortality, with 80% sensitivity and 70.5% specificity, and an AUC of 0.813 (95% CI, 0.703–0.923; P <0.001). Kaplan-Meier survival analysis further demonstrated that patients with a MELD-XI score above 9.76 had significantly higher 28-day mortality compared to those with lower scores (Log-rank test = 5.43, P <0.001, Figure 2). Independent predictors of mortality were identified as a MELD-XI score ≥9.76, cardiac arrest on admission, age, glucose levels, and hemoglobin levels, as shown in Table 3.

Discussion

In this retrospective cohort study, the prognostic significance of the MELD-XI score in predicting 28-day mortality among STEMI patients presenting to the ED was explored. The findings demonstrated that the MELD-XI score is a robust predictor of mortality in this population, with higher scores significantly correlating with an increased risk of mortality. By extending the use of the MELD-XI score to STEMI patients, this study highlights the potential benefits of integrating hepatic and renal function metrics into routine cardiovascular risk assessments, facilitating a more comprehensive approach to patient management in acute care settings.

LVEF is a well-established prognostic marker in STEMI, with lower values commonly associated with adverse outcomes and elevated mortality risk (11). In this study, LVEF at presentation was notably lower among no survivors compared to survivors, underscoring the association between compromised LVEF and increased mortality. Çelik et al. similarly identified LVEF as an independent predictor of in-hospital mortality, reinforcing its role in risk stratification for STEMI patients. Furthermore, a significant negative correlation between MELD-XI scores and LVEF (r =-0.223) was found, closely aligning with Çelik et al.'s findings (r =-0.232) (12). These results highlight a consistent relationship between elevated MELD-XI scores and reduced LVEF, emphasizing the prognostic value of the MELD-XI score as an indicator of cardiac impairment severity in STEMI patients. Elevated MELD-XI scores are associated with multi-organ stress and metabolic dysregulation, contributing to the observed decline in cardiac performance and worse outcomes in myocardial infarction cases. This inverse relationship between MELD-XI and LVEF, consistently observed across studies, supports the MELD-XI score as not only a reliable risk stratification tool but also a complementary measure of left ventricular function, enhancing multidimensional assessment in emergency settings.

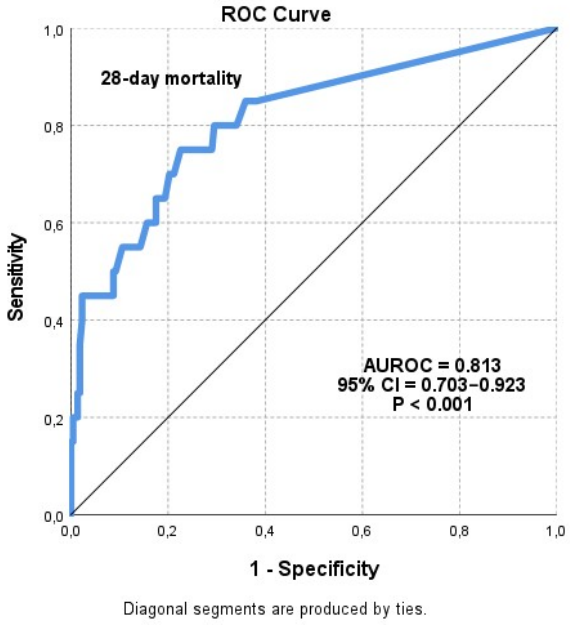

Figure 1. Receiver Operating Characteristic (ROC) Curve for MELD-XI Score in Predicting 28-Day All-Cause Mortality

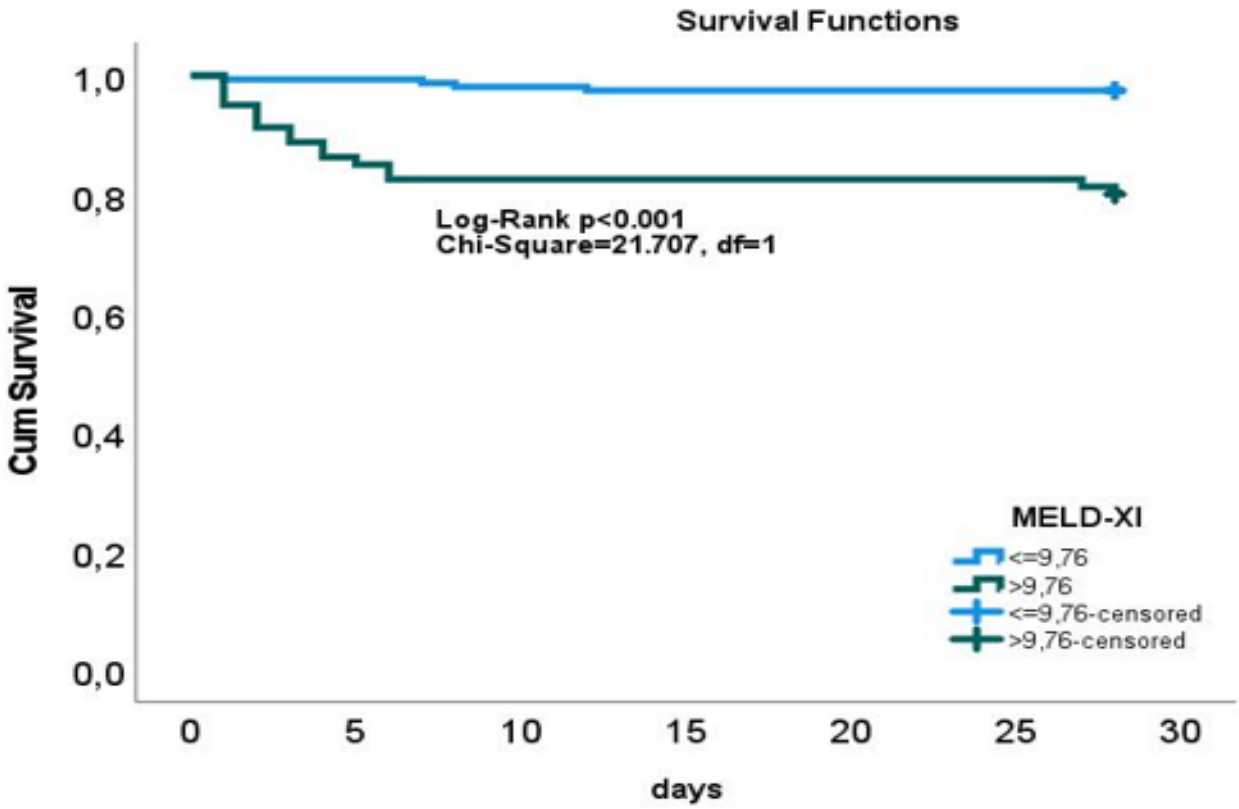

Figure 2. Kaplan–Meier Survival Curves for 28-Day Mortality Stratified by MELD-XI Score Threshold of 9.76

Variables for 28 d	Odds ratio	95% CI	*p* value
MELD-XI score ≥9.76	5.132	1.548-17.020	0.007
Cardiac arrest on admission	9.455	3.266-27.367	<0.001
Age, years	1.053	1.005-1.104	0.030
Glucose, g/dL	1.007	1.003-1.010	<0.001
Hemoglobin, g/dL	0.781	0.616-0.990	0.041

Table 3. Cox regression analysis for the prediction of 28-day mortality

CI: Confidence interval, MELD-XI: Model for end-stage liver disease excluding international normalized ratio.

Zhang et al. identified a MELD-XI threshold of >9.78 as an optimal predictor of short-term mortality in STEMI patients undergoing PCI (13), which closely corresponds to the threshold of >9.76 identified in this study. The minimal variation between these cutoff values underscores the consistency and reliability of the MELD-XI score across different cohorts. This supports the clinical utility of the MELD-XI score in ED settings, providing timely identification of patients at elevated risk. The concordance between these findings and those of Zhang et al. further validates the prognostic value of the MELD-XI score, suggesting its potential as a standardized metric to guide clinical interventions.

Similarly, Çelik et al. investigated the prognostic utility of the MELD-XI score in predicting in-hospital mortality among STEMI patients and found a significant association between elevated MELD-XI scores and higher mortality rates (12). Their study identified a threshold of 10, closely aligned with the threshold of 9.76 in this study. The consistency of these results corroborates the value of the MELD-XI score in risk stratification and patient management in the ED. Both studies support the use of the MELD-XI score for identifying patients vulnerable to adverse outcomes, optimizing the allocation of critical resources in ED.

In addition, He et al. focused specifically on elderly patients (≥60 years) with STEMI undergoing PCI and examined the prognostic role of the MELD-XI score (14). Their findings showed that a MELD-XI score ≥13 was significantly associated with poorer outcomes, suggesting that the MELD-XI score offers substantial prognostic value beyond the traditional TIMI risk score, particularly in older patients. Elderly populations often present with a higher burden of comorbidities and physiological decline, which may exacerbate STEMI outcomes. The higher MELD-XI scores reported in He et al.'s study, compared to this study, may be attributable to the inclusion of older patients with greater susceptibility to hepatorenal dysfunction. The additive value of the MELD-XI score, as shown in their investigation, supports current literature advocating for risk stratification tools that consider multi-organ involvement, particularly in complex cardiovascular cases. Such tools are essential for improving clinical decision-making and patient outcomes in

high-risk populations, enhancing the management of patients in EDs.

Recent studies have further underscored the prognostic relevance of the MELD-XI score across various cardiovascular populations. In a retrospective cohort of patients with chronic heart failure, Lin et al. demonstrated that a high MELD-XI score (median: 12.71 [IQR 10.88–15.44]) was independently associated with increased 3-year all-cause mortality, even after adjusting for confounders such as chronic kidney disease (15). Similarly, Chen et al. found that in patients with acute myocardial infarction undergoing coronary artery stenting, those with higher MELD-XI scores (mean: 11.98 ± 2.34) had significantly lower LVEF and higher rates of heart failure (24.5%) and mortality (5.7%) during 1-year follow-up compared to those with lower scores (16). Complementing these findings, Curcio et al. conducted a prospective longitudinal study in 93 patients with advanced heart failure and reported that patients who experienced adverse outcomes—including death, urgent heart transplant, or LVAD implantation—had significantly higher MELD-XI scores (mean: 16.3 ± 4.0) compared to event-free survivors (mean: 12.5 ± 4.4, P < .001) (17). Collectively, these findings support the broader applicability of MELD-XI as an integrative biomarker reflecting hepatic-renal dysfunction and its emerging role in prognostic models for cardiovascular risk stratification, particularly in populations with overlapping systemic comorbidities.

Beyond cardiac conditions, recent studies have expanded the prognostic scope of the MELD-XI score to include acute respiratory pathologies. In a large ICU cohort of patients with respiratory failure, Arslan et al. found that MELD-XI scores ≥11 were strongly associated with increased mortality across multiple etiological subgroups—including COPD exacerbation, cardiogenic pulmonary edema, and pneumonia—with a hazard ratio of 2.6 (95% CI: 2.4–2.9, P < .001). The mean MELD-XI score among non-survivors was notably elevated (13.6 ± 5.4), reinforcing its role as an independent predictor of ICU mortality (18). Similarly, in a study of normotensive patients with acute pulmonary embolism, Jiao et al. reported that the MELD-XI score was associated with in-hospital adverse events—including shock, catecholamine requirement, and mechanical ventilation—although its predictive capacity was slightly lower than the original MELD score (AUC: 0.618 vs. 0.731) (19). In an even larger multinational ICU cohort involving 11,091 mechanically ventilated patients, Wernly et al. demonstrated that a MELD-XI score >12 was independently associated with both hospital mortality (46% vs. 27%) and 28-day mortality (39% vs. 22%), even after adjusting for disease severity and ventilatory parameters (HR: 1.04; 95% CI: 1.03–1.05; P < .001) (20). These findings emphasize that the MELD-XI score may serve as a pragmatic, organ dysfunction–oriented tool across cardiopulmonary emergencies, including those not classically hepatic in origin, and underscore its potential integration into multidisciplinary risk stratification strategies.

However, it is important to note that the generalizability of our findings is limited to a specific subset of STEMI patients. Given that individuals with advanced hepatic or renal dysfunction, malignancy, or prior organ transplantation were excluded from this study, the prognostic performance of the MELD-XI score in such populations remains uncertain. Future studies are needed to evaluate the applicability and calibration of MELD-XI in broader, more heterogeneous STEMI cohorts, particularly those with coexisting multi-organ pathology.

Limitations

This study has several limitations that warrant consideration. First, the retrospective design, single-center setting, small sample size, and short follow-up period may limit the generalizability of the findings. Furthermore, patients with advanced liver or kidney failure, malignancy, or prior transplants were excluded to reduce confounding; as a result, the prognostic utility of MELD-XI in these higher-risk groups remains untested and should be investigated in future studies. Additionally, socioeconomic factors, which can influence patient prognosis and access to healthcare, were not included in this analysis, potentially introducing biases in evaluating the predictive value of the MELD-XI score for mortality. Furthermore, variability in the timing of patient presentation to the ED following STEMI, and the absence of door-to-balloon time data, may have introduced confounding factors. These limitations highlight the need for additional research involving larger, multicenter cohorts to validate the prognostic value of the MELD-XI score in STEMI patients in EDs.

Conclusion

The MELD-XI score is a crucial prognostic indicator for predicting 28-day all-cause mortality in STEMI patients upon presentation to the ED. Integrating this score into clinical practice may enhance risk stratification, enabling timely identification of high-risk individuals who could benefit from expedited interventions. By systematically incorporating MELD-XI assessments into routine evaluations, emergency physicians can refine management strategies and optimize patient outcomes. This study emphasizes the importance of hepatic and renal function metrics in informing clinical decision-making in acute care settings, particularly in selected STEMI patients without advanced hepatic or renal dysfunction. Broader validation studies are warranted to assess its performance across more diverse clinical subgroups.

Acknowledgments: The authors express their profound appreciation to Fulden Cantaş Türkiş, from the Department of Biostatistics, Muğla Sıtkı Koçman University School of Medicine, for her exceptional contributions to data management and statistical analysis, which were integral to this study.

Conflict of Interest: The authors declare that there is no conflict of interest.

Financial Support: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' Contribution: ŞEE: ŞEE: Designing the study, access to study data, statistical analysis, analysis and interpretation of data, drafting the manuscript, proofreading the

manuscript. **YG:** Designing the study, access to study data, statistical analysis, analysis and interpretation of data, drafting the manuscript, proofreading the manuscript.
All authors read and approved the final submitted version of the manuscript.
Ethical Approval: Ethical approval was obtained from Muğla Sıtkı Koçman University Medical Sciences Ethics Committee (Protocol No: 220113-1)

References

1. Ibanez B, James S, Agewall S, et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). Eur Heart J. 2018;39(2):119-177. doi:10.1093/eurheartj/ehx393.
2. Xanthopoulos A, Starling RC, Kitai T, Triposkiadis F. Heart failure and liver disease: Cardiohepatic interactions. JACC Heart Fail. 2019;7(2):87-97. doi:10.1016/j.jchf.2018.10.007.
3. Kamath PS, Wiesner RH, Malinchoc M, et al. A model to predict survival in patients with end-stage liver disease. Hepatology. 2001;33(2):464-470. doi:10.1053/jhep.2001.22172.
4. Heuman DM, Mihas AA, Habib A, et al. MELD-XI: A rational approach to "sickest first" liver transplantation in cirrhotic patients requiring anticoagulant therapy. Liver Transpl. 2007;13(1):30-37. doi:10.1002/lt.20906.
5. Lin Z, Liu X, Xiao L, et al. The MELD-XI score predicts 3-year mortality in patients with chronic heart failure. Front Cardiovasc Med. 2022;9:985503. doi:10.3389/fcvm.2022.985503.
6. He PC, Wei XB, Luo SN, et al. Risk prediction in infective endocarditis by modified MELD-XI score. Eur J Clin Microbiol Infect Dis. 2018;37(7):1243-1250. doi:10.1007/s10096-018-3240-8.
7. Saito Y, Nakai T, Ikeya Y, et al. Prognostic value of the MELD-XI score in patients undergoing cardiac resynchronization therapy. ESC Heart Fail. 2022;9(2):1080-1089. doi:10.1002/ehf2.13776.
8. Jorde UP, Benza R, McCarthy PM, et al. Impact of renal and liver function on clinical outcomes following tricuspid valve transcatheter edge-to-edge repair. J Am Coll Cardiol. Published online August 31, 2024. doi:10.1016/j.jacc.2024.08.044.
9. Çınar T, Şaylık F, Selçuk M, Akbulut T, Orhan AL. The predictive value of the MELD-XI score for short- and long-term mortality in elderly patients with non-ST elevation myocardial infarction. Aging Clin Exp Res. 2022;34(4):887-895. doi:10.1007/s40520-021-02004-9.
10. Lin X, Xie L, Jiang D, Wu Q, He J, Chen L. Hepatic dysfunction and adverse outcomes after total arch repair of acute type A aortic dissection: Application of the MELD-XI score. BMC Cardiovasc Disord. 2022;22(1):491. doi:10.1186/s12872-022-02934-w.
11. Mahdavi-Roshan M, Ghorbani Z, Gholipour M, Salari A, Savar Rakhsh A, Kheirkhah J. Evaluation of cardiometabolic risk markers linked to reduced left ventricular ejection fraction (LVEF) in patients with ST-elevation myocardial infarction (STEMI). BMC Cardiovasc Disord. 2022;22(1):224. doi:10.1186/s12872-022-02660-3.
12. Çelik O, Çiftci O, Müderrisoğlu İH. Prognostic value of MELD-XI score in patients referring to the emergency department with acute ST elevation myocardial infarction. Hong Kong J Emerg Med. 2021;28:361-365. doi:10.1177/1024907920904191.
13. Zhang XT, Lin ZR, Zhang L, Zhao ZW, Chen LL. MELD-XI score predicts no-reflow phenomenon and short-term mortality in patients with ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention. BMC Cardiovasc Disord. 2022;22(1):113. doi:10.1186/s12872-022-02556-2.
14. He SJ, Weng JX, Chen HJ, et al. The prognostic value of MELD-XI in elderly patients with ST-segment elevation myocardial infarction: An observational study. BMC Cardiovasc Disord. 2021;21(1):53. doi:10.1186/s12872-021-01862-5.
15. Lin Z, Liu X, Xiao L, et al. The MELD-XI score predicts 3-year mortality in patients with chronic heart failure. Front Cardiovasc Med. 2022;9:985503. doi:10.3389/fcvm.2022.985503
16. Chen D, Lu M, Fu Z, Ding K, Liang P. The association between the MELD-XI score and heart failure in patients with acute myocardial infarction after coronary artery stenting-a retrospective study. J Thorac Dis. 2023;15(5):2721-2728. doi:10.21037/jtd-23-562
17. Curcio F, Amarelli C, Chiappetti R, et al. MELD score predicts outcomes in patients with advanced heart failure: A longitudinal evaluation. ESC Heart Fail. 2025;12(2):839-847. doi:10.1002/ehf2.15002
18. Arslan F, Timurhan YG, Doğan Mülazımoğlu D, et al. The Prognostic Significance of MELD-XI in Patients Admitted to the Intensive Care Unit for Respiratory Failure. Thorac Res Pract. 2025;26(3):115-124. doi:10.4274/ThoracResPract.2024.24047
19. Jiao S, Liu Y, He H, et al. The Predictive Value of the MELD Scores for In-Hospital Adverse Events in Normotensive Patients with Acute Pulmonary Embolism. Clin Appl Thromb Hemost. 2024;30:10760296241266607. doi:10.1177/10760296241266607
20. Wernly B, Frutos-Vivar F, Peñuelas O, et al. Easy prognostic assessment of concomitant organ failure in critically ill patients undergoing mechanical ventilation. Eur J Intern Med. 2019;70:18-23. doi:10.1016/j.ejim.2019.09.002

Anatolian Journal of Emergency Medicine 2025;8(2):66-73

ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

A Ten-Year Clinico-Epidemiology Profile of Poisoned Patients in a Tertiary Care Emergency Department in the Black Sea Region of Türkiye

Karadeniz Bölgesi'ndeki Bir Üçüncü Basamak Acil Serviste Zehirlenme Vakalarının On Yıllık Klinik-Epidemiyolojik Profili

Mustafa Çiçek[1], Melih İmamoğlu[2], Özgen Gönenç Çekiç[1], Aynur Şahin[3], Abdulkadir Gündüz[2]

ABSTRACT

Aim: This study aimed to analyze the demographic, etiological, and clinical characteristics of acute poisoning cases, along with 10-year trends, in patients presenting to a tertiary emergency department in the Eastern Black Sea Region of Türkiye.

Material and Methods: This retrospective, cross-sectional study included 1811 patients aged over 17 years who were diagnosed with intoxications between 2007 and 2016. Data were collected from the emergency department database. Key variables included demographics, intoxication agents, clinical presentations, and outcomes. Decontamination and elimination techniques, as well as trends in substance use and presentation times, were evaluated.

Results: Of 505,525 emergency department visits, 0.4% (n=1811) were due to intoxications, predominantly involving females (63.1%) and individuals aged 17–24 years (50.0%). Suicide attempts accounted for 60.7% of cases, with 44.6% of these patients having a psychiatric history. The most common agents were analgesics (24.4%) and antidepressants (24.3%), with paracetamol and amitriptyline being the most frequently implicated drugs. Decontamination was applied to 57.3% of patients, and antidote therapy to 13.4%. Over the decade, a shift from amitriptyline to paracetamol poisonings was observed. Mortality was low, at 0.2%, and 90.8% of patients fully recovered.

Conclusion: This study highlights significant changes in poisoning agents over a decade, with increasing paracetamol use and decreasing amitriptyline-related cases. These findings underscore the importance of region-specific epidemiological studies to guide preventive and clinical strategies, reduce intoxication-related morbidity and mortality, and improve public health policies.

Keywords: Acute poisoning, drug overdose, retrospective study, toxicology.

ÖZ

Amaç: Bu çalışma, Türkiye'nin Doğu Karadeniz Bölgesi'nde yer alan bir üçüncü basamak acil servisine başvuran akut zehirlenme vakalarının demografik, etiyolojik ve klinik özelliklerini ve 10 yıllık eğilimlerini analiz etmeyi amaçlamıştır.

Gereç ve Yöntemler: Bu retrospektif, kesitsel çalışmada, 2007-2016 yılları arasında zehirlenme tanısı alan 17 yaş üstü 1811 hasta incelenmiştir. Veriler acil servis veri tabanından toplanmıştır. Demografik veriler, zehirlenme etkenleri, klinik bulgular ve sonuçlar gibi temel değişkenler değerlendirilmiştir. Dekontaminasyon ve eliminasyon teknikleri ile madde kullanımı ve başvuru zamanlarındaki eğilimler incelenmiştir.

Bulgular: 505.525 acil servis başvurusunun %0,4'ü (n=1811) zehirlenmeler nedeniyle olmuş ve vakaların çoğunluğu kadınlar (%63,1) ve 17-24 yaş grubundaki kişilerden (%50,0) oluşmuştur. Vaka sayısının %60,7'si intihar girişimleri ile ilişkili bulunmuş, bu hastaların %44,6'sının psikiyatrik hastalık öyküsü olduğu tespit edilmiştir. En yaygın zehirlenme etkenleri analjezikler (%24,4) ve antidepresanlar (%24,3) olup, parasetamol ve amitriptilin en sık sorumlu tutulan ilaçlar olmuştur. Hastaların %57,3'üne dekontaminasyon uygulanmış, %13,4'üne antidot tedavisi verilmiştir. On yıllık süreçte amitriptilin zehirlenmelerinin azaldığı, parasetamol zehirlenmelerinin ise arttığı görülmüştür. Mortalite oranı %0,2 ile düşük bulunmuş ve hastaların %90,8'i tamamen iyileşmiştir.

Sonuç: Bu çalışma, on yıllık süreçte zehirlenme etkenlerindeki önemli değişikliklere dikkat çekmektedir; parasetamol kullanımındaki artış ve amitriptilin zehirlenmelerindeki azalma bunlara örnek olarak verilebilir. Bulgular, bölgeye özgü epidemiyolojik çalışmaların, koruyucu ve klinik stratejiler geliştirilmesindeki önemini vurgulamaktadır. Bu tür çalışmalar, zehirlenme ile ilişkili morbidite ve mortaliteyi azaltmaya ve halk sağlığı politikalarını iyileştirmeye katkı sağlayabilir.

Anahtar Kelimeler: Akut zehirlenme, ilaç doz aşımı, retrospektif çalışma, toksikoloji.

Received: 23 January 2024 Accepted: 20 May 2025

[1]University of Health Sciences, Trabzon Kanuni Training and Research Hospital, Department of Emergency Medicine, Trabzon, Türkiye.
[2]Karadeniz Technical University, School of Medicine, Department of Emergency Medicine, Trabzon, Türkiye
[3]University of Health Sciences, Hamidiye International School of Medicine, Department of Emergency Medicine, Istanbul, Türkiye
Corresponding Author: Mustafa Cicek, Assistant Professor **Address:** University of Health Sciences, Trabzon Kanuni Training and Research Hospital, Department of Emergency Medicine, Trabzon, Türkiye. **Telephone:** +90 531 559 2168 **e-mail**: mustafacicek1989@gmail.com.

Atıf için/Cited as: Cicek M, Imamoglu M, Gonenc Cekic O, Sahin A, Gunduz A. A Ten-Year Clinico-Epidemiology Profile of Poisoned Patients in a Tertiary Care Emergency Department in the Black Sea Region of Türkiye. Anatolian J Emerg Med 2025;8(2):66-73. https://doi.org/10.54996/anatolianjem.1618180.

Introduction

Increasing intoxication-related mortality and morbidity have become an important problem. Analysis of retrospective large-scale data is required for establishing diagnostic, therapeutic and admission algorithms. The importance of epidemiological data illuminating prognostic characteristics of presenting patients and showing annual presentation rates and variations, and changes in substances involved, and assisting with the taking of protective legal and clinical measures is increasing all the time. The nature of these data changes over the years, from country to country and from region to region. The repetition of these data analyses at specific intervals will therefore contribute to the reinforcement of preventive measures and procedures in clinical practice and to a reduction in unnecessary health spending by reducing intoxication-related mortality and morbidity (1, 2).

The purpose of this study was to analyze data for patients presenting due to intoxication to a tertiary emergency department receiving a mean of 75,000 patient presentations a year and also serving as a toxicology center in the Black Sea region of Türkiye, and to identify changes occurring on a year-on-year basis.

Material and Methods

Study Design

This research was designed as a retrospective, cross-sectional, descriptive, single-center study. Following approval from the local ethics committee (No. 2016/48), all patients receiving intoxication-related International Statistical Classification of Diseases and Related Health Problems (ICD-10) codes between January 2007 and December 2016 were identified from the study center's computer software system, and patient records retrieved from the archives were examined retrospectively.

Study Setting and Population

The study center was the Karadeniz Technical University Medical Faculty Hospital Emergency Department. Demographic, clinical and laboratory data were recorded onto a data form through a retrospective examination of the records of patients presenting during the study period and constituting the study population. These data included age, sex, type and time of presentation, the intoxication agent, means of exposure, symptoms and findings, treatment administered, follow-up times and locations in the hospital, and clinical outcomes. Patients aged under 17, with missing data or with incorrect ICD-10 codes were excluded.

Statistical Analysis

Statistical analysis was performed on SPSS 23.0 (IBM SPSS, Armonk, NY) software. Normality of data distribution was analyzed using the Kolmogorov Smirnov test. Student's t test was used in the statistical analysis of normally distributed data, the chi-square test for frequency analysis of non-normally distributed non-parametric data, and the Mann Whitney U test for ordinal data. $p<0.05$ was regarded as statistically significant.

Results

Two thousand five hundred forty-six patients aged over 17 receiving intoxication-related ICD-10 diagnoses from among 505,525 patients presenting to the Karadeniz Technical

Parameter	n (%)
Sex	
Female	1143 (63.1)
Male	668 (36.9)
Age	
17-24	905 (50.0)
25-34	407 (22.5)
35-43	*221 (12.2)*
44-54	152 (8.4)
55-64	57 (3.1)
>65	69 (3.8)
Education level	
Illiterate	168 (9.2)
Primary school	62 (3.4)
Middle school	115 (6.3)
High school	155 (8.5)
University	258 (14.2)
Unknown	1053 (58.1)
Place of residence	
Provincial center	971 (53.6)
District center	422 (23.3)
Village	240 (13.3)
Unknown	178 (9.8)
Marital status	
Married	184 (10.1)
Single	411 (22.6)
Divorced	12 (0.6)
Widowed	21 (1.2)
Unknown	1183 (65.3)
Type of presentation	
On foot	810 (44.7(
Via the 112 emergency system	185 (10.2)
Referral from another institution	805 (44.4)
Unknown	11 (0.6)
History of psychiatric disease	
Yes	565 (31.1)
No	443 (24.4)
Unknown	803 (44.3)

Table 1. Patients' demographic characteristics

University Farabi Hospital between 1 January 2007, and 31 December 2016, were included in the study. Following a detailed examination of the patient records, 735 patients were excluded due to deficient data, and the data for 1811 patients were finally subjected to analysis.

Intoxication-related presentations represented 0.35% (n=1811) of all emergency presentations. Women represented 63.1% (n=1143) of the patients, and 50% of the patients (n=905) were in the 17-25 age group. The patients' demographic characteristics are presented in Table 1.

Attempted suicides represented 60.7% (n=1101) of presentations. Known psychiatric disease was present in 31.1% (n=565) of patients, and in 44.6% (n=492) of the 1101 patients consuming drugs for purposes of suicide. A statistically significant relation was determined between the type of intoxication and history of psychiatric disease ($p<0.05$).

Examination of the agents resulting in intoxication showed that analgesic drugs were the most common at 24.4%, followed by antidepressants at 24.3% and sedative-hypnotic-antipsychotics at 18.8%. Paracetamol exposure was the most common form of intoxication among analgesic drugs and also among all preparations (n=224, 12.3%). The most common preparate among antidepressants was amitriptyline (n=120, 6%). In terms of target organ systems, ingestion most commonly involved nervous system drugs at 49.0% (n=896) (Figure 1).

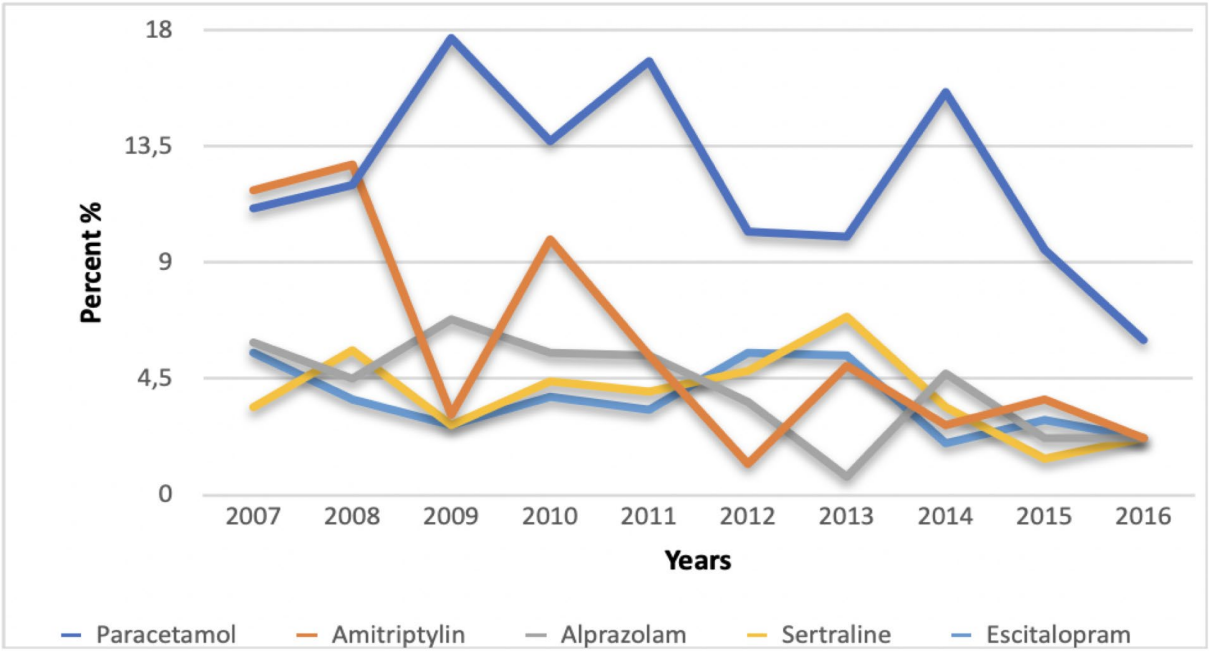

Figure 1: Distributions of the five most common agents by years

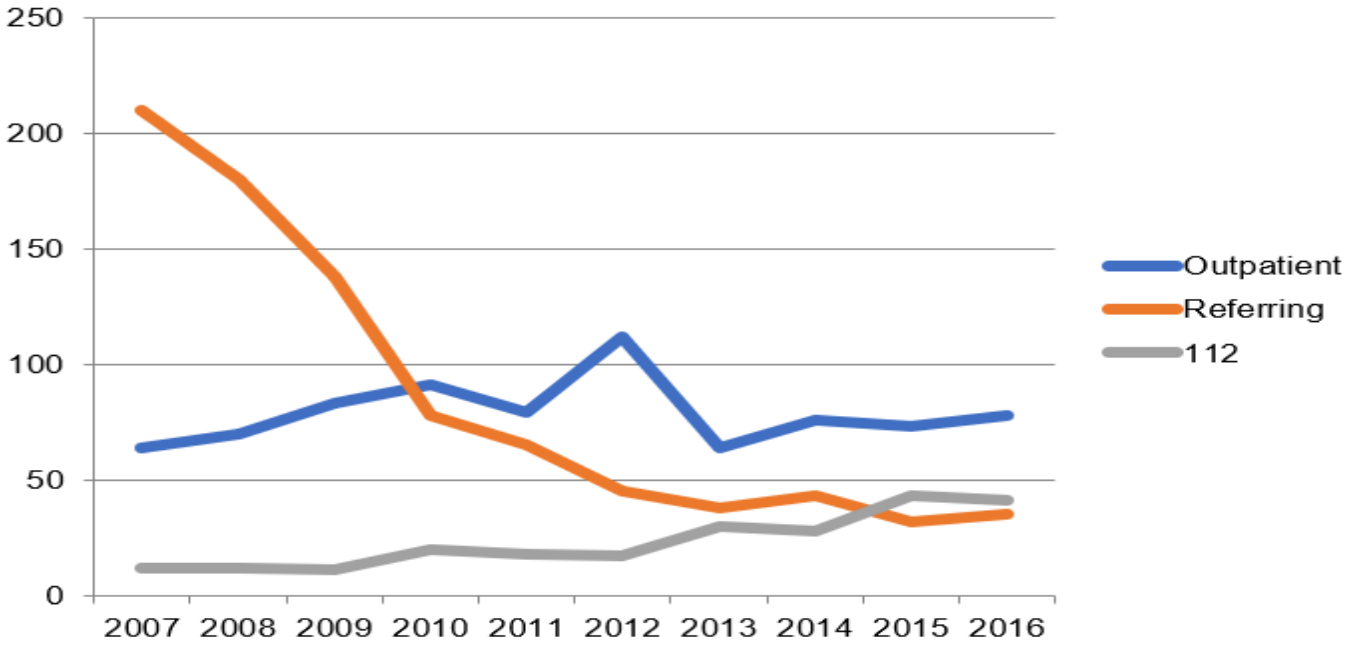

Figure 2: Types of presentation by years

Drug groups and substances	n (%)	Drug groups and substances	n (%)
Analgesic	443 (24.4)	**Antidepressant**	441 (24.3)
Paracetamol	224	SSRI	228
Non-steroidal anti-inflammatory drug	203	Sertraline	72
Diclofenac	49	Escitalopram	70
Naproxen	32	Paroxetine	57
Ibuprofen	27	TCA	154
Sedative-hypnotic-antipsychotic	342 (18.8)	Amitriptyline	120
Benzodiazepine	155	Opipramol	16
Alprazolam	82	Clomipramine	11
Medazepam	34	SNRI	19
Clonazepam	24	Venlafaxine	16
Atypical antipsychotic	115	Duloxetine	3
Quetiapine	41	Others	59
Risperidone	33	**Antihistaminic**	127 (7)
Olanzapine	28	**Cardiovascular drugs**	123 (6.8)
Typical antipsychotic	34	Beta blocker	25
Trifluoperazine	23	Diuretic	21
Haloperidol	3	Dihydropyridine calcium channel blocker	18
Chlorpromazine	3	Non-dihydropyridine calcium channel blocker	8
Opioid	7	Other	51
Other	31	**Pesticides**	40 (2.2)
Street drugs	53 (2.9)	Insecticide	19
Cocaine-Amphetamine	14	Rodenticide	21
Cannabinoid	39	**Chill medications**	180 (9.9)
Alcohol	120 (6.6)	**Animal bites/Stings**	102 (5.6)
Cleaning products	38 (2)	Scorpion	50
Vitamins	21 (1.2)	Snake	37
Antimicrobials	137 (7.5)	Bee	12
Anticonvulsants	113 (6.2)	Other	3
Carbamazepine	67	**Plant intoxications**	5 (0.2)
Valproic Acid	63	**Gas intoxication**	201 (11.0)
Phenytoin	9	Carbon monoxide	197
Hydrocarbons	6 (0.3)	Other	4
Gastrointestinal Drugs	128 (7.0)	**Other Drugs**	247 (13.6)
Mushroom	10 (0.5)	**Unknown**	39 (2.2)

Table 2. Distributions by drug groups and common agents
SNRI: Serotonin-norepinephrine reuptake inhibitor, SSRI: Selective serotonin reuptake inhibitor, TCA: Tricyclic antidepressants

All intoxication agents are shown in Table 2. In terms of procedures applied in the emergency department, decontamination methods were applied to 75.3% of patients (n=1038) and at least one elimination method to 17.2%. Antidote therapy was applied to 14.3% of patients (n=243).

We determined that the number of annual presentations to the emergency department due to intoxication decreased in a time-dependent manner (Figure 2). Presentations were most common in May and least common in September. Examination of presentations by month and sex revealed a significant difference between men and women ($p < 0.05$).

Analysis of presentation numbers and types by years revealed that the number of outpatient presentations increased between 2007 and 2012 and then decreased continuously between 2012 and 2016 (Figure 2).

The number of patients brought to the emergency department from the scene of the incident by the 112-emergency ambulance system increased continuously from 2007 to 2016. Referrals from other health institutions decreased significantly between 2007 and 2016 (Figure 2).

Analysis of times of drug ingestion and presentation to hospital among patients diagnosed with intoxication revealed a significant increase between 18:00 and 02:00 (Figure 3).

Decontamination methods were applied to 1038 (57.3%) patients. Gastric lavage was performed on 1026 (56.6%) patients, single-dose activated charcoal was administered to 977 (53.9%), whole bowel irrigation was used in two cases, and combined gastric lavage and activated charcoal was employed in 964 (53.2%) patients. Three hundred twelve (17.2%) patients received one elimination method.

Repetitive doses of activated charcoal were administered to 217 (11.9%) patients, hemodialysis to 22 (1.2%), forced diuresis to 89 (4.9%), and urine alkalinization to 5 (0.2%) (Table 3). Antidote therapy was applied to 243 patients. In addition, 83.9% (n=1702) of patients were treated in the emergency department, 1.2% (n=23) on the ward, and 4.5% (n=82) in intensive care. Healing was achieved in 90.8% (n=1645) of patients, while 0.2% (n=3) died, and outcome data were unavailable for 8.7%.

Treatment applied	**n (%)**
Decontamination	1038 (57.3)
Gastric lavage	1026 (56.6)
Single-dose activated charcoal	977 (53.9)
Gastric lavage + activated charcoal	964 (53.2)
Whole bowel irrigation	2 (0.1)
Elimination	312 (17.2)
Repetitive-dose activated charcoal	217 (11.9)
Hemodialysis	22 (1.2)
Forced diuresis	89 (4.9)
Urine alkalinization	5 (0.2)
Antidote therapy	243 (13.4)
Parameter	**n (%)**
Follow-up in the emergency department	1702 (83.9)
Follow-up on the ward	23 (1.2)
Follow-up in intensive care	82 (4.5)
Healed	1645 (90.8)
Died	3 (0.2)
Not known	163 (8.7)

Table 3. Decontamination and elimination techniques applied

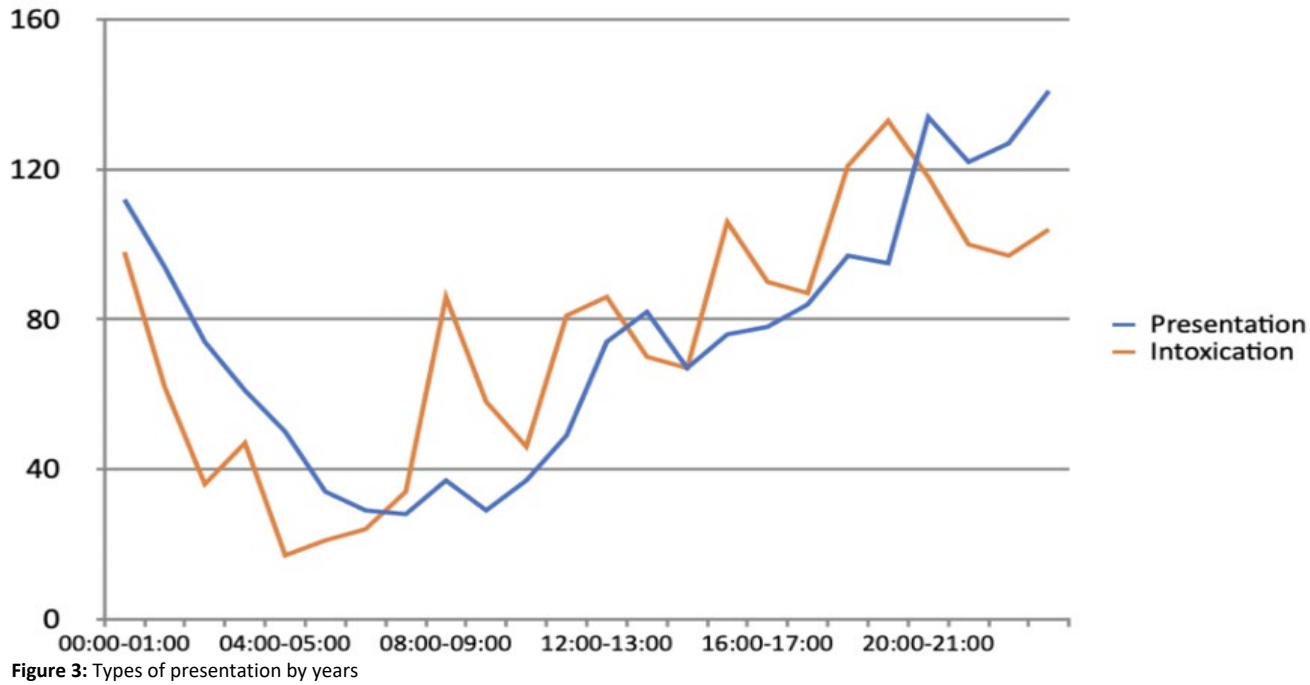

Figure 3: Types of presentation by years

Discussion

Comparison of the epidemiological findings from this study with various data in the previous literature revealed a number of discrepancies in addition to similarities. Women constituted 63.1% of cases and men (36.9%), with a female to male ratio of 1,71. The mean age of the patients was 30.6 years. Presentations were most common, at 50.0%, in the 17-25 age group, followed by the 26-34 age group. We determined that 60.7% of intoxications resulted from attempted suicide. Single drug intoxication was the most common type among our drug intoxication cases (67.7%), followed by multi-drug intoxication at 32.1%. Analgesics were the most common agents of intoxication, followed by antidepressants in second place. The number of intoxications involving paracetamol increases over time, while that of intoxications involving amitriptyline decreased. Three patients died in the departments to which they were transferred.

Our first study finding was that cases of intoxication represented 0.4% of emergency department presentations, a figure compatible with the previous literature. Several previous studies have investigated the proportion of intoxications among all patients presenting to the emergency departments. Studies from Türkiye have reported figures of 0.3-1.4%, compared to 1.4-1.7% in Japan and the USA (3-6).

The sex ratio in emergency department presentations resulting from intoxication varies from region to region, and one of the most important underlying factors is socioeconomic level. Presentation rates in studies from developing countries, and particularly in regions close to agricultural areas, are higher among men. One of our demographic findings was the higher ratio of intoxication-related hospital presentations among women. Examination of other studies in the literature shows that the male/female ratio is increasing, but that it is still higher in women than in men (7, 8). This may be due to increasing freedom among women and their beginning to enjoy economic freedom by entering the jobs market. However, unemployment is still a severe social problem, and women in Türkiye having low economic self-sufficiency together with economic difficulties and problems coping with the resulting emotional stress may lead to higher intoxication-related presentation rates compared to men (9, 10).

A gradual change in intoxication agents is inevitable due to developing and changing technology, medicolegal measures adopted, and the increase in new synthetic substances. Another finding from our study with the change in agents observed over the years. Amitriptyline was the most common intoxication agent in 2007 and 2008, but began being increasingly replaced by the analgesic paracetamol in subsequent years. The rate of intoxications with drugs affecting the nervous system, together with that of non-pharmacological agents, increased over time, while that of intoxications involving other agents remained similar over time. In a study from Europe conducted in 2001-2002, Fiaolva et al. reported that 20% of patients used at least one inappropriate drug, and that the most commonly prescribed of these were the psychotropic agents amitriptyline and doxazosin (11). Rhee et al. reported similar findings in their study from 2002-2012 (12). The prescription of more potentially harmful tricyclic antidepressants such as amitriptyline has decreased with the discovery and spread of SSRI and SNRIs (12). The initially high level of amitriptyline-related intoxications in this study may be associated with the inappropriate prescription observed in Europe during those same years. The development of new-generation antidepressants has reduced the numbers of such prescriptions. The incidence of amitriptyline-related intoxications has decreased, but it remains one of the drugs with the highest mortality levels (15).

Although paracetamol is the most common agent in some regions of Türkiye, others vary. While intoxications related to pesticides and food poisonings predominate in some regions, alcohol and corrosive materials occupy second place in others (8, 18-20). International studies show that analgesics, ethanol and other sedatives are among the most common causes of intoxications in Western countries, while organophosphates and hydrocarbons are particularly dominant in South Asia and African countries (21-26).

Young people aged 17-24 represented the majority of presentations in our study. Several other studies have reported similar findings (30-32). There may be several reasons why young patients constitute the majority of intoxication cases. These may include greater accidental exposure due to more active lifestyles, and their different responses to emotional stress.

The rate of drug consumption for purposes of suicide in our study was 60.7%, a figure compatible with studies from Türkiye but not in agreement with international studies. The rates of attempted suicides in studies from Türkiye range between 53.7% and 97.0% (27, 33). In a study from Norway in 2015, Vallersness et al. reported that drug-related attempted suicides constituted 9% of intoxication-associated presentations to the emergency department, and that the majority consisted of cases of substance abuse (34). In their study from Saudi Arabia performed in 2008-2012, Bakhaidar et al. reported that drug consumption for purposes of suicide accounted for 26.4% of intoxication cases presenting to the emergency department (7). In its 2017 report, the World Health Organization stated that intoxication for purposes of suicide represented 16% of all cases in developed countries (35).

In terms of history of psychiatric disease before presentation, Akkaş et al. reported such a history in 10% of patients (27). In our study, we determined a history of psychiatric disease in 31,1% of patients presenting to the emergency department due to intoxication. Analysis revealed a significant relation between type of intoxication and history of psychiatric disease. Patients with a history of psychiatric disease have a greater likelihood of drug ingestion for suicidal purposes and emergency department presentation (26, 36). This may be attributed to these patients having easier access to psychotropic drugs and a greater disposition to drug consumption for purposes of suicide due to depressive characteristics in the face of stressor conditions.

In terms of presentations by years, the numbers of presentations due to intoxication decreased in a time-dependent manner. In addition, analysis revealed a

significant decrease in the numbers of patients referred from other institutions. This decrease in presentation numbers and also numbers of referred patients may be due to an increase in numbers of specialist physicians and trained personnel in public hospitals, and to unnecessary referrals being prevented through improvements to health system infrastructure. Moreover, the updating of the relevant official communique on 16.10.2009 is thought to have led to a decrease in referral numbers by making these more difficult (37).

Several factors are associated with mortality and morbidity in intoxications, including the nature of the toxin consumed, the dose ingested, time of ingestion, and time elapsing until presentation to a health institution (38). Studies from Türkiye have reported intoxication-related mortality rates between 0% and 3.9% (20, 28). In international studies, the figures range between 0% and 28.5% (39, 40). Examination of studies with high mortality rates reveals that these have been conducted among populations living in areas with low socioeconomic levels, and that organophosphate intoxications predominate. The mortality rate in our study was 0.2%, relatively lower than the national average. This may be due to our center being well-equipped in terms of emergency care services and intensive care, and to presenting patients being exposed to low-degree toxin exposure.

Limitations

There are a number of limitations to this study. The first is its retrospective nature. Second, we were unable to retrieve all the data in the patient records. Another limitation is that due to the single-center nature of our study, the epidemiological data obtained reflect only the Eastern Black Sea region, and not the country as a whole.

Conclusion

Although significant time-dependent changes were not observed in demographic data this descriptive research, we nevertheless concluded that the agents involved changed significantly over time. These findings should therefore be taken into account when taking precautions aimed at reducing intoxication-related mortality and morbidity, and the characteristics of each country's own intoxication population should be clarified by means of multi-center studies.

Acknowledgements: We would like to express our gratitude to everyone who contributed to the successful completion of this study through their support and encouragement.

Conflict of Interest: The authors declare that there is no conflict of interest.

Financial Support: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' Contribution: AS: Designing the study, interpretation of data, overall supervision**. AG:** Designing the study, interpretation of data, overall supervision, performing critical revision. **MC:** Writing the manuscript, managing the submission process, interpretation of data, performing critical revision. **Mİ:** Data collection, data analysis, performing critical revision. **ÖGÇ:** Statistical analysis, interpretation of data, performing critical revision. All authors read and approved the final version of the manuscript.

Ethical Approval: Ethical approval was obtained from the local ethical committee (Approval No: 2016/48).

References

1. Andiran N, Sarikayalar F. Acute poisoning cases observed in Hacettepe University Ihsan Dogramaci Children's Hospital over the past 6 years. Katkı Pediatri Derg. 2001;22:396-408.
2. Islam MN, Islam N. Retrospective study of 273 deaths due to poisoning at Sir Salimullah Medical College from 1988 to 1997. Leg Med (Tokyo). 2003;5:S129-S31.
3. Avsarogullari L, Senol V, Akdur O, Akin A, Durukan P, Özkan S. Characteristics of acute adult poisonings in a university hospital emergency department in central Turkey: a three-year analysis. J Pak Med Assoc. 2012;62(2):129.
4. Goksu S, Yildirim C, Kocoglu H, Tutak A, Oner U. Characteristics of acute adult poisoning in Gaziantep, Turkey. J Toxicol Clin Toxicol. 2002;40(7):833-7.
5. Kubota Y, Hasegawa K, Taguchi H, Kitamura T, Nishiyama C, Iwami T, et al. Characteristics and trends of emergency patients with drug overdose in Osaka. Acute Med Surg. 2015;2(4):237-43.
6. Soslow AR. Acute drug overdose: one hospital's experience. Ann Emerg Med. 1981;10(1):18-21.
7. Bakhaidar M, Jan S, Farahat F, Attar A, Alsaywid B, Abuznadah W. Pattern of drug overdose and chemical poisoning among patients attending an emergency department, western Saudi Arabia. J Community Health. 2015;40(1):57-61.
8. Koylu R, Dundar ZD, Koylu O, et al. The experiences in a toxicology unit: a review of 623 cases. J Clin Med Res. 2014;6(1):59.
9. Gündüz A, Kesen J, Topbaş M, Narcı H, Yandı M. İntihar amaçlı zehirlenme nedeniyle acil servise başvuran hastaların analizi. TSK Koruyucu Hekim Bülteni. 2004;3(10):234-42.
10. Tountas C, Sotiropoulos A, Skliros SA, Kotsini V, Peppas TA, Tamvakos E, et al. Voluntary self-poisoning as a cause of admission to a tertiary hospital internal medicine clinic in Piraeus, Greece within a year. BMC Psychiatry. 2001;1(1):4.
11. Mort JR, Aparasu RR. Prescribing potentially inappropriate psychotropic medications to the ambulatory elderly. Arch Intern Med. 2000;160(18):2825-31.
12. Rhee TG, Schommer JC, Capistrant BD, Hadsall RL, Uden DL. Potentially inappropriate antidepressant prescriptions among older adults in office-based outpatient settings: National trends from 2002 to 2012. Adm Policy Ment Health. 2018;45(2):224-35.
13. Curtis LH, Østbye T, Sendersky V, Hutchison S, Dans PE, Wright A, et al. Inappropriate prescribing for elderly Americans in a large outpatient population. Arch Intern Med. 2004;164(15):1621-5.
14. Willcox SM, Himmelstein DU, Woolhandler S. Inappropriate drug prescribing for the community-dwelling elderly. JAMA. 1994;272(4):292-6.
15. McKenzie MS, McFarland BH. Trends in antidepressant overdoses. Pharmacoepidemiol Drug Saf. 2007;16(5):513-23.
16. Ozkose Z, Ayoglu F. Etiological and demographical characteristics of acute adult poisoning in Ankara, Turkey. Hum Exp Toxicol. 1999;18(10):614-8.
17. Kavalcı C, Durukan P, Çevik Y, Mehmet Ö. Zehirlenme olgularının analizi: Yeni bir hastanenin bir yıllık deneyimi. Turk J Emerg Med. 2006;6(4):163-6.

18. Baydin A, Yardan T, Aygun D, Doganay Z, Nargis C, Incealtin O. Retrospective evaluation of emergency service patients with poisoning: a 3-year study. Adv Ther. 2005;22(6):650-8.
19. Karakaya A, Vural N. Acute poisoning admissions in one of the hospitals in Ankara. Hum Toxicol. 1985;4(3):323-6.
20. Seydaoglu G, Satar S, Alparslan N. Frequency and mortality risk factors of acute adult poisoning in Adana, Turkey, 1997-2002. Mt Sinai J Med. 2005;72(6):393.
21. Cardozo L, Mugerwa R. The pattern of acute poisoning in Uganda. East Afr Med J. 1972;49(12):983.
22. Evans JG. Deliberate self-poisoning in the Oxford area. Br J Prev Soc Med. 1967;21(3):97.
23. Jamil H. Acute poisoning: A review of 1900 cases. J Pak Med Assoc. 1990;40(6):131-3.
24. Rygnestad T. A comparative prospective study of self-poisoned patients in Trondheim, Norway between 1978 and 1987: epidemiology and clinical data. Hum Toxicol. 1989;8(6):475-82.
25. Senewiratne B, Thambipillai S. Pattern of poisoning in a developing agricultural country. J Epidemiol Community Health. 1974;28(1):32-6.
26. Smith A. Self-poisoning with drugs: a worsening situation. Br Med J. 1972;4(5833):157.
27. Akkas M, Coskun F, Ulu N, Sivri B. An epidemiological evaluation of 1098 acute poisoning cases from Turkey. Vet Hum Toxicol. 2004;46(4):213-5.
28. Onur D, Kavak H, Serhat A, Ünlüer EE, Aksay E. Acil servise başvuran zehirlenme olgularının geriye dönük incelemesi. Çağdaş Tıp Derg. 2013;3(1).
29. Satar S, Seydaoglu G, Akpinar A, Sebe A, Karakoc E, Gumusay U, et al. Trends in acute adult poisoning in a ten-year period in Turkey: factors affecting the hazardous outcome. Bratisl Lek Listy. 2009;110(7):404-11.
30. Albert M, McCaig L, Uddin S. Emergency department visits for drug poisoning: United States, 2008-2011. NCHS Data Brief. 2015;(196).
31. Dorado SP, Martín JF, Sabugal GR, Caballero PV. Epidemiology of acute poisoning: study of 613 cases in the community of Madrid in 1994. Rev Clin Esp. 1996;196(3):150-6.
32. Viertel A, Weidmann E, Brodt H. Cases of acute poisoning admitted to a medical intensive care unit. Dtsch Med Wochenschr. 2001;126(42):1159-63.
33. Yeşil O, Akoğlu H, Onur Ö, Güneysel Ö. Acil servise başvuran zehirlenme olgularının geriye dönük analizi. Marmara Med J. 2008;21(1):26-32.
34. Vallersnes OM, Jacobsen D, Ekeberg Ø, Brekke M. Patients presenting with acute poisoning to an outpatient emergency clinic: a one-year observational study in Oslo, Norway. BMC Emerg Med. 2015;15(1):18.
35. World Health Organization. WHO Chemical Safety - Activity Report 2017. World Health Organization; 2017. Available from: http://www.who.int/ipcs/poisons/en/. Accessed December 2024.
36. Skegg K, Skegg D, Richards SM. Incidence of self-poisoning in patients prescribed psychotropic drugs. Br Med J (Clin Res Ed). 1983;286(6368):841-3.
37. T.C. Sağlık Bakanlığı. Yataklı Sağlık Tesislerinde Acil Servis Hizmetlerinin Uygulama Usul ve Esasları Hakkında Tebliğ. Resmi Gazete; 2009. Available from: http://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=9.5.13494&MevzuatIliski=0. Accessed November 2024.
38. Shadnia S, Esmaily H, Sasanian G, Pajoumand A, Hassanian-Moghaddam H, Abdollahi M. Pattern of acute poisoning in Tehran-Iran in 2003. Hum Exp Toxicol. 2007;26(9):753-6.
39. Hettiarachchi J, Kodithuwakku G. Pattern of poisoning in rural Sri Lanka. Int J Epidemiol. 1989;18(2):418-22.
40. Staikowsky F, Theil F, Mercadier P, Candella S, Benais JP. Change in profile of acute self-drug poisonings over a 10-year period. Hum Exp Toxicol. 2004;23(11):507-11.

Anatolian Journal of Emergency Medicine 2025;8(2):74-81

ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Psychiatric Emergencies and Their Characteristics Presenting to Prehospital Emergency Medical Services Between 2018 and 2023: The Case of Türkiye

2018 ve 2023 Yılları Arasında Hastane Öncesi Acil Sağlık Hizmetlerine Başvuran Psikiyatrik Acil Durumlar ve Özellikleri: Türkiye Örneği

Yeter Çuvadar Baş[1], Ayşegül Akdoğmuş [2]

ABSTRACT

Aim: Psychiatric disorders are characterized by significant impairments in cognition, emotion, and behavior, with a global prevalence of 29.2%. While these disorders are widespread, they are also commonly encountered as pre-hospital emergencies. The increase in psychiatric emergency admissions has surpassed the general trend in demand for emergency healthcare services. This study aims to identify the frequency and characteristics of psychiatric emergency calls received by the Anatolian Side Command and Control Center in Istanbul and to provide recommendations for improving pre-hospital emergency healthcare services.

Material and Methods: This retrospective cross-sectional study analyzed data from patients who received emergency services for emergent psychiatric conditions between 2018 and 2023. The data were collected from the "Emergency Health Automation System" (ASOS) and evaluated based on sociodemographic variables.

Results: Ambulance calls steadily increased from 2018 to 2021, followed by a decline in 2022 and 2023. Psychiatric emergencies were at their lowest in 2020 but rose again in 2021 and 2022. The majority of psychiatric emergencies consisted of acute behavioral disturbances and suicide attempts. Female cases accounted for 61.5% of the total, and the age group of 18-65 was the most frequently affected.

Conclusion: There has been a notable increase in psychiatric emergency cases within pre-hospital healthcare services. While most cases were classified as low urgency, the findings highlight the need for improved service delivery and increased awareness among healthcare personnel regarding psychiatric emergencies. Although most of the cases were classified as low priority, the findings suggest that healthcare personnel working in the prehospital setting should be more thoroughly informed and trained regarding the approach to psychiatric emergencies and the provision of care.

Keywords: Prehospital, psychiatric emergency, paramedic, ambulance calls

ÖZ

Amaç: Psikiyatrik bozukluklar, biliş, duygu ve davranışta belirgin bozulmalarla karakterize olup, küresel prevalansı %29,2'dir. Bu bozukluklar yaygın olmakla birlikte, hastane öncesi acil durumlar arasında da sıkça karşılaşılmaktadır. Psikiyatrik acil başvurularındaki artış, genel acil sağlık hizmetlerine olan talep artışını aşmıştır. Bu çalışmanın amacı, İstanbul Anadolu Yakası Komuta Kontrol Merkezi tarafından alınan psikiyatrik acil çağrıların sıklığını ve özelliklerini belirlemek ve hastane öncesi acil sağlık hizmetlerinin iyileştirilmesine yönelik öneriler sunmaktır.

Gereç ve Yöntemler: Bu retrospektif kesitsel çalışmada, 2018-2023 yılları arasında psikiyatrik durumlar için acil sağlık hizmeti alan hastaların verileri incelenmiştir. Veriler, "Acil Sağlık Otomasyon Sistemi" (ASOS) üzerinden toplanmış ve sosyodemografik değişkenlere göre değerlendirilmiştir.

Bulgular: Ambulans çağrıları 2018'den 2021'e kadar düzenli bir artış göstermiş, 2022 ve 2023 yıllarında ise azalma kaydedilmiştir. Psikiyatrik acil durumlar 2020 yılında en düşük seviyede görülmüş, ancak 2021 ve 2022'de yeniden artış göstermiştir. Psikiyatrik acil durumların çoğunluğunu akut davranışsal bozukluklar ve intihar girişimleri oluşturmuştur. Vakaların %61,5'i kadınlardan oluşmuş ve en çok 18-65 yaş grubunda görülmüştür.

Sonuç: Hastane öncesi sağlık hizmetlerinde psikiyatrik acil durum vakalarında belirgin bir artış gözlemlenmiştir. Vakaların çoğu düşük öncelikli olarak sınıflandırılmış olsa da elde edilen bulgular, hastane öncesi alanda çalışan sağlık personelinin psikiyatrik acil durumlara yaklaşım ve hizmet sunumu konusunda daha ayrıntılı bilgilendirilmesi ve eğitilmesi gerektiğini düşündürmektedir.

Anahtar Kelimeler: Hastane öncesi, psikiyatrik acil, paramedik, ambulans çağrıları

Received: 28 November 2024 Accepted: 20 May 2025

[1] Gedik University, Vocational School, First and Emergency Aid Department, Pendik, İstanbul, Türkiye

[2] Acıbadem Health Group, İstanbul, Türkiye

Corresponding Author: Yeter Çuvadar Baş. **Adress:** Gedik Üniversitesi, Meslek Yüksek Okulu, İlk ve Acil Yardım Bölümü, Pendik, İstanbul, Türkiye. **Telephone:** +905383275422 **E-mail**: yetercuvadar1@outlook.com.

Atıf için/Cited as: Çuvadar Baş Y, Akdoğmuş A. Psychiatric Emergencies and Their Characteristics Presenting to Prehospital Emergency Medical Services Between 2018 and 2023: The Case of Türkiye. Anatolian J Emerg Med 2025;8(2):74-81. https://doi.org/10.54996/anatolianjem.1592912.

Introduction

Psychiatric disorders, defined by disruptions in cognition, affect, and behavior, constitute a major global public health concern with a prevalence of 29.2%, and are increasingly recognized as frequent presentations in prehospital emergency medical settings (1,2).

In a period where the demand for emergency healthcare services is progressively increasing, the rise in psychiatric emergency admissions has surpassed this general trend (2). Istanbul, Türkiye's most populous city and a metropolis, is a difficult area for emergency health services to work in due to traffic, settlement and population (3). In the United States, psychiatric emergency admissions have increased by 15% over the past decade, accounting for approximately 12% of all emergency visits (2). In Iran, the one-year prevalence of psychiatric disorders has been reported at 23.6% (4). Similarly, in Germany, the rate of psychiatric emergency calls has increased by 23.3% since 1995 (5). In China, approximately 17.5% of the population is estimated to have a psychiatric disorder, contributing significantly to the nation's disease burden (1). Additionally, both Australia and the United Kingdom have experienced a year-on-year increase in demand for ambulance services, with psychiatric emergencies comprising a substantial portion of this demand (6,7,8). In Türkiye, the proportion of pre-hospital psychiatric emergencies has been reported to range from 3% to 17% between 2018 and 2023 (9).

The reasons for the increase in psychiatric emergency call rates have been explained as follows (5):

- Increased levels of psychosocial stress (e.g., due to rising unemployment and debt),
- Higher divorce rates, disintegration of family structures, and elevated levels of social isolation,
- Rising psychiatric morbidity following life-threatening illnesses or injuries, disasters, and traumas,
- An aging population with multiple comorbidities and increased polypharmacy,
- Increased rates of alcohol and substance use among young adults (5).

A significant portion of psychiatric emergency calls consists of severe acute conditions, anxiety and depressive disorders, psychosis, acute behavioral disturbances, and suicide attempts (8,10). While the etiology of psychiatric disorders remains unclear, there is broad consensus that the interaction of various genetic and environmental factors poses significant risks (1,11). Individuals with psychiatric disorders are vulnerable and require professional care (12). Therefore, it is essential for first-line emergency healthcare personnel to possess adequate knowledge of psychiatric disorders and appropriate approaches to provide effective treatment and care for individuals in need of urgent psychiatric assistance (9,12).

This retrospective study was designed to identify the frequency and characteristics of increasing psychiatric emergency calls, provide recommendations for improving the delivery of pre-hospital emergency healthcare services, and enhance the awareness of the personnel providing these services.

Material and Methods

Aim and Study Design

This study was designed as a retrospective cross-sectional analysis. The aim of the study is to identify the frequency and characteristics of increasing psychiatric emergency calls and to provide recommendations for improving the delivery of pre-hospital emergency healthcare services, as well as to enhance the awareness of the personnel providing these services.

Population and Sample of the Study

The study included patients who received emergency services due to psychiatric conditions from the ambulance service of the Anatolian Side Command and Control Center in Istanbul between 2018 and 2023. The population of this study consists of 2,013,045 individuals, and the sample includes 103,018 participants. The data of the selected patients were obtained from the "Emergency Health Automation System" (ASOS) and were evaluated based on sociodemographic characteristics. These sociodemographic variables included age, gender, time of day, season, triage status, outcome, and diagnosis. Diagnoses were categorized according to the International Classification of Diseases, 10th Revision (ICD-10). Each case was counted as representing a unique patient. Patients who were under follow-up in psychiatric clinics and utilized ambulance services solely for hospital transportation were not included in the study.

Data Collection and Analysis

Data were collected by the researcher from the Emergency Health Automation System (ASOS) of the Anatolian Side Command and Control Center in Istanbul. The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows version 22.0. Descriptive statistical methods such as frequency, percentage, mean, and standard deviation were used for data evaluation. Statistical analyses were conducted using the Pearson Chi-square test, and values of $p < 0.05$ were considered statistically significant.

Ethical Considerations

Ethical approval for the study was obtained from the Ethics Committee of Istanbul Gedik University with the reference number E-56365223-050.01.04-2023.137548.14. Institutional permission to conduct the study at the Istanbul Anatolian 112 Command and Control Center was granted by the Istanbul Provincial Health Directorate.

Results

Between 2018 and 2021, ambulance calls increased steadily, peaking at 384,922. This number declined in 2022 and 2023. Psychiatric-related calls followed a similar trend, with a sharp drop in 2020 (2.46%) likely due to the pandemic, followed by a rise in 2021–2022 and another decline in 2023. Overall, psychiatric cases accounted for 2.46% to 6% of total calls over the six-year period (Table 1).

Gender Distribution and Statistical Significance

Of the cases, 61.5% were female and 38.5% were male. Each year, the number of female cases exceeded that of males, with a particularly notable difference in 2019 and 2021. This difference is statistically significant ($p < 0.001$, Chi-square = 553.970). The higher number of female cases may be due to social, psychological, or biological factors.

Years	2018	2019	2020	2021	2022	2023	Total
Total Ambulance Calls	263,139 (100%)	331,280 (100%)	364,978 (100%)	384,922 (100%)	354,845 (100%)	314,072 (100%)	2,013,245 (100%)
Calls Due to Psychiatric Conditions	15,500 (5.89%)	19,443 (5.87%)	8,974 (2.46%)	20,970 (5.45%)	21,318 (6%)	16,813 (5.35%)	103,018 (5.12%)

Table 1. The Proportion of Psychiatric Cases Among Total Ambulance Calls

Age Distribution

The majority of cases fall within the 18-65 age group (81.5%), followed by the 0-18 age group (10.1%), the 65-74 age group (3.9%), and the 85+ group (1.6%). Notably, the 18-65 age group showed a continuous increase in the number of cases over the years, and these differences are also statistically significant ($p < 0.001$, Chi-square = 250.914). The prevalence of cases in this age group could be attributed to the working population, where stress factors from work and social life may lead to more frequent health issues.

Forensic Cases

Forensic cases account for 4.4% of the total cases, with the highest rates observed in 2021 and 2023. Non-forensic cases represent the vast majority, at 95.6%. The increase in forensic cases over the years is a notable finding, and changes in social environments or crime rates could be factors contributing to this rise. This difference is statistically significant ($p < 0.001$, Chi-square = 1193.888).

Triage Categories

Among the cases, 51.8% were classified in the green triage category, 42.5% in the yellow category, and 4.9% in the red category. The black triage category (deaths) accounted for only 0.1%, a very low proportion. There are significant differences in the distribution of triage categories ($p < 0.001$, Chi-square = 2016.090). The fact that the majority of cases fall under the green (low urgency) category may have helped balance the overall burden on the healthcare system.

Case Outcomes

Hospital transfer was the most common outcome, occurring in 51.3% of cases, followed by on-site treatment (7.7%) and inter-hospital transfers (7.6%). Refusals for transport occurred in 31.5% of cases. Significant differences were observed among the various outcomes ($p < 0.001$, Chi-square = 1878.975). These results indicate that most cases required serious intervention, often necessitating hospital transfer (Table 2).

Mental and Behavioral Disorders Due to Psychoactive Substance Use

Mental and behavioral disorders related to psychoactive substance use constituted 35.5% of the cases, making it the most prevalent disorder. A significant increase in these disorders was observed in 2022 and 2023 ($p < 0.001$, Chi-square = 94330.292).

Neurotic, Stress-Related, and Somatoform Disorders

Neurotic, stress-related, and somatoform disorders were the second most common diagnosis, accounting for 35.3% of the cases. Although there was a marked decline in these diagnoses in 2020, there was a resurgence in 2022, possibly linked to the psychological effects of the pandemic on mental health.

Organic Mental Disorders

Organic mental disorders were observed in 24.0% of the cases, showing fluctuations over the years. A significant spike was noted in 2021, where the prevalence reached 81.1%. This increase may be associated with the growing health needs of an aging population, as organic mental disorders are often linked to age-related conditions.

Other Diagnoses

Other diagnostic groups, including schizophrenia, schizotypal, and delusional disorders (2.2%), mood disorders (1.7%), and physiological disorders (0.3%), were observed at lower rates. Overall, mental health disorders demonstrate significant variability in both prevalence and diversity (Table 3).

Diagnosis Distribution by Gender

The most common diagnoses among women were neurotic, stress-related disorders (38.3%) and mental and behavioral disorders due to psychoactive substance use (33.8%). In contrast, among men, these rates were 30.7% and 38.2%, respectively. These differences are statistically significant ($p < 0.001$, Chi-square = 650.295).

Diagnosis Distribution by Age

In the 0-18 age group, the most prevalent disorders were mental and behavioral disorders due to psychoactive substance use (34.8%) and neurotic, stress-related disorders (37.6%). The frequency of these disorders in young people may be linked to adolescence and environmental influences. In the 18-64 age group, neurotic disorders (35.6%) and psychoactive substance use disorders (35.6%) were equally the most frequent conditions. The stress associated with working life could be a contributing factor to the high prevalence of these disorders in this group.

Among those aged 65 and older, organic mental disorders were the most common (27.2%). The increase in neurological and organic issues that accompany aging likely contributes to the higher prevalence of these disorders in this group. Significant differences were observed in the distribution of diagnoses across age groups and between genders ($p < 0.001$) (Table 4).

Years	2018	2019	2020	2021	2022	2023	Total	p (χ^2)
Gender								
Female	10,284	12,929	5,449	12,250	12,657	9,821	63,390	<.001 (553,970)
	(10%)	(%12.6%)	(5.3%)	(11.9%)	(12.3%)	(9.5%)	(61.5%)	
Male	5,216	6,514	3,525	8,720	8,661	6,992	39,628	
	(5.1%)	(6.3%)	(3.4%)	(8.5%)	(8.4%)	(6.8%)	(38.5%)	
Age								
0-18 years	1,634	2,155	861	1,882	2,130	1,714	10,376	<.001 (250,914)
	(1.6%)	(2.1%)	(0.8%)	(1.8%)	(2.1%)	(1.7%)	(10.1%)	
18-65 years	12,649	15,797	7,126	17,088	17,473	13,872	84,005	
	(12.3%)	(15.3%)	(6.9%)	(16.6%)	(17%)	(13.5%)	(81.5%)	
65-74 years	566	690	436	865	804	636	3,997	
	(0.5%)	(0.7%)	(0.4%)	(0.8%)	(0.8%)	(0.6%)	(3.9%)	
74-84 years	404	485	378	737	574	379	2,957	
	(0.4%)	(0.5%)	(0.4%)	(0.7%)	(0.6%)	(0.4%)	(2.9%)	
85 + years	247	316	173	398	337	212	1,683	
	(0.2%)	(0.3%)	(0.2%)	(0.4%)	(0.3%)	(0.2%)	(1.6%)	
Forensic Cases								
Yes	273	302	314	1,086	1,405	1,185	4,565	<.001 (1,193,888)
	(0.3%)	(0.3%)	(0.3%)	(1.1%)	(1.4%)	(1.2%)	(4.4%)	
No	15,227	19,141	8,660	19,884	19,913	15,628	98,453	
	(14.8%)	(18.6%)	(8.4%)	(19.3%)	(19.3%)	(15.2%)	(95.6%)	
Triage Category								
Green	8,913	11,506	4,870	9,672	9,994	8,333	53,342	<.001 (2,016,090)
	(8.7%)	(11.2%)	(4.7%)	(9.4%)	(9.7%)	(8.1%)	(51.8%)	
Yellow	5,316	6,635	3,463	10,188	10,375	7,799	43,776	
	(5.2%)	(6.4%)	(3.4%)	(9.9%)	(10.1%)	(7.6%)	(42.5%)	
Red	1,125	1,026	556	982	788	584	5,061	
	(1.1%)	(1.0%)	(0.5%)	(1.0%)	(0.8%)	(0.6%)	(4.9%)	
Black (Deceased)	10	22	13	17	21	18	101	
	(0.0%)	(0.0%)	(0.0%)	(0.0%)	(0.0%)	(0.0%)	(0.1%)	
Transport	136	200	72	111	140	79	738	
	(0.1%)	(0.2%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.7%)	
Outcome								
On-site Intervention	1,346	1,691	723	1,439	1,707	1,016	7,922	<.001 (1,878,975)
	(1.3%)	(1.6%)	(0.7%)	(1.4%)	(1.7%)	(1.0%)	(7.7%)	
Transfer to Hospital	7,095	8,782	4,135	11,879	11,785	9,159	52,835	
	(6.9%)	(8.5%)	(4.0%)	(11.5%)	(11.4%)	(8.9%)	(51.3%)	
Inter-hospital Transfer	930	1,271	620	1,623	1,940	1,415	7,799	
	(0.9%)	(1.2%)	(0.6%)	(1.6%)	(1.9%)	(1.4%)	(7.6%)	
Refusal of Transfer	5,883	7,381	3,313	5,589	5,524	4,780	32,470	
	(5.7%)	(7.2%)	(3.2%)	(5.4%)	(5.4%)	(4.6%)	(31.5%)	
Other	246	318	193	440	362	443	1,992	
	(0.2%)	(0.3%)	(0.2%)	(0.4%)	(0.3%)	(0.4%)	(1.9%)	

Table 2. Distribution of Cases by Sociodemographic Characteristics
n = sample size χ^2 = Pearson Chi-square, p <.001

Discussion

Gender Distribution in Our Study and Comparison with the Literature

In this study, female cases (61.5%) outnumbered male cases (38.5%). Additionally, women tend to seek healthcare services more frequently than men, which could also be a contributing factor. Similar findings have been reported in the literature, where studies indicate that psychiatric emergency admissions are more common among women (13,14). A study conducted in Türkiye also found that women had a higher rate of emergency admissions (15). Similarly, another study reported that women are more likely to seek healthcare service (16). This tendency could be attributed to women having greater access to, or a higher inclination toward, utilizing healthcare services. However, a study by the London Ambulance Service that examined gender distribution among patients experiencing agitation did not observe such gender differences (17). Moreover, another study concluded that while gender differences were not significant, men were more prone to substance use (18). On the other hand, a study by Spurrell et al. (2003) on psychiatric emergency admissions in the UK found that male cases (54.5%) were more prevalent than female cases (19). This disparity may be explained by differences in access to healthcare services, social norms, and the tendency of women to seek psychological help, which can vary between countries.

Diagnoses	2018	2019	2020	2021	2022	2023	Total	p (χ^2)
Mental health disorders due to organic causes	528 (3.4%)	753 (3.9%)	6.216 (25.2%)	16.997 (81.1%)	155 ,0.7%)	47 (0.3%)	24,696 (24.0%)	<.001 (94,330,292)
Mental and behavioral disorders related to the use of psychoactive substances	2,960 (19.1%)	3,608 (18.6%)	1,673 (18.6%)	3,973 (18.9%)	10,825 (50.8%)	13,490 (80.2%)	36,532 (35.5%)	
Schizophrenia, schizotypal, and delusional disorders	570 (3.7%)	588 (3.0%)	52 (0.6%)	0 (0.0%)	1,079 (5.9%)	506 (3.0%)	2,795 (2.2%)	
Mood disorders	207 (1.3%)	243 (1.2%)	25 (1.5%)	0 (0.0%)	701 (3.3%)	542 (3.2%)	1,718 (1.7%)	
Neurotic, stress-related, and somatoform disorders	10,987 (70.9%)	13,932 (71.7%)	987 (11.0%)	0 (0.0%)	8,389 (39.4%)	2,117 (12.6%)	36,412 (35.3%)	
Behavioral syndromes associated with physiological disorders and physical factors	34 (0.2%)	39 (0.2%)	2 (0.0%)	0 (0.0%)	117 (0.5%)	70 (0.4%)	262 (0.3%)	
Adult personality and behavior disorders	119 (0.8%)	145 (0.7%)	12 (0.1%)	0 (0.0%)	6 (0.0%)	3 (0.0%)	285 (0.3%)	
Intellectual disabilities	2 (0.0%)	5 (0.0%)	0 (0.0%)	0 (0.0%)	3 (0.0%)	1 (0.0%)	11 (0.0%)	
Developmental disorders of psychological development	15 (0.1%)	29 (0.1%)	4 (0.0%)	0 (0.0%)	10 (0.0%)	18 (0.1%)	76 (0.1%)	
Unspecified mental health disorder	78 (0.5%)	101 (0.5%)	3 (0.0%)	0 (0.0%)	33 (0.2%)	19 (0.1%)	234 (0.2%)	

Table 3. Distribution of Cases by Diagnoses

n = sample size, χ^2 = Pearson Chi-square, p <.001

Gender Differences in Neurotic Disorder Admissions in Our Study

In this study, the rate of admissions related to neurotic disorders among women was approximately twice that of men. This finding aligns with the literature on gender-based mental health differences. Similarly, a study reported that women are more likely than men to seek emergency services for psychiatric disorders (20). Another study highlighted that the COVID-19 pandemic, with its associated social isolation, economic uncertainty, and increased psychosocial stress, disproportionately affected women, leading to a greater burden on their mental health (18). This suggests that women may be more vulnerable to mental health issues and that their coping mechanisms for neurotic disorders might weaken, leading to higher emergency healthcare admissions. A study conducted in the UK reported that the majority of mental health emergency visits were made by women, with a significant portion of these visits attributed to neurotic disorders such as anxiety and depression (10). The fact that women are more frequently faced with such disorders likely increases their rate of seeking healthcare services. This consistency between our findings and international trends suggests that the results of our study are reflective of broader, global patterns in mental health.

Age Distribution in Our Study and Comparison with the Literature

In this study, the largest patient group was those aged 18-65 (81.5%), with 10.1% of cases in the 0-18 age group. This finding is consistent with a study conducted in Türkiye, where the majority of individuals seeking emergency healthcare services were also within the 18-65 age range (15). This result supports the notion that young and middle-aged adults are more likely to seek mental health services due to stressors related to work and social life. A study focusing on older individuals reported an increase in psychiatric emergency admissions among those aged 65 and above over the years, with symptoms such as cognitive impairments, including delirium and Alzheimer's disease, being prevalent in this age group (20). This rise in psychiatric cases among the elderly highlights the growing need for psychiatric healthcare services as the population ages. In Türkiye, the higher frequency of emergency healthcare visits by elderly individuals is likely related to the increased incidence of conditions such as dementia, depression, and cognitive disorders in old age. Similarly, in the study by Spurrell et al. (2003), the average age of patients was 36.6 years, with a higher number of visits made by younger adults. The frequent encounters of young adults with stressors from work, social life, and familial responsibilities may explain the high number of cases in this age group (19).

Prevalence of Substance Use and Neurotic Disorders in Our Study and Comparison with the Literature

In this study, 35.5% of the cases seeking pre-hospital emergency services were diagnosed with mental and behavioral disorders due to psychoactive substance use, while 35.3% were diagnosed with neurotic stress-related disorders. Lindor et al. similarly reported that substance use is common among psychiatric emergency cases, with 30% of patients presenting to emergency services due to substance-related complaints (21). Both in Türkiye and internationally, substance use has been observed to significantly increase the demand for emergency healthcare services. A similar study conducted in Germany found that 11.8% of psychiatric emergency calls were related to psychiatric disorders, with alcohol intoxication, agitation, and suicide attempts being frequently reported (5). In line with these findings, substance use plays a significant role in psychiatric emergency admissions. However, the rates observed in Türkiye are higher compared to Germany, which may be explained by differences in the social structure and awareness of substance use issues in Türkiye.

Gender	Mental health disorders due to organic causes	Mental and behavioral disorders related to the use of psychoactive substances	Schizophrenia, schizotypal, and delusional disorders	Mood disorders	Neurotic, stress-related, and somatoform disorders	Behavioral syndromes associated with physiological disorders and physical factors	Adult personality and behavior disorders	Intellectual disabilities	Developmental disorders of psychological development	Unspecified mental health disorder	p (χ^2)
Woman	14,653 (23.1%)	21,408 (33.8%)	1,549 (2.4%)	1,023 (1.6%)	24,262 (38.3%)	143 (0.2%)	158 (0.2%)	9 (0.0%)	39 (0.1%)	146 (0.2%)	<.001 (650,295)
Man	10,043 (25.3%)	15,121 (38.2%)	1,246 (3.1%)	695 (1.8%)	12,150 (30.7%)	119 (0.3%)	127 (0.3%)	2 (0.0%)	37 (0.1%)	88 (0.2%)	
Age Group											
0-18 age	2,248 (21.7%)	3,608 (34.8%)	277 (2.7%)	211 (2.0%)	3,904 (37.6%)	26 (0.3%)	31 (0.3%)	2 (0.0%)	26 (0.3%)	43 (0.4%)	
18-65 age	19,877 (23.7%)	29,898 (35.6%)	2,314 (2.8%)	1,355 (1.6%)	29,918 (35.6%)	189 (0.2%)	225 (0.3%)	9 (0.0%)	42 (0.0%)	178 (0.2%)	
65-74 age	1,089 (27.2%)	1,410 (35.3%)	110 (2.8%)	69 (1.7%)	1,285 (32.1%)	14 (0.4%)	13 (0.3%)	0 (0.0%)	6 (0.2%)	1 (0.0%)	<.001 (421,649)
74-84 age	967 (32.7%)	1,015 (34.3%)	66 (2.2%)	51 (1.7%)	823 (27.8%)	18 (0.6%)	10 (0.3%)	0 (0.0%)	1 (0.0%)	6 (0.2%)	
85 age and above	515 (30.6%)	598 (35.5%)	28 (1.7%)	32 (1.9%)	482 (28.6%)	15 (0.9%)	6 (0.4%)	0 (0.0%)	1 (0.1%)	6 (0.4%)	

Table 4. Distribution of Diagnoses by Gender and Age Variables
n = sample size, χ^2 = Pearson Chi-square, p <.001

Although, this difference may also be due to the limited size of the research group.

Kabadayı Şahin and Usul reported that during the COVID-19 period, substance use-related admissions decreased among individuals under the age of 18, while increasing among those aged 65 and older (18). This finding suggests that older individuals may be more susceptible to health problems related to substance use, leading to a rise in emergency healthcare admissions in this group.

In addition, neurotic stress-related disorders were also prevalent in our study. It is likely that the increase in psychological stress factors and social isolation following the pandemic has contributed to the widespread occurrence of such disorders. A study conducted in Italy during the pandemic similarly reported an increase in psychiatric disorders during this period (22). Silva et al. noted that stress-related disorders are frequently observed in psychiatric emergency cases. They also highlighted that emergency psychiatric protocols struggle to adequately address these conditions and that healthcare workers often require additional psychosocial interventions when dealing with such cases (16).

This highlights the global nature of stress-related mental health issues, particularly in the aftermath of crises like the pandemic, and underscores the need for enhanced psychosocial support in emergency healthcare settings.

The Impact of COVID-19 on Mental Health and Psychiatric Emergency Admissions

The effects of the COVID-19 pandemic on mental health are evident in this study, particularly in the changes in psychiatric emergency admissions over the years. Notably, a significant increase in organic mental disorders was observed in 2021 and 2022. A study conducted in Italy examining the mental health impacts of the COVID-19 pandemic similarly emphasized that the pandemic had exacerbated psychiatric disorders and led to severe challenges in mental health services (22). This supports the notion that the uncertainty, social isolation, and economic hardships caused by the pandemic had devastating effects on mental health across society.

Forensic Cases and Socioeconomic Factors

In this study, forensic cases accounted for 4.4% of all cases, with an increase observed particularly between 2021 and 2023. Similarly, a study found that men from lower socioeconomic backgrounds were more prone to criminal behavior and forensic cases (19). The rise in forensic cases may be linked to worsening socioeconomic conditions and heightened societal tensions following the pandemic.

Triage Categories and Case Severity

This study found that the majority of cases were classified in the green triage category (51.8%), indicating low urgency, while only 4.9% of cases fell under the red triage category, which signifies high urgency. This suggests that most psychiatric cases presented to pre-hospital emergency services were not life-threatening. A study conducted in Copenhagen similarly reported that the majority of psychiatric emergency cases were low-risk (23). These findings highlight that psychiatric emergencies tend to require observation and assessment rather than immediate critical intervention. A similar observation was made in a

study on elderly individuals, where most cases fell into low-risk categories (20). The predominance of low-urgency triage categories in psychiatric emergencies suggests that while these cases may not pose an immediate life-threatening risk, they nonetheless require timely observation, evaluation, and treatment (24). This aligns with the broader trend of psychiatric emergencies being less about acute medical crises and more about managing mental health conditions that need ongoing care and attention.

Limitations

The findings of this study are limited to the Anatolian Side of Istanbul and cannot be generalized.

Conclusion

This retrospective study conducted in a local part of Istanbul provides a detailed analysis of the distribution and diagnoses of psychiatric cases presenting to pre-hospital emergency healthcare services. When compared with other studies in the literature, similar findings were observed regarding gender, age groups, substance use, and the effects of the COVID-19 pandemic. However, the increase in forensic cases and the differences in triage categories reflect the socio-cultural and economic dynamics in Istanbul/ Türkiye and their impact on mental health. These findings offer valuable insights that can serve as an important guide for planning and improving healthcare services in the future. Regular training programs should be implemented to enhance the knowledge and intervention skills of prehospital emergency healthcare personnel regarding psychiatric emergencies. Additionally, more comprehensive field studies should be conducted to investigate the underlying causes of the increase in psychiatric emergency calls, and service planning should be structured accordingly. Establishing an effective referral and transfer system for the management of psychiatric cases will improve the efficiency of healthcare services.

Conflict of Interest: The authors declare that there is no conflict of interest.

Financial Support: The study was supported under application number 1919B012303395 as part of the 2023 first-term cycle of TÜBİTAK's 2209-A Research Projects Support Program for University Students, administered by the Scientist Support Programs Presidency (BİDEB).

Authors' Contribution: YÇB: Conceptualization, Statistical analysis, Literature review, study design, data collection, interpretation of data, and manuscript writing, supervision.n **AA:** Literature review, data collection, interpretation of data, manuscript writing.

Ethical Approval: Ethical approval for the study was obtained from the Ethics Committee of Istanbul Gedik University with the reference number E-56365223-050.01.04-2023.137548.14. Institutional permission to conduct the study at the Istanbul Anatolian 112 Command and Control Center was granted by the Istanbul Provincial Health Directorate.

References

1. Liu JJ, Wang F, Liu H, et al. Ambient fine particulate matter is associated with increased emergency ambulance dispatches for psychiatric emergencies. Environ Res. 2019;177:108611. doi:10.1016/j.envres.2019.108611
2. Çuvadar Baş Y. Prehospital psychiatric emergencies. J Pre-Hosp. 2023;8(1):129-136. doi:10.54409/hod.1228744
3. Karakuş Yılmaz B, Çevik E, Doğan E, et al. 112 Emergency Medical Service In The Metropolis. J Ist Faculty Med. 2014; 77(3).
4. Shirzad S, Maleki M, Eskandari Z, et al. Developing a prehospital suicide management protocol for emergency medical services: An Iranian experience. BMC Emerg Med. 2021;21(47):1-10. doi:10.1186/s12873-021-00437
5. Pajonk FG, Lubda J, Sittinger H, et al. Assessment of psychiatric emergencies by physicians in the pre-hospital emergency medical system. Gen Hosp Psychiatry. 2008;30(4):360-366. doi:10.1016/j.genhosppsych.2008.03.006
6. Chalk D, Black S, Pitt M. Which factors most influence demand for ambulances in South West England? J Paramed Pract. 2016;8(7):356-367. doi:10.12968/jpar.2016.8.7.356
7. Paulin J, Kurola J, Salanterä S, et al. Changing role of EMS: Analyses of non-conveyed and conveyed patients in Finland. Scand J Trauma Resusc Emerg Med. 2020;28(1):1-4. doi:10.1186/s13049-020-00737-4
8. Moore HE, Siriwardena AN, Gussy M, Spaight R. Mental health emergencies attended by ambulances in the United Kingdom and the implications for health service delivery: A cross-sectional study. J Health Serv Res Policy. 2022;28(2):138-146. doi:10.1177/13558196221119913
9. Çuvadar Baş Y. The concept of empathy in paramedic practices. J Pre-Hosp. 2023;8(3):320-328. doi:10.54409/hod.1360384
10. Moore A, Kapur N, Osborn D, et al. Mental health emergencies attended by ambulances in the United Kingdom and the implications for health services: A population-based cohort study. Br J Psychiatry. 2022;220(2):123-131. doi:10.1192/bjp.2022.16
11. Matosin N, Halldorsdottir T, Binder EB. Understanding the molecular mechanisms underpinning gene by environment interactions in psychiatric disorders: The FKBP5 model. Biol Psychiatry. 2018;83(9):821-830. doi:10.1016/j.biopsych.2017.10.021
12. Sunnqvist C, Berngarn A, Ekezie PE, et al. A pilot evaluation of a prehospital emergency psychiatric unit: The experiences of patients, psychiatric and mental health nurses, and significant others. Perspect Psychiatr Care. 2022;58(4):2255-2262. doi:10.1111/ppc.13055
13. Sabancıoğulları S. Psychiatric Disorders. In: Gündüz ES, ed. Prehospital Approach to Patients with Special Needs for Paramedics. Ankara; 2020:232-260.
14. Stiffler KA, Kohli E, Chen O, et al. Characterization of older emergency department patients admitted to psychiatric units. J Clin Med Res. 2015;7(11):842-844. doi:10.14740/jocmr2356w
15. İpekçioğlu D, Çetinkaya Ö, Yıldırım MH, et al. Emergency service: What are the needs of the elderly in this area differing from young people and what can be done? A retrospective comparative study. J Acad Res Med. 2020;10(1):61-62. doi:10.4274/jarem.galenos.2020.3150
16. Kaya AA, Ulutaşdemir N, Ayker BB, et al. Evaluation of emergency applications made to pre-hospital emergency health services by schools and dormitories. Gümüşhane Univ Sağlık Bilim Derg. 2023;12(2):737-745. doi:10.37989/gumussagbil.1272443
17. Silva SDV, Oliveira AMN, Medeiros SP, et al. Nurses' conceptions regarding the use of psychiatric emergency protocols in mobile pre-hospital care. Rev Enferm UERJ. 2020;28:e50191. doi:10.12957/reuerj.2020.50191
18. Brown N, Edwards T, McIntyre I, Faulkner M. A retrospective cohort study of pre-hospital agitation management by advanced paramedic practitioners in critical care. Br Paramed J. 2022;7(3):8-14. doi:10.29045/14784726.2022.12.7.3.8

19. Kabadayi Sahin E, Usul E. Prehospital emergency service use for substance-related issues before and during COVID-19. Emerg Med Int. 2023;2023:8886832. doi:10.1155/2023/8886832
20. Hatfield B, Spurrell M, Perry A. Characteristics of patients presenting for emergency psychiatric assessment at an English hospital. Psychiatr Serv. 2003;54(2):240-245. doi:10.1176/appi.ps.54.2.240
21. Şan İ, Uzunhasanoğlu G, Özkan B. Hastane öncesi geropsikiyatrik hastalıklar ve özellikleri: Retrospektif bir çalışma. Geriatrik Bilimler Dergisi. 2020;3(3):124-131. doi:10.47141/geriatrik.846769
22. Lindor RA, Campbell RL, Pines JM, et al. EMTALA and patients with psychiatric emergencies: A review of relevant case law. Ann Emerg Med. 2014;64(5):439-444. doi:10.1016/j.annemergmed.2014.01.005
23. de Girolamo G, Cerveri G, Clerici M, et al. Mental health in the coronavirus disease 2019 emergency—The Italian response. JAMA Psychiatry. 2020. doi:10.1001/jamapsychiatry.2020.1276
24. Sæbye D, Høegh EB, Knop J. Triage in psychiatric emergency services in Copenhagen: Results from a descriptive 1-year evaluation study. Nord J Psychiatry. 2017;71(7):536-542. doi:10.1080/08039488.2017.1348540

Anatolian Journal of Emergency Medicine 2025;8(2):82-90

ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Level of Satisfaction of Parents of Children with Nursing Care in the Paediatric Emergency Departments

Çocuk Acil Servise Başvuran Ebeveynlerin Hemşirelik Bakımına İlişkin Memnuniyet Düzeyleri

Ahmet Bütün[1], Mehmet Özyurt[2]

ABSTRACT

Aim: Assessing the level of satisfaction among parents in paediatric emergency departments (PED) is important in determining whether healthcare providers are meeting parents' needs and expectations. Understanding the factors that influence parents' satisfaction with nursing care in the PED is essential for improving the quality of healthcare delivery. This study aims to determine the level of satisfaction of parents with nursing care in PED and identify specific nursing activities associated with parents' satisfaction.

Material and Methods: This study is a descriptive cross-sectional study. Participants were parents who visited the PED of Mardin Training and Research Hospital in Mardin, Turkey. The study included 619 parents. A convenience sampling was used to recruit participants. The data were collected between 20/05/2024 – 18/08/2024. Data collection tools included "socio-demographic and paediatric emergency department admission questions questionnaire" and "Newcastle Satisfaction with Nursing Scale".

Results: The results show that the satisfaction scores of illiterates were found to be higher than those of secondary school, high school, and undergraduate graduates ($p<0.05$). The results showed that there were statistically significant differences in the satisfaction scores in terms of satisfaction with the care child received in the PED, the time allocated to child for treatment and care, trust in PED, level of satisfaction with PED, opinions about the behaviours of nurses in PED and prefer to receive healthcare from this PED and its nurses in the future ($p<0.05$). The highest scores obtained from the Newcastle Satisfaction with Nursing Scale were given to the items of respect for patients' privacy, nurses' helpfulness, and nurses' competence in their work. The lowest scores obtained from the Newcastle Satisfaction with Nursing Scale were given to nurses giving information to patients about their conditions and diseases, nurses making patients feel at home, and nurses checking whether the patient was okay.

Conclusion: Parents' satisfaction levels with nursing care in PED were low. This study recommends increasing the quality of nursing practices in order to increase parents' satisfaction.

Keywords: Satisfaction, parents, children, nursing care, emergency department, paediatric emergency department.

ÖZ

Amaç: Çocuk acil servislerde ebeveynler arasındaki memnuniyet düzeyinin değerlendirilmesi, sağlık hizmeti sunucularının ebeveynlerin ihtiyaç ve beklentilerini karşılayıp karşılamadığını belirlemede önemlidir. Ebeveynlerin çocuk acil servislerde hemşirelik bakımından memnuniyetini etkileyen faktörleri anlamak, sağlık hizmeti sunumunun kalitesini artırmak için çok önemlidir. Bu çalışmanın amacı, ebeveynlerin çocuk acil servislerde hemşirelik bakımından memnuniyet düzeylerini belirlemek ve ebeveynlerin memnuniyeti ile ilişkili spesifik hemşirelik etkinliklerini belirlemektir.

Gereç ve Yöntemler: Bu çalışma tanımlayıcı kesitsel bir çalışmadır. Katılımcılar, Türkiye'de Mardin ilinde Mardin Eğitim ve Araştırma Hastanesi çocuk acil servisi ziyaret eden ebeveynlerdi. Çalışma 619 ebeveyn ile tamamlanmıştır. Katılımcıların çalışmaya dahil edilmesinde kolaylık örneklemesi kullanılmıştır. Veriler 20/05/2024 – 18/08/2024 tarihleri arasında toplanmıştır. Veri toplama araçları arasında "sosyo-demografik ve çocuk acil servis başvuru soruları anketi" ve "Newcastle Hemşirelikten Memnuniyet Ölçeği" yer almaktadır.

Bulgular: Sonuçlar, okuryazar olmayanların memnuniyet puanlarının ortaokul, lise ve lisans mezunlarına göre daha yüksek olduğunu göstermektedir ($p<0,05$). Sonuçlar, çocuğun çocuk acil serviste aldığı bakımdan memnuniyet, çocuğa tedavi ve bakım için ayrılan zaman, çocuk acil servise güven, çocuk acil servisinde memnuniyet düzeyi, çocuk acil servisindeki hemşirelerin davranışlarına ilişkin görüşler ve gelecekte bu çocuk acil serviste ve hemşirelerinden sağlık hizmeti almayı tercih etme açısından memnuniyet puanlarında istatistiksel olarak anlamlı farklılıklar olduğunu göstermiştir ($p<0,05$). Newcastle Hemşirelikten Memnuniyet Ölçeği'nden en yüksek puanlar hasta mahremiyetine saygı, hemşirelerin yardımseverliği ve hemşirelerin işlerindeki yeterlilikleri maddelerine verilmiştir. Newcastle Hemşirelikten Memnuniyet Ölçeği'nden elde edilen en düşük puanlar hastalara durumları ve hastalıkları hakkında bilgi veren hemşirelere, hastaların kendilerini evlerinde hissetmelerini sağlayan hemşirelere ve hastanın iyi olup olmadığını kontrol eden hemşirelere verilmiştir.

Sonuç: Ebeveynlerin çocuk acil serviste hemşirelik bakımından memnuniyet düzeyleri düşüktü. Bu çalışma, ebeveyn memnuniyetinin artırılması için hemşirelik uygulamalarının niteliğinin artırılmasını önermektedir.

Anahtar Kelimeler: Memnuniyet, ebeveyn, çocuk, hemşirelik bakımı, acil servis, çocuk acil servisi

Received: 30 September 2024 Accepted: 21 March 2025

[1] Mardin Artuklu University, Faculty of Health Sciences, Department of Nursing, Mardin, Türkiye

[2] Mardin Artuklu University, Faculty of Health Sciences, Department of Healthcare Management, Mardin, Türkiye

Corresponding Author: Ahmet Bütün. **Address:** Mardin Artuklu Üniversitesi, Sağlık Bilimleri Fakültesi, Hemşirelik Bölümü, Mardin, Türkiye. **Telephone:** +905457173212 **E-mail**: ahmetbutun@artuklu.edu.tr.

Atıf için/Cited as: Bütün A, Özyurt M. Level of Satisfaction of Parents of Children with Nursing Care in the Paediatric Emergency Departments. Anatolian J Emerg Med 2025;8(2):82-90. https://doi.org/10.54996/anatolianjem.1558753.

Introduction

Nursing care in the Paediatric Emergency Department (PED) encompasses a wide range of activities, including the provision of comfort, interaction with patients, and the management of diverse patient populations (1). The level of satisfaction of patients with nursing care in the PED is a critical aspect of healthcare delivery. Patient satisfaction is closely linked to the quality of nursing care provided in PED (2). The role of nurses as the primary interface between patients and hospital services underscores the significance of their activities in shaping patient satisfaction (2). Additionally, the relationship between patient safety culture, job satisfaction, and adverse events among nurses working in PED has been investigated. These studies collectively highlight the multifaceted nature of nursing care in the PED and its impact on patient satisfaction (1, 2).

The quality of nursing care in paediatric emergency care settings significantly impacts the satisfaction and well-being of both children and their families. Nursing staff play an important role in addressing the specific needs and concerns of children and their parents, and their performance can significantly impact the overall patient experience. Satisfaction of healthcare service users is a critical measure of healthcare quality, reflecting the extent to which a patient's needs and expectations are fulfilled during treatment process (3). In addition, overcrowding in the PED setting is associated with decreased levels of satisfaction, longer waiting times, and poses a risk to the quality of care (4, 5). Reducing overcrowding could result in an increased level of satisfaction and higher quality of care in PED settings (5).

Assessing the level of satisfaction among parents in PED is important in determining whether healthcare providers are meeting their parents' needs and expectations. In addition, understanding the factors that influence parents' satisfaction with nursing care in the PED is essential for improving the quality of healthcare delivery. Several factors have been identified as contributing to patient satisfaction with nursing care, including communication, availability of nursing staff, and their technical competence. Studies have shown that improvements in these areas can lead to higher levels of patient satisfaction and better health outcomes (3, 6). However, the existing literature on patient satisfaction in the PED setting remains limited, particularly in terms of the perspectives of parents and caregivers. This study aims to address this gap by evaluating the level of satisfaction among parents of children receiving nursing care in PEDs. This study aims to determine the level of satisfaction of parents with nursing care in PED and identify specific nursing activities associated with parents' satisfaction. By analysing the perspectives and experiences of parents, this study aims to provide valuable insights into the strengths and areas for improvement in nursing care within PED settings.

Material and Methods

Study Design

This study was designed as a descriptive cross-sectional study.

Study Setting and Population

Participants were those who visited the PED of Mardin Training and Research Hospital in Mardin, Turkey. The Mardin Training and Research Hospital is a tertiary hospital with a 700-bed capacity, and with a PED serves an average of 400 children daily and approximately 140 thousand children annually. The minimum sample size was determined as n = 384, with a 50% incidence rate at a 95-confidence interval using the Sample Size website. The study was completed with 619 parents. A convenience sampling was used to recruit participants. Power analysis was performed using G*Power version 3.1.9.6 software. As the data did not follow a normal distribution, the Mann-Whitney U test was used to compare groups. The expected effect size was set at medium (Cohen's d = 0.5), with a significance level of 0.05 and a two-sided hypothesis. With a total sample size of 619 participants, the power of the study was calculated 100%.

Data collection

The data were collected between 20/05/2024 – 18/08/2024 from 619 participants by the research team. The researchers (A.B. and M.Ö.) invited participants to the study, and the questionnaire was applied to those who agreed to participate. The questionnaire questions were asked by the researchers to the participants face-to-face, and their answers were recorded on Google Forms by the researchers. Following such a face-to-face data collection approach allows to collect more reliable data.

Data collection tools

Data collection tools were "socio-demographic and paediatric emergency department admission questions questionnaire" and "Newcastle Satisfaction with Nursing Scale".

Socio-demographic and paediatric emergency department admission questions questionnaire:

This questionnaire was developed based on the existing literature. This was piloted with 10 participants and amended based on the feedback received before the actual data collection process. This form included 24 questions regarding gender, age, marital status, education status, occupation of the parent, where the parent lives, income status, the average number of times per month the child visits a health institution for any health problem (illness, vaccination, test, prescription, etc.), the first health institution to be contacted in case of any health problem/illness for the child, and various questions about emergency admissions.

Newcastle Satisfaction with Nursing Scale (NSNS):

The scale was developed by Thomas et al. (7), and its validity and reliability into Turkish was conducted by Akin and Erdogan (8). The necessary permission was obtained from the authors of the Turkish version of this scale (8). The scale consists of 19 questions. In the evaluation of the scale, 5-point Likert type (not at all satisfied: 1, barely satisfied: 2, quite satisfied: 3, very satisfied: 4, and completely satisfied: 5) was used. The maximum score that can be obtained from the scale is 95 and the minimum score is 19. The total score for each parent is converted to 100 and 100 represents complete satisfaction/highest level of satisfaction with all aspects of care. In the Turkish version of the scale, Akin and Erdogan (8) calculated the Cronbach alpha value as 0.96, while in this study it was calculated as 0.97 and its reliability is high.

Data Analysis

The data were analysed using SPSS 26.0 software (Statistical Package for Social Science). Percentage, mean and standard deviation were used to describe the socio-demographic variables. Since the data did not follow the normal distribution, Mann-Whitney U test and Kruskal Wallis H test were used to compare the quantitative data. The p value <0.05 was considered significant.

Ethical considerations

Ethical approval was obtained from Mardin Artuklu University Non-Invasive Clinical Research Ethics Committee (Date: 07/05/2024, Reference no: 2024/5-9). In addition, the necessary institutional permissions were obtained from the Mardin Provincial Directorate of Health (Date: 15/05/2024, Reference no: E-68051626-770-243855324). Informed consent was obtained from all participants. The study was carried out in accordance with the principles of the Declaration of Helsinki.

Results

Table 1 presents the socio-demographic characteristics and satisfaction scores of parents of children with nursing care in the PED. A total of 619 parents were surveyed. Of these, 61.1% (378) were female, the mean age of parents was (33.74±10.24), and the mean age of children brought to the PED was (6.39±4.62). Of participants, 35.7% (221) were aged between 20 and 29 years, 86.6% (536) were married, 64.9% (402) had a nuclear family, 27.6% had a bachelor's degree, 30.9% were unemployed, almost half of the parents (49.6%) live in the province, more than half of parents (61.4%) had income equal to expenditure, and the vast majority (89.5%) had health insurance. The results revealed statistically significant differences in the satisfaction scores of parents in terms of parents' education status, profession, residence address and whether had health insurance (p<0.05).

The results show that the satisfaction scores of illiterates were found to be higher than those of secondary school, high school and undergraduate graduates (p<0.05). Additionally, housewives reported higher satisfaction scores than the unemployed (p<0.05). Furthermore, those living in the district had higher satisfaction scores than those living in the village. The satisfaction levels of the participants with health insurance were higher than those without health insurance (p<0.05). There were no statistically significant differences in the satisfaction scores among the variables of gender, age group, marital status, type of family and income status (Table 1).

Table 2 shows the most common presenting medical problems that led parents to visit the PED. Accordingly, the most common complaints reported by parents were fever (139, 24.0%), gastrointestinal problems (138, 23.8%), pain (106, 18.3%), and infection (62, 10.7%), respectively. The least reported complaints were allergic diseases (16, 2.7%), and metabolic problems (11, 1.8%). The satisfaction scores of the parents of children with allergic complaints with nursing care were lower than those with respiratory system diseases (p<0.05).

Table 3 shows the responses to the items of the Newcastle Satisfaction with Nursing Scale. A total mean score of 2.64 ± 0.89 was given to the scale. In addition, parents gave the highest scores among the scale items to nurses' respect for patients' privacy with a mean score of 2.96±1.06, followed by nurses' helpfulness with 2.82±1.04, and nurses' competence in their work with 2.78±0.98. The lowest scores were given to nurses informing patients about their conditions and diseases, with a mean score of 2.55±1.12, nurses making patients feel at home with a mean score of 2.55±1.10, and nurses checking whether the patient was okay with a mean score of 2.56±1.08 (Table 3).

Table 4 presents the characteristics related to PED admissions and satisfaction scores of parents with nursing care. The results showed statistically significant differences in the satisfaction scores in terms of frequency of monthly visits to health institutions, PED unit where children received care, and the way of arrival in the PED (p<0.05). The results show that those who visited health institutions 5 or more times a month had higher satisfaction scores than those who visited less frequently (p<0.05). Those who received service in the yellow zone of the PED reported higher satisfaction than those who received service in the green zone. Furthermore, those arriving by ambulance had higher satisfaction scores than those arriving on foot, and those arriving on foot had higher satisfaction scores than those arriving by private car (p<0.05) (Table 4). There were no statistically significant differences in the satisfaction scores among the variables of the first health institution visited in case of any health problem/illness of the child, PED visit frequency in the last year, time period for visiting the PED (Table 4).

Table 5 shows parents' perceptions and experiences of PED visits. The results showed that there were statistically significant differences in the satisfaction scores regarding satisfaction with the care child received in the PED, the time allocated to child for treatment and care, trust in PED, level of satisfaction with PED, opinions about the behaviours of nurses in PED and prefer to receive healthcare from this PED and its nurses in the future (p<0.05). The results show that those who were satisfied with the care the child received in the PED had higher satisfaction scores than those who were partially satisfied or dissatisfied (p<0.05) Furthermore, those who thought that the time allocated for the treatment was sufficient had higher satisfaction scores than those who thought that it was partially or insufficient (p<0.05). Those who trusted the PED a lot had higher satisfaction scores than those who were undecided and did not trust the PED (p<0.05). As the level of satisfaction with PED decreased from very satisfied to not satisfied at all, the scores of satisfaction with nursing services also decreased (p<0.05). Likewise, as the evaluation of nurses' behavior declined from "very good" to "not good," satisfaction scores with nursing care also decreased. (p<0.05). The satisfaction scores of those who prefer to receive health services from the same PED and nurses in the future are higher than those who are undecided and do not want to receive services from the same PED and nurses in the future (p<0.05) (Table 5).

Socio-demographic variables	n (%)	Mean±SD	Median Score	U/X^2	P value	Post-hoc
Parent's gender				42588.5	0.172	
Female	378 (61.1)	41.98±22.39	38.16			
Male	241 (38.9)	39.76±22.04	34.21			
Parent's age (Mean±SD): (33.74±10.24) (min:18 max:88)						
Age of the child brought to the PED (Mean±SD): (6.39±4.62) (min:0 max:17)						
Parent's age group						
Less than 20	32 (5.2)	38.73±18.05	34.21			
20-29	221 (35.7)	40.51±22.51	35.53			
30-39	181 (29.2)	43.69±23.85	38.16	5.509	0.357	
40-49	141 (22.8)	40.44±21.34	35.53			
50-59	37 (6.0)	35.45±19.73	36.84			
60 and over	7 (1.1)	48.31±15.26	50.00			
Parent's marital status				0.325	0.850	
Married	536 (86.6)	41.40±22.44	36.84			
Single	14 (2.3)	38.53±20.36	38.16			
Widow-divorced	69 (11.1)	39.43±21.42	35.53			
Type of family						
Single-parent family	83 (13.4)	39.28±21.12	35.53			
Nuclear family	402 (64.9)	40.14±21.98	35.53	5.540	0.063	
Extended family	134 (21.6)	45.16±23.44	39.47			
Parent's education status				14.538	**0.013**	
Illiterate	50 (8.1)	50.84±23.22	50.00			
Primary school	85 (13.7)	43.00±23.05	35.53			
Secondary school	130 (21.0)	39.50±21.71	34.21			**1>3,4,5**
High school	168 (27.1)	38.44±21.90	34.21			
Bachelor's degree	171 (27.6)	40.90±23.28	38.16			
Postgraduate graduate	15 (2.4)	44.47±19.19	47.37			
Profession				16.403	**<0.001**	
Unemployed	191 (30.9)	36.31±18.89	32.89			
Housewife	174 (28.1)	45.83±23.19	43.42			**1<2**
Worker	254 (41.0)	41.49±23.27	34.21			
Where parent live						
Village	69 (11.1)	36.46±18.93	32.89			
District	243 (39.3)	42.85±20.55	38.16	6.557	**0.038**	**1<2**
Province	307 (49.6)	40.79±24.07	35.53			
Income status				3.641	0.162	
Income less than expenditure	143 (23.1)	39.85±22.39	35.53			
Income equals expenditure	380 (61.4)	40.71±22.11	35.53			
Income more than expenditure	96 (15.5)	44.62±22.54	42.11			
Health insurance				12412.5	**0.001**	
Insured	554 (89.5)	42.27±22.46	36.84			
Uninsured	65 (10.5)	31.27±17.81	25.00			

Table 1. Socio-demographic characteristics and satisfaction scores of parents of children with nursing care in PED
SD: Standard Deviation, U: Mann Whitney U, X^2: Kruskal-Wallis H. Post Hoc: Bonferroni, PED: Paediatric Emergency Department

Child's medical problems	n (%)	Mean±SD	Median Score	U	P value	Post-hoc
What is your child's medical problems that led you to visit to the PED?				23.789	0.014	7<5
Fever	139 (24.0)	38.23±21.62	32.89			
Gastrointestinal problems	138 (23.8)	42.72±23.88	38.16			
Pain	106 (18.3)	40.77±20.53	36.18			
Infection	62 (10.7)	41.82±22.77	36.84			
Respiratory system problems	62 (10.7)	48.09±22.95	45.39			
Fatigue	45 (7.7)	43.36±23.18	44.74			
Allergic diseases	16 (2.7)	27.38±11.08	28.29			
Metabolic problems	11 (1.8)	39.45±25.15	32.89			

Table 2. Most common presenting medical problems
SD: Standard Deviation, U: U: Mann Whitney U

Items	Min-Max	Median	Mean±SD
1. The amount of time spent with you	1-5	2	2.60±0.99
2. How capable nurses were at their job	1-5	3	2.78±0.98
3. There always being a nurse around if you needed one	1-5	2	2.61±1.03
4. The amount nurses knew about your care	1-5	3	2.58±1.11
5. How quickly nurses came when you called for them	1-5	2	2.58±1.02
6. The way the nurses made you feel at home	1-5	2	2.55±1.10
7. The amount of information nurses gave to you about your condition and treatment	1-5	2	2.55±1.12
8. How often nurses checked to see if you were okay	1-5	2	2.56±1.08
9. Nurses' helpfulness	1-5	3	2.82±1.04
10. The way nurses explained things to you	1-5	3	2.65±1.09
11. How nurses helped put your relatives' or friends' minds at rest	1-5	2	2.60±1.05
12. Nurses' manner in going about their work	1-5	2	2.58±1.07
13. The type of information nurses gave to you about your condition and treatment	1-5	2	2.60±1.07
14. Nurses' treatment of you as an individual	1-5	2	2.66±1.05
15. How nurses listened to your worries and concerns	1-5	2	2.58±1.03
16. The amount of freedom you were given on the ward	1-5	3	2.68±1.13
17. How willing nurses were to respond to your requests	1-5	2	2.65±1.03
18. The amount of privacy nurses gave you	1-5	3	2.96±1.06
19. Nurses' awareness of your needs	1-5	2	2.65±1.04
Total	1-5	2.47	2.64±0.89
Total (19-95)	19-95	47.00	50.25±16.92
Total (0-100)	0-100	38.84	41.11±22.26

Table 3. Responses to the items of the Newcastle Satisfaction with Nursing Scale
Min.: Minimum, Max.: Maximum, SD: Standard deviation

PED admissions questions	n (%)	Mean±SD	Median Score	U/X2	P value	Post-hoc
Average number of visits to any healthcare services in a month for their children				15.210	0.004	1,3,4<5
1	92 (14.9)	39.27±21.08	35.53			
2	194 (31.3)	43.18±25.00	34.87			
3	195 (31.5)	38.05±20.26	34.21			
4	66 (10.7)	38.17±19.84	35.53			
5+	72 (11.6)	48.90±21.23	46.71			
Which healthcare service is your first choice to visit in case of any health problem/illness of your child?						
PED	369 (59.6)	41.77±21.45	36.84	7.376	0.061	
Family healthcare centre	142 (22.9)	38.03±23.57	32.23			
Private hospital	9 (1.5)	47.66±22.27	39.47			
Polyclinics	99 (16.0)	42.50±23.14	43.42			
How many times did you visit the PED for your child in the last year?				13.766	0.184	
1	30 (4.8)	42.89±22.56	38.16			
2	59 (9.5)	48.77±27.29	44.74			
3	79 (12.8)	38.50±21.73	34.21			
4	68 (11.0)	40.36±22.05	35.53			
5	40 (6.5)	38.88±19.73	33.55			
6	32 (5.2)	42.14±23.15	32.89			
7	37 (6.0)	41.03±25.04	35.53			
8	49 (7.9)	37.40±21.35	35.53			
9	64 (10.3)	43.95±20.32	39.47			
10	75 (12.1)	36.12±19.34	31.58			
11+	86 (13.9)	43.31±21.99	38.16			
In which unit of the PED did your child receive care?						
Yellow zone	194 (31.3)	45.21±20.51	42.11	33230.00	0.001	1>2
Green zone	425 (68.7)	39.24±22.79	34.21			
In which time period did you visit the PED?				2.904	0.234	
08:00-17:00	286 (46.2)	43.61±24.54	38.16			
17:00-24:00	250 (40.4)	39.23±19.70	36.18			
24:00-08:00	83 (13.4)	38.19±20.53	34.21			
The way they arrive at PED?				10.388	0.016	
By private car	322 (52.0)	39.90±22.32	30.26			4>2; 2>1
Outpatient (walking)	156 (25.2)	45.90±23.36	34.21			
By public transport	84 (13.6)	41.05±23.62	46.05			
By ambulance	57 (9.2)	34.97±12.84	43.42			

Table 4. Characteristics related to PED admissions and satisfaction scores of parents with nursing care
SD: Standard Deviation, U: Mann Whitney U, X^2: Kruskal-Wallis H. Post Hoc: Bonferroni, PED: Paediatric Emergency Department

Parents perceptions and experiences regarding their PED visit	n (%)	Mean±SD	Median Score	U/X2	P value	Post-hoc
How urgent do you think your child's health condition is?				4.692	0.196	
Not urgent	12 (1.9)	43.31±25.90	40.13			
Normal	215 (34.7)	39.21±23.22	34.21			
Urgent	340 (54.9)	41.48±20.98	36.84			
Very urgent	52 (8.4)	46.07±25.11	40.79			
Were you satisfied with the care your child received?				148.052	0.000	
Yes	368 (59.5)	49.02±21.15	47.37			1>2,3;
Partly	206 (33.3)	30.88±18.02	26.32			2>3
No	45 (7.3)	23.30±19.45	18.42			
In which unit of the PED did your child receive care?				156.658	0.000	
Yes	345 (55.7)	49.79±21.40	48.68			1>2,3;
Partly	173 (27.9)	33.79±18.91	31.58			2>3
No	101 (16.3)	24.02±14.96	21.05			
To what extent do you trust PED?				170.795	0.000	
I trust a lot	63 (10.2)	66.14±21.34	69.74			1>2,3,4
I trust	336 (54.3)	44.78±19.86	40.79			2>3,4
Undecided	179 (28.9)	29.01±16.75	23.68			
I do not trust	41 (6.6)	25.51±19.88	18.42			
What is your level of satisfaction with PED?						
I am very satisfied	62 (10.0)	67.93±21.52	73.68	200.836	0.000	1>2,3,4,5;
I am satisfied	337 (54.4)	44.94±19.45	42.11			2>3,4,5;
Undecided	167 (27.0)	30.50±16.97	25.00			**3>4,5**
Not satisfied	45 (7.3)	19.70±13.12	17.11			
I am not satisfied at all	8 (1.3)	14.30±10.32	15.79			
How do you generally evaluate the behaviour of nurses towards you in the PED?						
Very good	65 (10.5)	67.97±23.93	75.00	197.000	0.001	1>2,3,4;
Good	271 (43.8)	46.80±19.40	46.05			2>3,4;
Moderately	243 (39.3)	31.26±15.82	28.95			3>4
Not good	40 (6.5)	18.88±14.60	15.79			
Would you prefer to receive care from this PED and its nurses in the future?						
Yes	373 (60.3)	49.30±21.43	47.37	157.717	0.001	1>2,3;
Undecided	177 (28.6)	30.34±16.49	26.32			2>3
No	69 (11.1)	24.52±18.40	19.74			

Table 5. Parents perceptions and experiences regarding their PED visit
SD: Standard Deviation, U: Mann Whitney U, X^2: Kruskal-Wallis H. Post Hoc: Bonferroni, PED: Paediatric Emergency Department

Scale	n	Mean	SD	Median	Min.	Max.	α
Newcastle Satisfaction with Nursing Scale (19-95)	619	50.25	16.92	47.00	19	95	0.97
Newcastle Satisfaction with Nursing Scale (0-100)		41.11	22.26	36.84	0	100	

Table 6. Newcastle Satisfaction with Nursing Scale scores
SD: Standard deviation, Min.: Minimum, Max.: Maximum, α: Cronbach's alpha

In addition, there were no statistically significant differences in the satisfaction scores among the variables of the parents perception about the urgency of the child's health condition (p>0.05). Most of the parents (340, 54.9%) assumed that the health condition of their children were urgent, however, the results showed that the vast majority of children (425, 68.7%) received care in green zone of PED (Table 4 and Table 5).

Table 6 presents the Newcastle Satisfaction with Nursing Scale scores (in the range of 19-95 and 0-100), and the Cronbach's alpha score of the scale. In general, the level of satisfaction can be expressed as low because it is below normal (50), with a score of 41.11 (±22.26) among a range of

0-100 points. The Cronbach alpha coefficient (α) of the scale were 0.97.

Discussion

This study investigated the level of satisfaction among parents of children receiving nursing care in the PED setting. This study revealed the socio-demographic characteristics and satisfaction scores of parents of children with nursing care in PED. In addition, the most common presenting medical problems that led parents to visit the PED were identified. Furthermore, the characteristics related to PED admissions and satisfaction scores of parents with nursing care were identified. This study also revealed the parents' perceptions and experiences regarding their PED visit.

In this study, the level of satisfaction of parents with nursing care in PED was low. This result contradicts some of the existing studies (9, 10). This study revealed that parents with higher education levels have a lower level of satisfaction. The results on this issue are not consistent. While some of the existing studies supported this (9-13), others did not concur with this result (14, 15). This could be because those with higher education levels tend to have a better understanding of the healthcare process, have more critical aspects of provided care, and have higher expectations.

This study revealed that the amount of time allocated to children for treatment and care affects parents' satisfaction. Those who received more time by healthcare staff reported a higher level of satisfaction. This is also supported by the existing literature (16). This showed that allocating enough time for patients and providing effective nursing practices contribute to positive parental experiences in PED settings. Therefore, healthcare staff in the PED should care for children and their parents patiently, dedicating sufficient time to provide appropriate care.

This study also found that parents' satisfaction was affected by their trust in the PED. Those who trust in PED have a higher level of satisfaction. In line with this result, Deml, Buhl (17) highlighted that parents' trust in healthcare staff significantly influences their satisfaction with care. Trust in healthcare staff is crucial for parental satisfaction, as parents who feel understood and valued are more likely to express satisfaction with the care received (18, 19). This is particularly relevant in PED settings, where parents are sensitive and parents seek reassurance that their children are receiving appropriate care. This study showed that those who were satisfied with the care the child received in the PED had higher satisfaction scores.

This study revealed a difference between parents' and healthcare staff's perceptions of the urgency of a child's condition. Of parents, 54.9% think that the health condition of their child was urgent, however, the vast majority of children (68.7%) received care in the green zone of PED. While healthcare staff generally categorize urgency based on the severity of the medical condition, parents' perceptions are often influenced by emotional factors (4, 5, 20). In line with the existing literature, this study revealed that perceived urgency of the child's health condition differs among parents and healthcare staff (21).

Regarding parents' satisfaction with nursing care services, the highest scores on the Newcastle Satisfaction with Nursing Scale were given to items related to respect for patients' privacy, nurses' helpfulness, and nurses' competence in their work. Maintaining confidentiality and providing a private environment for care are essential in promoting positive experiences for parents and their children. The study's results suggest that parents appreciate when nurses are approachable, responsive, and willing to assist with their concerns. In line with these results, Mersinlioğlu and Öztürk (22) found that patients are most satisfied with the fact that nurses respect the privacy of the patients, that the nurses apply the treatment (medications) on time, and that patients can easily reach the nurses when needed. Furthermore, Emordi, Orukwowu (23) found that attitudes of the nurses, providing information to the patients, and respect for privacy are the factors that affect the satisfaction level of patients. Maintaining confidentiality and providing a private environment for care are essential in promoting positive experiences for parents and their children.

In addition, the lowest scores on the Newcastle Satisfaction with Nursing Scale were given to items related to nurses providing information about patients' conditions and illnesses, making patients feel at home, and checking on patients' well-being. In line with these results, existing literature supports that those who received information about their health state from nurses had a higher level of satisfaction (24). When nurses fail to adequately inform parents about their child's condition, it can lead to feelings of uncertainty and anxiety, thereby reducing overall satisfaction with the care experience. In addition, regular check-ins are essential for demonstrating attentiveness and concern for patients' well-being. In line with these results, the perception of care quality is influenced by engaging with patients and monitoring their conditions (19).

This study suggests that key factors influencing parents' satisfaction in the PED setting include improving the quality of nursing care, maintaining patient privacy, providing clear information about the care and treatment process, enhancing nurses' competency, ensuring a comfortable care environment, and regularly checking on the patient throughout treatment. Future efforts to enhance satisfaction should focus on improving communication and fostering collaborative care environments that prioritize the needs of both children and their families.

Strengths and Limitations

One of the strengths of this study is that collects data from a large number of participants (n=619) which could increase the generalizability of the results. However, this study is not without limitations. This study is based on data obtained from a single center and therefore may not be generalizable to other settings

Conclusion

In conclusion, the level of satisfaction of parents with nursing care in PED was low. This study recommends increasing the quality of nursing practices in order to increase parents' satisfaction. This study highlighted the importance of respecting patient privacy, demonstrating helpfulness, and exhibiting competence in nursing care as key factors influencing parental satisfaction in PED. By focusing on these dimensions, healthcare providers can

enhance the quality of care delivered to children and their families, ultimately leading to improved health outcomes and greater satisfaction. This study could inform policy-makers, leaders, and researchers about factors influencing parents' satisfaction, helping to develop strategies that enhance the quality of nursing care and improve the overall patient experience in PED settings.

Conflict of Interest: The authors declare that there is no conflict of interest.

Financial Support: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Acknowledgements: The authors would also like to acknowledge the participants for their participation to this study and to the hospital management teams for their help with participant recruitment.

Authors' Contribution: Each author contributed significantly to the research process and preparation of the manuscript. All authors reviewed and approved the final version of the manuscript for submission.

Ethical Approval: Ethical approval was obtained from Mardin Artuklu University Non-Invasive Clinical Research Ethics Committee (Date: 07/05/2024, Reference no: 2024/5-9). In addition, the necessary permissions were obtained from the Mardin Provincial Directorate of Health (Date: 15/05/2024, Reference no: E-68051626-770-243855324). Informed consent was obtained from all participants. The study was carried out in accordance with the principles of the Declaration of Helsinki.

References

1. Chou H-J, Tseng K-Y. The Experience of Emergency Nurses Caring for Patients With Mental Illness: A Qualitative Study. International Journal of Environmental Research and Public Health. 2020. doi:10.3390/ijerph17228540
2. Messina G, Vencia F, Mecheroni S, Dionisi S, Baragatti L, Nante N. Factors Affecting Patient Satisfaction With Emergency Department Care: An Italian Rural Hospital. Global journal of health science. 2014. doi:10.5539/gjhs.v7n4p30
3. Mensa M, Taye A, Katene S, Abera F, Ochare O. Determinants of patient satisfaction towards inpatient nursing services and its associated factors in, Gamo Gofa zone, SNNPR, Ethiopia, April 2017. MOJ Clin Med Case Rep. 2017;7(3):00205.
4. Butun A, Hemingway P. A qualitative systematic review of the reasons for parental attendance at the emergency department with children presenting with minor illness. International Emergency Nursing. 2018;36:56-62). doi:10.1016/j.ienj.2017.07.002
5. Butun A, Lynn F, McGaughey J, McLaughlin K, Linden M. Exploring attendance at emergency departments for children with non-urgent conditions in Turkey: a qualitative study of parents and healthcare staff perspectives. Emergency and Critical Care Medicine. 2022;2(2):50-60. doi:10.1097/EC9.0000000000000027
6. Nkabinde NP, Bopape MA, Mothiba TM, Mphekgwana PM. Patients' Satisfaction With Services Offered by Nurses at a Selected Ideal Clinic in Ehlanzeni District, Mpumalanga Province, South Africa. The Open Nursing Journal. 2021;15(1):229-35. doi:10.2174/266695870210100229
7. Thomas L, McColl E, Priest J, Bond S, Boys R. Newcastle satisfaction with nursing scales: an instrument for quality assessments of nursing care. BMJ Quality & Safety. 1996;5(2):67-72. doi:10.1136/qshc.5.2.67
8. Akin S, Erdogan S. The Turkish version of the Newcastle Satisfaction with Nursing Care Scale used on medical and surgical patients. Journal of Clinical Nursing. 2007;16(4):646-53. doi:10.1111/j.1365-2702.2006.01583.x
9. Cerit B. Hastaların Hemşirelik Bakımından Memnuniyet Düzeyi. Journal of Hacettepe University Faculty of Nursing. 2016;3(1).
10. Buchanan J, Dawkins P, Lindo JLM. Satisfaction with nursing care in the emergency department of an urban hospital in the developing world: A pilot study. International Emergency Nursing. 2015;23(3):218-24. doi:10.1016/j.ienj.2015.01.001
11. Kayrakçı F, Özşaker E. Cerrahi hastalarının hemşirelik bakımından memnuniyet düzeylerinin belirlenmesi. Florence Nightingale Hemşirelik Dergisi. 2014;22(2):105-13.
12. Kuzu C, Ulus B. Cerrahi kliniklerde tedavi gören hastaların aldıkları hemşirelik bakımından memnuniyet durumlarının belirlenmesi. Acıbadem Üniversitesi Sağlık Bilimleri Dergisi. 2014(2):129-34.
13. Aşılıoğlu N, Akkuş T, Baysal K. Çocuk acil servisinde ebeveyn memnuniyeti ve etkileyen etmenlerin araştırılması. Türkiye Acil Tıp Dergisi. 2009;9(2):65-72.
14. Gutysz-Wojnicka A, Dyk D, Cudak E, Ozga D. Measuring patient satisfaction with the Polish version of the Newcastle Satisfaction with Nursing Scale. Scandinavian journal of caring sciences. 2013;27(2):311-8. doi:10.1111/j.1471-6712.2012.01034.x
15. Alhusban MA, Abualrub RF. Patient satisfaction with nursing care in Jordan. Journal of nursing management. 2009;17(6):749-58. doi:10.1111/j.1365-2834.2008.00927.x
16. Tsironi S, Koulierakis G. Factors Affecting Parents' Satisfaction With Pediatric Wards. Japan Journal of Nursing Science. 2018;16(2):212-20. doi: 10.1111/jjns.12239
17. Deml MJ, Buhl A, Huber BM, Burton-Jeangros C, Tarr PE. Trust, affect, and choice in parents' vaccination decision-making and health-care provider selection in Switzerland. Sociology of Health & Illness. 2022;44(1):41-58. doi:10.1111/1467-9566.13388
18. Ebi SJ, Deml MJ, Jafflin K, Buhl A, Engel R, Picker J, et al. Parents' vaccination information seeking, satisfaction with and trust in medical providers in Switzerland: a mixed-methods study. BMJ Open. 2022;12(2):e053267. doi:10.1136/bmjopen-2021-053267
19. Koirala M, Koirala ML. Contributing Factors for Perceived Satisfaction With Nursing Care Among Inpatients in General Wards. Journal of Lumbini Medical College. 2016;3(2):34. doi:10.22502/jlmc.v3i2.69
20. Ruud SE, Hjortdahl P, Natvig B. Is It a Matter of Urgency? A Survey of Assessments by Walk-in Patients and Doctors of the Urgency Level of Their Encounters at a General Emergency Outpatient Clinic in Oslo, Norway. BMC Emergency Medicine. 2016;16(1). doi:10.1186/s12873-016-0086-1
21. Rassin M, Nasie A, Bechor Y, Weiss G, Silner D. The characteristics of self-referrals to ER for non-urgent conditions and comparison of urgency evaluation between patients and nurses. Accident and Emergency Nursing. 2006;14(1):20-6. doi:10.1016/j.aaen.2005.10.003
22. Mersinlioğlu G, Öztürk H. Acil servise başvuran hastaların hemşirelik hizmetlerinden memnuniyet düzeyi. Sağlık ve hemşirelik yönetimi dergisi. 2015;2(2):70-82. doi:10.5222/SHYD.2015.070
23. Emordi N, Orukwowu U, Robinson-Mbato L. Predictors of Patients` Satisfaction With Nursing Care Delivery Among Patients in Mbodo Aluu Health Center, Rivers State. International Journal of Nursing Midwife and Health Related Cases. 2024;10(1):49-60. doi:10.37745/ijnmh.15
24. Gündoğdu H, Tanrıkulu F, Erol F, Koç F, Yılmaz D, Dikmen Y. Nursing Care Satisfaction among Patients Infected with Covid-19: A Turkish Perspective. Galician Medical Journal. 2022;29(1):E202213. doi:10.21802/gmj.2022.1.3

Anatolian Journal of Emergency Medicine 2025;8(2):91-93

CASE REPORT / OLGU SUNUMU

Isolated Fourth Ventricle Hemorrhage Following Minor Trauma: A Case Report

Minör Travma Sonrası İzole Dördüncü Ventrikül Kanaması: Olgu Sunumu

Hakan Ak[1], Ege Coşkun[2], Yener Çakır[3]

ABSTRACT

Aim: Isolated fourth ventricle hemorrhage is an extremely rare clinical pathology and is usually associated with severe trauma. Ventricular hemorrhages are usually seen in the lateral ventricles and are often accompanied by cerebral contusions, skull fractures, or parenchymal hemorrhages. The fourth ventricle, which has an anatomical position surrounded by the brain stem and cerebellum, is less sensitive to trauma compared to other ventricles.

Case Presentation: In this case report, a 3-year-old child was presented to the emergency department with a gait disturbance following a backward fall from a chair. The neurological examination of the patient was normal, except for a gait disturbance (ataxic gait). Cranial computed tomography (CT) imaging showed a hemorrhage of approximately 1 cm in the fourth ventricle. The patient was hospitalized for close follow-up and observation. After 12 hours, the gait disturbance had completely disappeared, and the hemorrhage had also resolved on the CT image.

Conclusion: This case report highlights the recognition of isolated fourth ventricular hemorrhage in clinical practice, possible mechanisms underlying it, management strategies, and prognostic considerations in the context of pediatric trauma.

Keywords: Epidural hemorrhage, fourth ventricle hemorrhage, head injury, intracerebral hemorrhage, subdural hemorrhage

ÖZ

Amaç: İzole dördüncü ventrikül kanaması oldukça nadir görülen bir klinik patolojidir ve genellikle ağır travma ile ilişkilidir. Ventriküler kanamalar genellikle lateral ventriküllerde görülür ve sıklıkla beyin kontüzyonları, kafatası kırıkları veya parankimal kanamalar eşlik eder. Beyin sapı ve beyincik ile çevrili anatomik bir konuma sahip olan dördüncü ventrikül, diğer ventriküllere göre travmaya daha az duyarlıdır.

Olgu Sunumu: Bu olgu sunumunda, sandalyeden geriye doğru düşme sonucu yürüme bozukluğu şikayeti ile acil servise başvuran 3 yaşında bir çocuk hasta sunulmuştur. Hastanın yürüme bozukluğu (sarhoş gibi yürüme) dışında nörolojik muayenesi normaldi. Kranial bilgisayarlı tomografi (BT) görüntülemede dördüncü ventrikülde yaklaşık 1 cm'lik lezyon izlendi. Hasta yakın takip için hastaneye yatırıldı. 12 saat sonra yürüme bozukluğu tamamen ortadan kalktı ve BT görüntüsünde kanama kayboldu.

Sonuç: Bu olgu sunumu, pediatrik travma bağlamında izole dördüncü ventrikül kanamasının klinik pratikte tanınmasının, altında yatan olası mekanizmaların, tedavi stratejilerinin ve prognostik hususların önemini vurgulamaktadır.

Anahtar Kelimeler: Epidural kanama, dördüncü ventrikül kanaması, kafa travması, intraserebral kanama, subdural kanama

Received: 28 March 2025 Accepted: 20 June 2025

[1] Kırşehir Ahi Evran University Medical School, Department of Neurosurgery, Kırşehir, Türkiye

[2] Kırşehir Ahi Evran University Medical School, Kırşehir, Türkiye

[3] Afyonkarahisar Health Sciences University Medical School, Department of Neurosurgery, Afyonkarahisar, Türkiye

Corresponding Author: Hakan Ak, MD. **Address:** Kırşehir Ahi Evran Üniversitesi Tıp Fakültesi, Beyin ve Sinir Cerrahisi Anabilim Dalı, Bağbaşı Mahallesi, Kırşehir, Türkiye. **Phone:** +905549032071 **E-mail**: nrsdrhakanak@yahoo.com

Atıf için/Cited as: Ak H, Coşkun E, Çakır Y. Isolated Fourth Ventricle Hemorrhage Following Minor Trauma: A Case Report. Anatolian J Emerg Med 2025;8(2):91-93. https://doi.org/10.54996/anatolianjem.1667790

Introduction

Traumatic cerebral hemorrhages are the cause of high morbidity and mortality in the pediatric population, and these hemorrhages are usually seen as epidural, subdural, and intracerebral hemorrhages (1,2,3,4). Trauma-related intraventricular hemorrhages may also be seen in this age group (5,6). Ventricular hemorrhages are usually seen in the lateral ventricles and are often accompanied by cerebral contusions, skull fractures, or parenchymal hemorrhages. The fourth ventricle, which is anatomically positioned between the brain stem and cerebellum, is less sensitive to trauma compared to other ventricles (7,8,9). According to our literature search, we did not encounter any traumatic isolated fourth ventricular hemorrhage in childhood.

In this report, we are presenting a 3-year-old case with isolated 4th ventricular hemorrhage due to minor trauma.

Case Presentation

A 3-year-old male child was brought to the emergency department with a complaint of gait disturbance after falling on his back from a chair. Physical examination revealed edema on the scalp and periorbital ecchymosis. Neurological examination was normal except for gait disturbance (ataxic gait). His Glasgow Coma Score was 15. The patient had no history of any bleeding disorder, such as hemophilia, that would increase the likelihood of bleeding in his personal or family history. The patient had no known chronic disease. The initial cranial CT showed an isolated fourth ventricular hemorrhage (Figure 1). The patient was admitted to the hospital ward for follow-up. During hospitalization, no clinical deterioration occurred. A follow-up CT scan at 24 hours showed complete resolution of the hemorrhage (Figure 2). The gait disturbance resolved in parallel with the radiological improvement, and the patient was discharged on the second day of hospitalization. No additional radiological imaging was performed because the patient's clinical and radiological findings improved very rapidly simultaneously. The patient remains under clinical follow-up with no complaints.

Discussion

Ventricular hemorrhage is a rare pathology in the pediatric population. The etiology of ventricular hemorrhages in children includes intracranial tumors, arteriovenous malformations, and Moyamoya disease (10). Ventricular hemorrhages are frequently observed in the lateral ventricles in the literature, but isolated bleeding in the fourth ventricle is extremely rare. Das et al recently reported a primary isolated fourth ventricular hemorrhage, but their case had no history of trauma (11). However, no isolated fourth ventricular hemorrhage related to trauma has been encountered in the literature. Our case is the first in the literature to address this issue.

The branches of the anterior choroidal artery, the posterior choroidal artery, and the posterior cerebral artery supply the ventricular system. On the other hand, the fourth ventricle is supplied by the branches of the posterior inferior cerebellar artery (PICA) and anterior inferior cerebellar artery (AICA). These arteries can be easily damaged in cases of trauma or vascular anomalies. Considering this blood supply pattern, especially in the pediatric population, which has more fragile vascular structures, even mild trauma can lead to bleeding within the fourth ventricle (12,13).

One of the significant complications of fourth ventricular hemorrhage is hydrocephalus. Bleeding that occurs in the fourth ventricle, located in a key site for cerebrospinal fluid circulation, can clot and block the flow of cerebrospinal fluid. Therefore, obstructive hydrocephalus may develop, leading to an increase in intracranial pressure and neurological deterioration (14). However, in our case, fortunately, hydrocephalus did not develop due to the small and rapid disappearance of the fourth ventricular hemorrhage. We believe that the bleeding was cleaned by the washing effect of cerebrospinal fluid (CSF). This situation may suggest that isolated small ventricular hemorrhages that do not form a blockage often have a good prognosis. In our patient, we didn't perform any more radiological imaging techniques due to the known etiology of the hemorrhage and rapid resorption. However, in pediatric patients with isolated ventricular hemorrhage, it may be important to exclude additional vascular pathologies with advanced imaging techniques such as magnetic resonance angiography.

Written informed consent was obtained from the patient's parent.

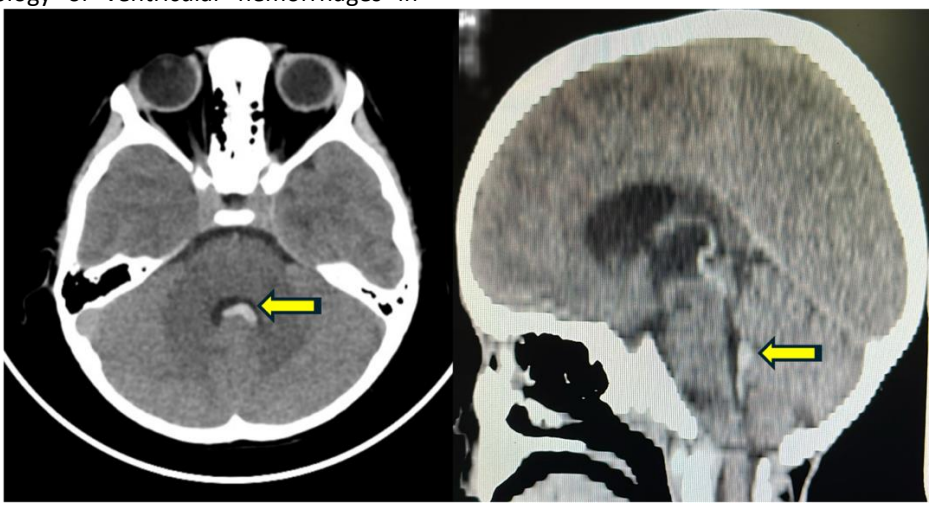

Figure 1. Axial and sagittal CT images of the brain showing hemorrhage in the fourth ventricle. The arrow illustrates bleeding.

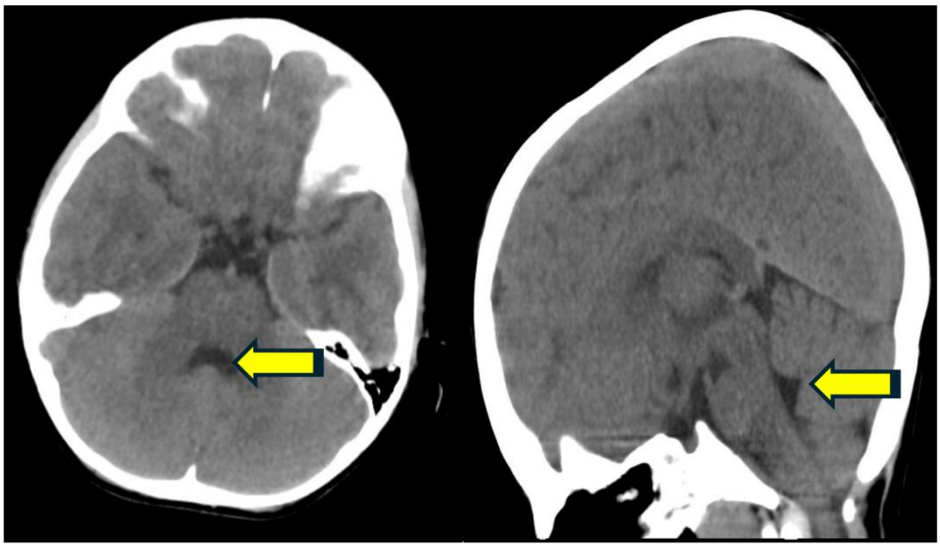

Figure 2. After 24 hours, the hematoma had completely resolved.

Conclusion

This case shows that isolated fourth ventricular hemorrhage, even after minor trauma, may occur. In the presence of any abnormal neurological sign or symptom, a brain CT scan should be performed as the first line of investigation. Patients with this type of hemorrhage should be followed carefully for the possible development of disruption of the flow of CSF and the potential development of hydrocephalus. It is thought that more reporting of such cases in the literature will contribute to a better understanding of clinical management strategies.
Conflict of Interest: The authors declare that there is no conflict of interest.

Conflict of Interest: The authors declared no conflict of interest.

Financing Disclosure: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' Contributions: HA: Conceptualization; Data curation; Formal analysis; Methodology; Project administration; Writing & Reviewing. **EC:** Conceptualization; Data curation; Formal analysis; Methodology; Writing & Reviewing**. YÇ:** Conceptualization; Data curation; Formal analysis; Methodology; Writing & Reviewing.

Informed Consent: Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review in this journal.

References

1. Gardner MT, Omeara AMI, Ferguson NM. Pediatric traumatic brain injury: an update on management. Curr Pediatr Rep. 2017;5(3):213–9.
2. Rocchi G, Caroli E, Raco A, et al. Traumatic epidural hematoma in children. J Child Neurol. 2005;20(7):569–72.
3. Wittschieber D, Karger B, Pfeiffer H, et al. Understanding subdural collections in pediatric abusive head trauma. AJNR Am J Neuroradiol. 2019;40(3):388–95.
4. Hochstadter E, Charyk-Stewart T, Alharfi IM, et al. Subarachnoid hemorrhage prevalence and its association with short-term outcome in pediatric severe traumatic brain injury. Neurocrit Care. 2014;21(3):505–13.
5. Kobayashi S, Nakazawa S, Otsuka T. Acute traumatic intraventricular hemorrhage in children. Childs Nerv Syst. 1985;1(1):18–23.
6. Lichtenstein RL, Glass TF, Quayle KS, et al. Presentations and outcomes of children with intraventricular hemorrhages after blunt head trauma. Arch Pediatr Adolesc Med. 2012;166(8):725–31.
7. Özdemir ÖMA, Gürses M, Küçüktaşçı K et al. Periventriküler/intraventriküler kanamalı yenidoğanlarda risk faktörleri. J Dr Behcet Uz Child Hosp. 2015 undefined;5(3):161-166. doi:10.5222/buchd.2015.161.
8. Whitelaw AG. Core concepts: intraventricular hemorrhage. NeoReviews. 2011;12(2):e94–104. Doi: 10.1542/neo.12-2-e94.
9. Kurland D, Hong C, Aarabi B, et al. Hemorrhagic progression of a contusion after traumatic brain injury: a review. J Neurotrauma. 2012;29(1):19–31.
10. Guo R, Chen R, Yu Z, et al. Primary intraventricular hemorrhage in pediatric patients: causes, characteristics, and outcomes. World Neurosurg. 2020;133:121–8.
11. Das A, Bhadran B, Sanker V, et al. Pediatric primary intraventricular hemorrhage: a case report of isolated fourth ventricle hemorrhage in a 10-year-old boy. Clin Case Rep. 2023;11(9):e7952.
12. Javed K, Das JM. Neuroanatomy, anterior choroidal arteries. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 [cited 2025 Jun 21]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK532271/
13. JanMiao HL, Zhang DY, Wang T, et al. Clinical importance of the posterior inferior cerebellar artery: a review of the literature. Int J Med Sci. 2020;17(18):3005–19.
14. Robinson S. Neonatal post hemorrhagic hydrocephalus from prematurity: pathophysiology and current treatment concepts. Pediatr Neurosurg. 2012;9(3):242–58.

Anatolian Journal of Emergency Medicine 2025;8(2):94-100

REVIEW / DERLEME

Overcrowding in Emergency Departments: A Scoping Literature Review

Acil Servislerde Aşırı Kalabalıklık: Kapsayıcı Bir Literatür İncelemesi

Mustafa Altun[1], Emre Kudu[2]

ABSTRACT

Emergency department (ED) overcrowding occurs when healthcare demand exceeds available resources, significantly impairing the quality of patient care and the efficiency of the healthcare system. This review comprehensively analyzes the definition, causes, measurement methods, consequences, and proposed solutions of ED overcrowding. ED crowding is marked by prolonged waiting times, disrupted patient flow, interrupted medical service delivery, and risks to patient and staff safety. Patient-related factors include the preference for EDs for non-emergent conditions, complicated health issues in the elderly, low health literacy, and frequent visits by individuals with chronic illnesses. Systemic factors involve access block, staff shortages, inefficiencies in discharge processes, and delays in diagnostic tests and consultations. External factors include inadequate primary care services, socioeconomic disparities, seasonal fluctuations, epidemics, and natural disasters. To evaluate ED crowding, measurement tools such as the National Emergency Department Overcrowding Scale and the Emergency Department Work Index are utilized; however, the lack of standardization and variability across different hospital types remains a point of contention. Overcrowding compromises patient safety, leading to treatment delays, increased medical errors, staff burnout, and escalating healthcare costs. Proposed solutions include short-term measures (fast-track units, early discharge planning, patient redirection), long-term strategies (enhancing primary care, establishment of acute care centers, management of inpatient bed capacity, and planning to reduce the burden of chronic illnesses), and technological approaches (artificial intelligence, simulation models, telemedicine, and patient tracking technologies). Gaps in the literature include issues related to the validity and reliability of measurement tools, limited data on the economic and clinical impacts of interventions, insufficient research in low- and middle-income countries, and inadequate examination of patient behaviors and the psychological effects on healthcare personnel. The effective management of ED crowding requires the coordinated implementation of systemic reforms, innovative technologies, and collaborative efforts across clinical, academic, and policy-making domains. This is a critical step toward enhancing patient safety, improving clinical outcomes, and ensuring the sustainability of the healthcare system.

Keywords: Access block, emergency department, patient flow, overcrowding

ÖZ

Acil servis (AS) kalabalıklığı, sağlık hizmeti talebinin mevcut kaynakları aşmasıyla ortaya çıkan ve hasta bakım kalitesini, sağlık sisteminin verimliliğini olumsuz etkileyen ciddi bir sorundur. Bu derleme, AS kalabalıklığının tanımını, nedenlerini, ölçüm yöntemlerini, sonuçlarını ve çözüm önerilerini ayrıntılı bir şekilde ele almaktadır. AS kalabalıklığı, uzun bekleme süreleri, hasta akışında aksamalar, tıbbi hizmet sunumunda kesintiler ve hasta ile sağlık çalışanlarının güvenliğine yönelik risklerle karakterizedir. Hasta kaynaklı faktörler arasında acil olmayan durumlar için AS'yi tercih etme, yaşlı nüfusun komplike sağlık sorunları, düşük sağlık okuryazarlığı ve kronik hastalıklara sahip bireylerin sık ziyaretleri yer alır. Sistemsel faktörler, yatış bloğu, personel eksikliği, taburculuk süreçlerindeki verimsizlik ile tetkik ve konsültasyon gecikmelerini içerir. Dış faktörler ise yetersiz birincil bakım hizmetleri, sosyoekonomik eşitsizlikler, mevsimsel dalgalanmalar, salgınlar ve doğal afetlerdir. AS kalabalıklığını değerlendirmek için National Emergency Department Overcrowding Scale ve Emergency Department Work Index gibi ölçüm araçları kullanılır; ancak bu araçların standartlaşma eksikliği ve hastane türlerine göre değişkenliği tartışmalıdır. AS kalabalıklığı, hasta güvenliğini tehdit eder, tedavi gecikmelerine, tıbbi hatalarda artışa, personel tükenmişliğine ve sağlık maliyetlerinde artışa neden olur. Çözüm önerileri; kısa vadeli (hızlı bakı, erken taburculuk planları, hasta yönlendirmeler), uzun vadeli (birinci basamak hizmetlerinin geliştirilmesi, akut bakım merkezlerinin kurulması, yatak kapasitesinin yönetilmesi, kronik hasta yükünü azaltmaya yönelik planlamalar) ve teknolojik (yapay zeka, simülasyon, tele-tıp, hasta takip teknolojileri) yaklaşımları kapsar. Literatürdeki boşluklar, ölçüm araçlarının geçerlilik ve tutarlılık sorunları, müdahalelerin ekonomik ve klinik etkilerine dair sınırlı veri, düşük ve orta gelirli ülkelerdeki araştırma eksiklikleri ile hasta davranışları ve personel üzerindeki psikolojik etkilerin yeterince incelenmemesini içerir. AS kalabalıklığının etkili yönetimi, sistemik reformların, yenilikçi teknolojilerin ve klinik, akademik ve politik iş birliğinin koordineli bir şekilde uygulanmasını gerektirir. Bu, hasta güvenliğini artırmak, klinik sonuçları iyileştirmek ve sağlık sisteminin sürdürülebilirliğini sağlamak için kritik bir adımdır.

Anahtar Kelimeler: Yatış bloğu, acil servis, kalabalıklık, hasta akışı

Received: 26 April 2025 Accepted: 11 June 2025

[1] Department of Emergency Medicine, Marmara University Pendik Training and Research Hospital, Istanbul, Türkiye
[2] Department of Emergency Medicine, Marmara University School of Medicine, Istanbul, Türkiye
Corresponding Author: Mustafa Altun, MD. **Adress:** Marmara Universitesi Pendik Egitim ve Arastirma Hastanesi, Acil Tip Anabilim Dali. Pendik, İstanbul, Türkiye.
Telephone: +905457788404 **E-mail:** mustaffaltun@gmail.com

Atıf için/Cited as: Altun M, Kudu E. Overcrowding in Emergency Departments: A Scoping Literature Review. Anatolian J Emerg Med 2025;8(2):94-100. https://doi.org/10.54996/anatolianjem.1684632.

Introduction

Emergency department (ED) overcrowding occurs when the demand for emergency healthcare services exceeds the available resources, including the physical, human, and structural capacities of the ED, resulting in a critical issue that adversely impacts both patient care quality and the overall efficiency of the healthcare system (1). ED overcrowding, defined as an excessive volume of patients, is characterized by prolonged waiting times, inadequate availability of stretchers or examination space, disruptions in the delivery of medical services, and impaired patient flow, thereby posing significant risks to the safety of both patients and healthcare professionals (2).

Contributing Factors

ED overcrowding results from a complex interplay of patient-related and operational factors. This phenomenon is typically analyzed within the framework of "input" (patient inflow), "throughput" (process management), and "output" (patient outflow) factors, a classification that represents an internationally recognized standard. Input encompasses the increase in the number of patients presenting to the ED and the urgency and complexity of their conditions; throughput refers to delays in the process from patient admission to discharge, hospitalization, or transfer, including issues such as staff shortages, diagnostic delays, and consultation bottlenecks; output involves barriers to patients' departure from the ED (3–6).

Patient-Related Factors

Patient-related factors contributing to ED overcrowding encompass a wide range of dynamics stemming from individuals' healthcare utilization behaviors and health conditions. A primary factor is patients' preference for EDs to address non-emergent conditions that could be managed in primary care settings. This tendency is driven by expectations of rapid service delivery (e.g., laboratory tests, imaging, or prompt access to specialists), difficulties in securing appointments, or the unavailability of primary care services outside regular hours (7,8). This issue manifests as both a patient-related and an external factor.

The inclination to use the ED as a primary care source, particularly among individuals with chronic illnesses, limited social support, or restricted access to alternative healthcare services (often termed "frequent flyers"), leads to recurrent visits, significantly exacerbating ED overcrowding (6,9).

The aging population, a consequence of demographic shifts, is another key parameter directly influencing ED demand. Older adults typically present with more complex health issues and multiple comorbidities, resulting in longer ED stays (10). Low health literacy, which leads patients to perceive their health conditions as urgent even when they are not medically necessary, further increases ED visits (7). Additionally, some sources suggest that the high number of accompanying persons brought by patients can negatively impact ED workflow; crowded waiting areas may hinder staff-patient communication and disrupt patient flow processes (11).

Systemic Factors

Systemic factors contributing to ED overcrowding stem from structural and operational challenges within the healthcare system's hospital operations, playing a critical role in directly affecting patient flow and resource management. Bed access issues, commonly referred to as "access block," are a primary contributor. Patients who require hospitalization often remain in the ED due to the unavailability of suitable inpatient beds, resulting in the extended use of ED beds and limiting the department's ability to accept new patients (1, 9, 12–14). Access block is often directly linked to inadequate bed turnover within the hospital. Insufficient bed capacity represents a broader systemic issue, particularly in intensive care units and inpatient wards, where the number of available beds fails to meet demand, disrupting patient flow (13).

Staff shortages and suboptimal staff distribution further complicate ED operations, constituting a fundamental factor. The lack of sufficient personnel with the appropriate skill levels in the ED and related units (e.g., consulting physicians, nurses) impairs patient management and flow (2,15,16). Misalignment between staff allocation and patient volume results in service delivery disruptions, reflecting strategic deficiencies in workforce planning (7). Diagnostic and consultation delays represent another dimension of systemic bottlenecks. Delays in diagnostic services, such as laboratory and radiology, are coupled with challenges in accessing specialist consultations, slow patient flow, and extended treatment timelines (3,12,17).

Triage inefficiencies manifest as disruptions and delays in patient prioritization processes, often associated with inadequate staff training or the lack of standardized triage protocols (4,18). Inadequate information systems hinder patient tracking and resource management, with outdated electronic health records potentially disrupting decision-making processes (1,6,19). Hospital policies and protocols constitute additional systemic factors; inflexible or inadequate policies regarding discharge, hospitalization, and patient transfers impede the optimization of patient flow (15).

External Factors

External factors contributing to ED overcrowding originate from healthcare system operations beyond the hospital or from non-healthcare-related elements, indirectly shaping overcrowding by increasing demand on the ED. Deficiencies in public health and preventive services are a significant contributor; shortcomings in the management and prevention of chronic diseases lead to worsening health conditions among individuals, increasing the frequency of ED visits (20). This is particularly evident in populations where conditions such as diabetes or hypertension are inadequately managed, elevating the preventable burden on EDs.

Socioeconomic factors play a critical role among external contributors; low income levels and lack of health insurance may drive certain populations to rely on EDs instead of regular primary care services. This is directly linked to inequities in healthcare access, with uninsured individuals or those facing financial constraints often perceiving the ED as a source of free care (21). Demographic shifts also

significantly influence ED demand. For instance, migration can strain healthcare infrastructure in newly settled areas, where services may not keep pace with demand (20,22). Seasonal variations, epidemics, and natural disasters introduce predictable yet challenging periods of increased ED utilization. Influenza outbreaks, heatwaves, pandemics such as COVID-19, and post-disaster surges following earthquakes or floods overwhelm system capacity, exacerbating overcrowding and highlighting its ties to both societal and systemic dynamics (5,9,16).

Weekends and holiday periods, when non-ED healthcare services are closed or less accessible, often see an increase in ED visits due to a lack of alternative care options. This reflects a lack of continuity in the healthcare system, intensifying pressure on EDs, particularly during public holidays (10). Additionally, the closure or reduced capacity of other hospitals or EDs in a region is a critical external factor; such reductions redirect patient loads to remaining EDs, concentrating demand (2,7). Environmental factors also play a significant role; for example, inadequate transportation infrastructure may limit access to primary care, leading patients to EDs, which are often more geographically accessible (9).

Factors contributing to ED overcrowding are summarized in Table 1.

Measurement Methods and Scoring Systems

The objective assessment of ED overcrowding has been made possible through various scoring systems developed internationally, designed to support clinical decision-making processes and evaluate the effectiveness of intervention strategies (14). The most widely used tool, the National Emergency Department Overcrowding Scale (NEDOCS), calculates a score by integrating multiple parameters, including the number of patients in the ED, waiting times, the number of boarded patients awaiting hospitalization, the number of patients requiring ventilators, and available bed capacity. NEDOCS translates clinicians' subjective perceptions into a quantitative framework, enabling standardized analysis of ED performance (14).

The Emergency Department Work Index (EDWIN) is another index that measures workload within the ED. EDWIN calculates workload per unit of time by considering factors such as patient volume, staff capacity, and the distribution of patients across triage categories (16,19). Additionally, alternative approaches are also available in the literature. The Community Emergency Department Overcrowding Score (CEDOCS) is a tool designed to measure overcrowding in community-based EDs, incorporating parameters specific to local contexts (23). The Severely Overcrowded-Overcrowded-Not Overcrowded Estimation Tool (SONET) offers a simplified estimation method, categorizing overcrowding levels into three tiers for rapid situational assessment (23).

These measurement methods are indispensable for understanding this complex issue in EDs, developing effective interventions, and ultimately improving patient care and the overall quality of healthcare services. For instance, the NEDOCS score is particularly sensitive in assessing the contribution of patient outflow factors, such as boarding, to overcrowding, while EDWIN is more effective in evaluating staff-focused throughput processes (23). However, these systems have limitations in providing a standardized "gold standard"; their variability based on hospital volume, patient population, and local healthcare system dynamics raises questions about their universal applicability.

Importance and Consequences of ED Overcrowding

ED overcrowding extends beyond compromising patient care quality, presenting a multifaceted challenge to the healthcare system with severe consequences. It threatens patient safety, staff well-being, and overall system efficiency, making it a global crisis that requires urgent intervention (11,14). The impact on patient care is among the most striking manifestations of overcrowding. Prolonged waiting times increase the "left without being seen" rate by up to 10% (24) and cause delays in treatment for emergent conditions, elevating mortality and morbidity rates. For example, in overcrowded EDs, antibiotic administration for sepsis cases is delayed by 5 minutes for every 10% increase in patient volume, increasing mortality risk (17,25). In critical conditions such as myocardial infarction, a 30-minute delay in treatment can increase mortality risk by up to 7.5% (26). Furthermore, medical errors more than double due to ED overcrowding (27), while patient satisfaction significantly declines (5).

The impact on staff represents another critical dimension of overcrowding. Excessive workload and stress contribute to burnout among ED staff (5). In overcrowded EDs, staff job satisfaction decreases, which leads to higher turnover rates (7,8,28). These conditions create a vicious cycle that indirectly affects patient care quality; stressed staff are more prone to errors, further worsening clinical outcomes. At the system level, ED overcrowding results in inefficient resource utilization and a 10–15% increase in healthcare costs (7), as well as delays in ambulance offloading (1). These disruptions hinder patients' access to healthcare services and jeopardize system functionality. Consequently, the multifaceted threats to patient safety, staff well-being, and healthcare system efficiency underscore the need to understand the causes of overcrowding, measure its effects, and develop effective mitigation strategies. In this context, a deeper examination of the clinical and financial consequences of ED overcrowding emerges as a critical step in reshaping healthcare policies.

Proposed Solutions and Intervention Strategies

Solutions to address ED overcrowding can be categorized under three main headings: short-term, long-term, and technologically innovative approaches. These strategies aim to reduce overcrowding and improve patient care across a broad spectrum, from optimizing existing resources to addressing systemic challenges.

Short-Term Strategies

Short-term strategies focus on rapidly implementable interventions to alleviate immediate or short-term pressure on the ED. Fast-track systems streamline the evaluation and treatment of low-acuity patients (e.g., green-coded cases) in a dedicated area, staffed by experienced professionals such as emergency medical technicians, nurses, general

Factor category	Subcategories	Description
Patient-related	Non-emergent conditions	Patients seek ED care over primary care due to expectations of rapid service delivery
	Frequent ED use	Patients with chronic conditions or limited social support regularly utilize the ED
	Older population and comorbidities	Demographic shifts increase complex health issues, leading to prolonged ED stays
	Patient perception of urgency	Low health literacy prompts ED visits for low-acuity conditions
Systemic	Bed access issues	Boarding occupies ED beds, limiting space for new patients
	Staff shortages	Insufficient staff disrupts patient management, particularly during peak hours
	Inefficient discharge processes	Delayed discharges hinder bed turnover, interrupting patient flow
	Diagnostic and consultation delays	Challenges in accessing laboratory services and specialists slow patient flow
External	Limited primary care access	Lack of timely access drives patients to the ED, exacerbated by after-hours restrictions
	Socioeconomic factors	Low income and lack of insurance make the ED a primary care option
	Seasonal factors and epidemics	Influenza, COVID-19, and similar outbreaks cause sudden surges
	Lack of specialist appointments	Difficulty accessing specialists redirects patients to the ED

Table 1. Summary of factors contributing to ED overcrowding

practitioners, or specialists, thereby reducing waiting times and improving patient flow (3,9,12,13). This approach minimizes unnecessary delays. Similarly, team triage, which involves a collaborative assessment by a physician and a nurse, improves the accuracy and speed of patient evaluations (3). Empowering triage nurses to initiate diagnostic tests (e.g., X-rays, laboratory tests, ECGs) further supports this process (4). Day units, designed for outpatients requiring only short-term observation or treatment, prevent these patients from being directed to the ED, thus reducing the ED's burden and preserving beds for critical cases (4). Early discharge protocols, which encourage discharges during morning hours, free up inpatient ward beds, facilitating the transfer of ED patients awaiting hospitalization. When combined with full-capacity protocols, redirecting boarded patients to alternative areas temporarily further alleviates ED pressure (2).

Long-Term Strategies

Long-term strategies target the root causes of overcrowding to provide sustainable relief. Improving access to primary care services, particularly by strengthening after-hours care, encourages patients to seek family physicians for non-emergency conditions instead of the ED (7,9). As an extension of this effort, urgent care centers offer an alternative for acute but non-emergent health issues, naturally reducing ED demand (29). Effective bed capacity management optimizes hospital-wide bed allocation, while specialty observation units separate patients requiring short-term stays from the ED, mitigating boarding (8,12,13). However, increasing ED bed numbers alone does not resolve this issue (8,12,13). Strengthening long-term care services ensures regular follow-up for patients with chronic diseases, reducing ED dependency (7). An integrated healthcare system establishes seamless coordination between the ED, primary care, specialists, and public health services, facilitating patient transfers and follow-up (4,7). Integrating social services accelerates the discharge of patients with complex social issues (1). Regional healthcare planning balances the distribution of resources (e.g., staff, beds, equipment) based on need, while staff training enhances overcrowding management and communication skills, supporting this system (4,7). Policy reforms, driven by national goals and incentives, guide hospitals toward long-term improvement (1,9,11). Collectively, these systemic reforms strengthen the ED and establish lasting equilibrium.

Technological and Innovative Approaches

Technological and innovative approaches leverage modern tools to reduce overcrowding and enhance efficiency. Predictive and simulation models, powered by machine learning and artificial intelligence, forecast patient flow, enabling more effective resource planning (8,14). Telemedicine provides remote consultations for non-emergent conditions and facilitates post-discharge follow-up, which reduces the number of ED visits (9,15,16). Patient flow management centers coordinate bed allocation through real-time monitoring, maintaining oversight of system dynamics (9,15). Technologies such as Radio Frequency Identification (RFID) streamline patient and equipment tracking, identify overcrowded areas, and enable targeted solutions, thus indirectly alleviating pressure (2,5,19). These innovations highlight the potential of technology in ED management. The success of all these

strategies depends on their adaptation to the unique conditions of each ED; sustained improvement requires the consistent implementation of this holistic framework. Proposed solutions and intervention strategies are summarized in Table 2.

Strategy type	Interventions	Objective
Short-term	Fast-track	Reduce waiting times
	Early discharge	Free up inpatient ward beds
	Improved ambulance turnaround	Shorten ambulance return-to-service times
	Patient Redirection	Divert non-emergent cases to primary care
Long-term	Enhanced primary care access	Reduce non-emergent ED visits
	Urgent care centers	Address acute but non-emergent demand
	Bed capacity management	Mitigate boarding
	Long-term care services	Reduce chronic patient burden
Technological and innovative	Telemedicine	Alleviate non-emergent visits
	Artificial intelligence and simulation models	Optimize patient flow
	Tracking technologies	Develop solutions for overcrowded areas
	Mobile applications	Prevent unnecessary visits

Table 2. Summary of proposed solutions and intervention strategies

Literature Gaps and Future Research Directions

The applicability of scoring systems used to measure ED overcrowding is frequently debated, with conflicting findings regarding the consistency and validity of tools such as the NEDOCS and the EDWIN. Altun et al. (14) note that NEDOCS is strongly influenced by prolonged hospitalization times, which complicates its standardization, while Ilhan et al. (28) report that it is unsuitable for university hospitals. Wang et al. (30) highlight NEDOCS's limitations in high-volume EDs, and Phillips et al. (23) point to its inadequacy in low-volume EDs. Conversely, Improta et al. (19) suggest that NEDOCS may outperform EDWIN in severe overcrowding scenarios. These discrepancies underscore the absence of a universal gold standard and the variability of these scores based on factors such as hospital volume, patient population, and external conditions (e.g., pandemics). This highlights the need for standardized, validated measurement tools tailored to diverse ED types and contexts. Multicenter validation studies and research examining the correlation of NEDOCS, EDWIN, and other scoring systems with clinical outcomes are warranted.

The economic and clinical impacts of interventions targeting ED overcrowding remain underexplored. Oredsson et al., in their systematic review, indicate that studies provide limited data on patient safety or cost-benefit analyses (3), while Darraj et al. emphasize that existing reviews focus primarily on causes and solutions, with insufficient examination of the clinical consequences of treatment delays, particularly in emergent conditions such as sepsis or myocardial infarction (17). Additionally, Butun et al. report that research on reasons for ED utilization is predominantly conducted in high-income countries, with low- and middle-income countries underexplored due to differences in healthcare systems and cultural norms (7). Furthermore, while reasons for patients' preference for EDs (e.g., perceived urgency, 24-hour access, expectations of rapid service) are noted, behavioral factors and the influence of social networks on overcrowding have not been thoroughly investigated. Similarly, the psychological effects of ED overcrowding on staff (e.g., burnout, stress, job satisfaction) and the effectiveness of interventions to mitigate these impacts remain inadequately studied. Future research designed to address these gaps is essential (Table 3).

Gap area	Description	Research recommendation
Applicability of scoring systems	Lack of a gold standard and variability based on hospital conditions	Multicenter validation and correlation with clinical outcomes
Lack of cost-benefit analyses	Uncertain economic and safety impacts of interventions	Cost-effectiveness and patient safety analyses
Research addressing inequities	Perspectives of vulnerable groups are overlooked	Evaluations of interventions to reduce inequities
Examination of treatment delays	Insufficient emphasis on the clinical outcomes of delays	Systematic review of causes and consequences of delays
Low- and middle-income countries	Research focuses on high-income countries.	Contextual and actionable solution exploration
Behavioral and social influences	Patient preferences and societal factors are underexplored	Demand management strategies informed by behavioral sciences

Table 3. Literature gaps and research recommendations

Conclusion

ED overcrowding is not merely a healthcare delivery issue but a global crisis with multidimensional impacts on patient safety, clinical outcomes, staff well-being, and healthcare system sustainability. Its causes span a broad spectrum, from individual patient behaviors to systemic operational inefficiencies, external societal conditions, and resource constraints, with these dynamics mutually influencing one another. Analyses clearly demonstrate the contributions of patient-related, systemic, and environmental factors to overcrowding. Proposed solutions range from short-term interventions (e.g., fast track, early discharge) to long-term strategies (e.g., improved primary care access, bed management) and technological innovations (e.g., artificial intelligence, telemedicine). Notable gaps include inconsistencies in scoring systems used to assess overcrowding, a lack of cost analyses, and a scarcity of research in low-income countries.

Effectively managing ED overcrowding, enhancing patient safety, and ensuring the sustainability of the healthcare system require concerted efforts from clinical, academic, and policy sectors. This can be achieved not only by optimizing existing resources but also through the coordinated implementation of systemic reforms and innovative strategies.

Conflict of Interest: The Authors declared that there is no conflict of interest.

Financial Disclosure: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' Contributions: MA: Conceptualization; Formal analysis; Investigation; Methodology; Project administration; Visualization; Writing – original draft. **EK:** Formal analysis; Investigation; Methodology; Visualization; Writing – review & editing. All authors read and approved the final submitted version of the manuscript. All authors have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

Ethical Approval: This is an invited scoping review and does not involve human or animal subjects. Therefore, ethical approval was not required.

References

1. Maninchedda M, Proia AS, Bianco L, Aromatario M, Orsi GB, Napoli C. Main Features and Control Strategies to Reduce Overcrowding in Emergency Departments: A Systematic Review of the Literature. Risk Manag Healthc Policy. 2023;16:255–66.
2. Nasr Isfahani M, Davari F, Azizkhani R, Rezvani M. Decreased Emergency Department Overcrowding by Discharge Lounge: A Computer Simulation Study. Int J Prev Med. 2020;11:13.
3. Oredsson S, Jonsson H, Rognes J, et al. A systematic review of triage-related interventions to improve patient flow in emergency departments. Scand J Trauma Resusc Emerg Med. 2011 Jul 19;19:43.
4. Bittencourt RJ, Stevanato A de M, Bragança CTNM, Gottems LBD, O'Dwyer G. Interventions in overcrowding of emergency departments: an overview of systematic reviews. Rev Saude Publica. 2020;54:66.
5. Savioli G, Ceresa IF, Gri N, et al. Emergency Department Overcrowding: Understanding the Factors to Find Corresponding Solutions. J Pers Med. 2022 Feb 14;12(2):279.
6. Pearce S, Marr E, Shannon T, Marchand T, Lang E. Overcrowding in emergency departments: an overview of reviews describing global solutions and their outcomes. Intern Emerg Med. 2024 Mar;19(2):483–91.
7. Butun A, Kafdag EE, Gunduz H, et al. Emergency department overcrowding: causes and solutions. Emergency and Critical Care Medicine 3(4):p 171-176, December 2023.
8. Harrou F, Dairi A, Kadri F, Sun Y. Forecasting emergency department overcrowding: A deep learning framework. Chaos Solitons Fractals. 2020 Oct;139:110247.
9. Sartini M, Carbone A, Demartini A, et al. Overcrowding in Emergency Department: Causes, Consequences, and Solutions-A Narrative Review. Healthc Basel Switz. 2022 Aug 25;10(9):1625.
10. Lindner G, Woitok BK. Emergency department overcrowding : Analysis and strategies to manage an international phenomenon. Wien Klin Wochenschr. 2021 Mar;133(5–6):229–33.
11. Javidan AP, Hansen K, Higginson I, Jones P, Lang E, IFEM Task Force on Emergency Department Crowding and Access Block. The International Federation for Emergency Medicine report on emergency department

crowding and access block: A brief summary. Emerg Med Australas EMA. 2021 Feb;33(1):161–3.
12. Affleck A, Parks P, Drummond A, Rowe BH, Ovens HJ. Emergency department overcrowding and access block. CJEM. 2013 Nov;15(6):359–84.
13. Chan SSW, Cheung NK, Graham CA, Rainer TH. Strategies and solutions to alleviate access block and overcrowding in emergency departments. Hong Kong Med J Xianggang Yi Xue Za Zhi. 2015 Aug;21(4):345–52.
14. Altun M, Kudu E, Demir O, et al. Effect of access block on emergency department crowding calculated by NEDOCS score. Am J Emerg Med. 2024 Aug;82:136–41.
15. Emergency Department Overcrowding in Canada: CADTH Health Technology Review Recommendation [Internet]. Ottawa (ON): Canadian Agency for Drugs and Technologies in Health; 2023 Nov. Report No.: OP0553GUI. Available from: http://www.ncbi.nlm.nih.gov/books/NBK599980/ Accessed April 20, 2025
16. Colella Y, Di Laura D, Borrelli A, Triassi M, Amato F, Improta G. Overcrowding analysis in emergency department through indexes: a single center study. BMC Emerg Med. 2022 Nov 18;22(1):181.
17. Darraj A, Hudays A, Hazazi A, Hobani A, Alghamdi A. The Association between Emergency Department Overcrowding and Delay in Treatment: A Systematic Review. Healthc Basel Switz. 2023 Jan 29;11(3):385.
18. Jung HM, Kim MJ, Kim JH, et al. The effect of overcrowding in emergency departments on the admission rate according to the emergency triage level. PloS One. 2021;16(2):e0247042.
19. Improta G, Majolo M, Raiola E, Russo G, Longo G, Triassi M. A case study to investigate the impact of overcrowding indices in emergency departments. BMC Emerg Med. 2022 Aug 9;22(1):143.
20. Ukkonen M, Jämsen E, Zeitlin R, Pauniaho SL. Emergency department visits in older patients: a population-based survey. BMC Emerg Med. 2019 Feb 27;19(1):20.
21. Gertz AM, Frank S, Blixen CE. A survey of patients and providers at free clinics across the United States. J Community Health. 2011 Feb;36(1):83–93.
22. Immordino P, Sà Machado R, Hargreaves S, et al. Migration, Urbanism and Health: Moving Toward Systems-Informed Policy and Practice. F1000Research 2024, 13:1344
23. Phillips JL, Jackson BE, Fagan EL, Arze SE, Major B, Zenarosa NR, et al. Overcrowding and Its Association With Patient Outcomes in a Median-Low Volume Emergency Department. J Clin Med Res. 2017 Nov;9(11):911–6.
24. Gorski JK, Arnold TS, Usiak H, Showalter CD. Crowding is the strongest predictor of left without being seen risk in a pediatric emergency department. Am J Emerg Med. 2021 Oct;48:73–8.
25. Gaieski DF, Agarwal AK, Mikkelsen ME, et al. The impact of ED crowding on early interventions and mortality in patients with severe sepsis. Am J Emerg Med. 2017 Jul;35(7):953–60.
26. De Luca G, Suryapranata H, Ottervanger JP, Antman EM. Time delay to treatment and mortality in primary angioplasty for acute myocardial infarction: every minute of delay counts. Circulation. 2004 Mar 16;109(10):1223–5.
27. Epstein SK, Huckins DS, Liu SW, et al. Emergency department crowding and risk of preventable medical errors. Intern Emerg Med. 2012 Apr;7(2):173–80.
28. Ilhan B, Kunt MM, Damarsoy FF, Demir MC, Aksu NM. NEDOCS: is it really useful for detecting emergency department overcrowding today? Medicine (Baltimore). 2020 Jul 10;99(28):e20478.
29. Black LI, Adjaye-Gbewonyo D. Urgent Care Center and Retail Health Clinic Utilization Among Adults: United States, 2019. NCHS Data Brief. 2021 Jun;(409):1–8.
30. Wang H, Robinson RD, Bunch K, et al. The inaccuracy of determining overcrowding status by using the national ED overcrowding study tool. Am J Emerg Med. 2014 Oct;32(10):1230–6.