

# The Impact of Weather and Air Conditions on Pediatric Emergency Department Visits in 2019-2022: A Single-Center Study

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2019-2022 Yılları Arasında Mevsim ve Hava Koşullarının Çocuk Acil Servis Ziyaretleri Üzerindeki Etkisi: Tek Merkezli Bir Çalışma

## ABSTRACT

**Objective:** This study aimed to explore the impact of environmental factors, specifically adverse weather conditions, on the rate of pediatric emergency department visits.

**Methods:** A retrospective analysis was performed at a tertiary care hospital specializing in pediatric and emergency medicine. Data on environmental factors, including particulate matter (PM10) and nitrogen oxide (NO<sub>x</sub>) levels, temperature, wind speed, and precipitation, were collected from official Turkish sources and correlated with pediatric emergency department admissions over a year. Admissions were categorized seasonally, and analyzed variables included patient demographics, visit details, diagnosis, and outcomes, utilizing ICD-10 codes for a broad range of conditions.

**Results:** A retrospective study from 2019 to 2022 investigated 126,364 pediatric patients aged <15 years. Seasonal variation was noted, with the highest number of admissions in the fall of 2022. Admissions significantly decreased during periods of water and air pollution, with the most substantial decline seen during the pandemic year of 2021. During the post-pandemic period, there was a sharp increase in the number of visits. Upper respiratory tract infections (URTIs) constitute 47% of all cases and are the leading cause of emergency department visits. The majority of patients (99%) walked, whereas only 1% arrived by ambulance (0.2%) required referral to higher-level care, and 3% of emergency visits resulted in hospital admissions, of which 5% required intensive care. The frequency of visits was correlated with environmental factors, with fewer visits occurring during adverse weather conditions ( $P<.001$ ). URTIs remained the predominant diagnosis, even during extreme weather or pollution events, suggesting that such environmental factors did not diminish the urgency of these conditions.

**Conclusion:** This study found that environmental factors influence child emergency room visits, particularly during summer when children engage in more outdoor activities due to warmer weather. Based on the results obtained, health systems are able to allocate resources and formulate response strategies that enhance the provision of care for children, thereby increasing the resilience of the emergency health services infrastructure.

**Keywords:** Pediatric Emergency Medicine, Environmental Health Impact, Air Quality and Child Health, Seasonal Variation in Pediatric Emergency Department Admissions, Pediatric Healthcare Utilization Patterns

## ÖZ

**Amaç:** Bu çalışmanın amacı çevresel faktörlerin, özellikle olumsuz hava koşullarının, çocuk acil servis ziyaretlerinin oranı üzerindeki etkisini incelemektir.

**Yöntemler:** Pediatrik ve acil tıpta uzmanlaşmış üçüncü basamak bir hastanede retrospektif bir analiz yapıldı. Partikül madde (PM10) ve nitrojen oksit (NOX) seviyeleri, sıcaklık, rüzgar hızı ve yağış gibi çevresel faktörlere ilişkin veriler resmi Türk kaynaklarından toplandı ve bir yıl boyunca pediatrik acil servis yatışlarıyla ilişkilendirildi.

Yatışlar mevsimsel olarak kategorize edildi ve analiz edilen değişkenler arasında hasta demografisi, ziyaret ayrıntıları, tanı ve sonuçlar yer aldı ve geniş bir yelpazedeki koşullar için ICD-10 kodları kullanıldı.

**Bulgular:** 2019-2022 yılları arasında yapılan retrospektif bir çalışmada 15 yaşından küçük 126.364 pediatrik hasta incelendi. Mevsimsel değişim kaydedildi ve en yüksek yatış sayısı 2022 sonbaharında gerçekleşti. Su ve hava kirliliği dönemlerinde yatışlar önemli ölçüde azaldı ve en büyük düşüş 2021 pandemi yılında görüldü. Pandemi sonrası dönemde ziyaret sayısında keskin bir artış oldu. Üst solunum yolu enfeksiyonları tüm vakaların %47'sini oluşturuyordu ve acil servis ziyaretlerinin önde gelen nedeniydi. Hastaların çoğu (%99) ayakta, sadece %1'i ambulansla geldi. %0,2 oranında daha üst düzey bakıma sevk edilmesi gerekti, acil servis ziyaretlerinin %3'ü hastane yatışlarıyla sonuçlandı ve bunların %5'i yoğun bakım gerektirdi. Ziyaret sıklığı çevresel faktörlerle ilişkiliydi ve olumsuz hava koşullarında daha az ziyaret meydana geldi ( $P<.001$ ). Aşırı hava koşulları veya kirlilik olayları sırasında bile, üst solunum yolu enfeksiyonları baskın tanı olmaya devam etti; bu da çevresel faktörlerin bu durumların aciliyetini azaltmadığını gösteriyor.

**Sonuç:** Bu çalışma, özellikle çocukların daha sıcak hava nedeniyle daha fazla açık hava aktivitesine katıldığı yaz aylarında çevresel faktörlerin çocuk acil servis ziyaretlerini etkilediğini buldu. Elde edilen sonuçlarla, sağlık sistemleri kaynakları tahsis edebilir ve acil sağlık hizmetleri altyapısının dayanıklılığını artırma amacıyla çocuklara yönelik bakım sunumunu optimize eden yanıt stratejileri geliştirebilir.

**Anahtar Kelimeler:** Pediatrik Acil Tıp, Çevresel Sağlık Etkisi, Hava Kalitesi ve Çocuk Sağlığı, Pediatri Acil Servisine Kabulde Mevsimsel Değişim, Pediatrik Sağlık Hizmeti Kullanım Modelleri

## INTRODUCTION

The provision of effective Emergency Medical Services (EMS) is a critical component of a life-saving healthcare infrastructure. Emergency Departments (EDs) are vital for ensuring the uninterrupted delivery of urgent medical care. However, the efficiency of these services can be compromised by the high frequency of nonurgent cases. Environmental conditions, notably adverse weather, have been identified as significant contributors to this phenomenon, with disproportionate effects on pediatric emergency admissions.<sup>1,2</sup>

Adverse weather conditions, such as extreme temperatures, heavy precipitation, and high levels of air pollution, adversely affect pediatric health, potentially leading to an increased number of ED visits. This association is particularly evident in the increased incidence of respiratory illnesses, asthma exacerbations, and heat-related illnesses in the pediatric population. Owing to their developmental stage, children exhibit heightened sensitivity to weather fluctuations. Their increased participation in outdoor activities exacerbates their vulnerability to environmental risk.<sup>3,4</sup>

The impact of global warming on human health has been evident for years and its effects are disproportionately distributed across global populations. The resultant inequity has manifested in a variety of health outcomes, including vector-borne diseases, stress from water and food shortages, and morbidities associated with air pollution and fluctuating climatic conditions.<sup>4,5</sup>

Several factors contribute to ED visit rates, among which adverse environmental conditions play a significant role. The literature on the subject reveals that weather

conditions such as heatwaves, cold and polluted air exposure, and allergenic conditions during windy and rainy days correlate with increased adult admissions for cardiovascular and chronic pulmonary diseases, as well as outbreaks of gastroenteritis.<sup>6-10</sup> However, the pediatric population remains understudied. There is a paucity of research addressing the effect of environmental factors on ED visit rates in the pediatric age group, despite evidence suggesting a considerable influence of such factors.

Although substantial research exists regarding the influence of environmental factors on adult ED visits, pediatric-focused studies are limited.<sup>11,12</sup> Different factors such as parental perception of urgency, transportation accessibility to hospitals, and variations in daily routines, including school, work, and holidays, can also influence pediatric emergency visits.<sup>11</sup> Consequently, findings from adult studies may not be directly applicable to pediatric emergency management.

While there is extensive literature on how environmental factors influence adult ED visits, studies focusing on pediatric populations are still scarce. There is a need for research to provide a more detailed examination of the role that environmental factors play in pediatric emergency department visits. This study aimed to fill this gap by examining the influence of environmental factors on pediatric emergency visits in greater detail.

## METHODS

### Study Design

This observational retrospective study was conducted at the Pediatric Emergency Department of the Kırklareli Training and Research Hospital's Pediatric Emergency Department (KTRH PED). The KTRH PED is staffed around

the clock by board-certified pediatricians and emergency medicine specialists supported by two general practitioners. The facility was outfitted with a seven-bed observation unit and fully equipped resuscitation room. In times of peak demand, the department expands its capacity to an additional critical care area within the adult emergency wing.

### Data Sources and Categorizations

Data on environmental changes were obtained from the Republic of Türkiye Ministry of Environment, Urbanization and Climate Change, the General Directorate of Meteorology, and statistical reports from the Kırklareli Provincial Directorate of the Turkish Statistical Institute.<sup>13, 14</sup> This study examined the impact of air pollution on emergency service admissions by assessing particulate matter (PM<sub>10</sub>) and nitrogen oxide (NO<sub>x</sub>) levels, temperature fluctuations beyond seasonal norms, high wind speeds, and significant rainfall. Regional thresholds were established for PM<sub>10</sub> and NO<sub>x</sub>, with PM<sub>10</sub> concentrations between 50-150 mcg/m<sup>3</sup> considered moderate and above 150 mcg/m<sup>3</sup> considered poor, while NO<sub>x</sub> concentrations below 30 mcg/m<sup>3</sup> were deemed normal, and 30-150 mcg/m<sup>3</sup> were considered high for the province of Kırklareli.

Data spanning one year were categorized into four seasonal groups. On days or months with sudden temperature shifts above or below the seasonal average, or when significant water and air pollution were noted, the following variables were analyzed: the patient's sex, year of visit, season of visit, mode of arrival (walk-in or ambulance), diagnosis, whether hospitalization was necessary, which department they were followed in, the need for referral, and the outcome. Diagnoses were coded according to the International Classification of Diseases (ICD-10) for conditions such as intestinal infections, abdominal pain, trauma, and upper respiratory tract infections (URTI). A comprehensive range of diagnoses, including URTI, gastrointestinal infections, abdominal pain, trauma, skin diseases, rheumatic conditions, eye infections, genitourinary infections, lower respiratory tract infections, neurological emergencies, dental emergencies, blood disorders, cardiac emergencies, psychiatric emergencies, endocrine emergencies, and intoxications, was examined using the ICD-10 classification system.

### Ethical Considerations

Prior to the commencement of this study, approval was obtained from the Kırklareli University Faculty of Medicine Ethics Committee (P202200041/01-January 5, 2023). This study was conducted in strict accordance with the ethical principles for medical research involving human subjects

outlined in the Declaration of Helsinki.

All patient data were anonymized before the analysis to ensure confidentiality. In cases where patient records were accessed, data extraction was performed in a manner that preserved the anonymity of individuals, and no identifying information was used in the reporting of the findings.

### Statistical Analysis

Data analysis incorporated descriptive statistics, including calculation of mean, standard deviation, median, minimum, maximum, frequency, and proportion values. The distribution of variables was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. For the analysis of quantitative independent data, the Kruskal-Wallis and Mann-Whitney U tests were employed. Categorical independent data were analyzed using the Chi-square test, and Fisher's exact test was applied when the Chi-square test assumptions were not met. All analyses were conducted using the SPSS (IBM Corp., Armonk, NY, USA) software version 27.0.

### RESULTS

This retrospective study analyzed the computer-based records of 126,364 pediatric patients aged < 15 years who presented to KTRH-PED from January 2019 to December 2022.

**54% of patients were male.** The data revealed that the highest number of admissions will occur during the fall of 2022. Notably, a decrease in ED visits was observed during periods of water pollution, air pollution, and extraordinary weather conditions. Table 1 provides the basic demographics and climate distribution in detail.

Most ED presentations were due to URTIs, accounting for 47% of the cases, followed by trauma patients at 23%. It was found that 99% of patients arrived at the facility on their own (walk-in). It was also observed that 1% of patients (n=1822) were brought in by the 112 Emergency Command and Coordination Center. Of these, 0.2% were referred to a higher-level center and 3% were admitted to inpatient wards from the ED, within this admitted group, 5% required intensive care monitoring (Table 2).

During the study period from 2019 to 2022, 126,364 pediatric admissions were recorded at the KTRH-PED. The mean age of presenting patients remained relatively stable over the four years, with a slight variation in 2020 (7±4.4 years) compared to 2019 (6.7±4.4 years), 2021 (6.6±4.5 years), and 2022 (6.9±4.3 years),  $P<.001$ . There was a consistent distribution in sex, with females comprising approximately 46% and males 54% of admissions each year ( $P=.011$ ).

A notable decline in admissions was observed during the pandemic, with the lowest point reached in 2021. Following

this period, a substantial increase has occurred, culminating in the highest admission rate in 2022. This resurgence in admissions could reflect the easing of pandemic-related restrictions, or a rebound effect following the initial decline.

**Table 1:** Demographic Characteristics and Admission Periods of Patients

Demographic/Admission Period	Total (n=126,364)	%
<b>Age (years) [Mean±SD (min-max)]</b>	6.8±4.4 (0-15)	-
<b>Gender</b>		
Female	58,006	46
Male	68,358	54
<b>Year of Admission</b>		
2019	33,987	27
2020	17,448	14
2021	25,475	20
2022	49,454	39
<b>Season of Admission</b>		
Winter	32,17	25
Spring	25,308	20
Summer	33,679	27
Fall	35,207	28
<b>Admissions During Water Pollution</b>		
Yes	8,347	7
No	118,017	93
<b>Admissions During Extreme Weather Conditions</b>		
No	124,794	99
Yes		1
- Excessive Heat	428	27
- Strong Wind	360	23
- Heavy Rainfall	782	50
<b>Admissions by PM10 Level</b>		
Normal	92,389	73
Moderate	33,841	27
Poor	134	<1
<b>Admissions by NOX Level</b>		
Normal	110,387	87
High	15,977	13

PM10: particulate matter NO<sub>x</sub>: nitrogen oxide

**Table 2:** Most Common Diagnoses and Patient Follow-up Outcomes

Variable	Number (n=126,364)	(%)
<b>Diagnoses</b>		
Upper Respiratory Tract Infection	59,387	47
Trauma	29,529	23
Gastrointestinal System Infection	12,29	10
Acute Abdomen	11,047	9
Other	14,111	9
<b>Arrival</b>		
Ambulance	1,822	1
Walk-in	124,542	99
<b>Referral to a Higher Center</b>		
No	126,114	99.8
Yes	250	0.2
<b>Hospitalization at Same Hospital</b>		
Yes	122,034	97
No	4,33	3
<b>Unit of Hospitalization</b>		
Services	4,118	95
Intensive Care Unit	212	5
<b>Prognosis</b>		
Discharged	125,297	98.8
Deceased	1	<0.1
Referred to a Higher Center	66	<0.1
<b>Length of Stay (days) [Mean±SD (min-max)]</b>	1.7±1.6 (0-27)	

The presence of water pollution seemed to correlate with a reduction in admissions, as shown by the lower percentage of visits during times of reported water pollution across the years. Notably, 11% of visits occurred during such conditions in 2021, compared to 3% in 2019, and 9% in 2022 ( $P<.001$ ). PM10 levels showed a significant impact on ED visits, with 78% of visits occurring during normal PM10 conditions in 2022, compared to 68% in 2019 ( $P<.001$ ). The admissions during high NOX levels were lowest in 2021 (8%) and highest in 2020 (23%) ( $P<.001$ ).

In 2020, the age of the patients was significantly higher than in 2019 and 2021 ( $P<.05$ ). In 2022, the age of the

**Table 3:** Annual Pediatric Admissions by Demographics, Environmental Conditions, and Clinical Outcomes (2019-2022)

Variable	2019 <sup>1</sup> (n=32,032)	2020 <sup>2</sup> (n=17,202)	2021 <sup>3</sup> (n=26,360)	2022 <sup>4</sup> (n=50,770)	P
<b>Age (years)</b> [Mean±SD (min-max)]	6.7±4.4	7±4.4	6.6±4.5	6.9±4.3	<.05 <sup>2/1,3 k</sup> <.05 <sup>4/1,3 k</sup> <.05 <sup>1/3 k</sup> >.05 <sup>2/4 k</sup>
<b>Gender</b>					
Female	15,566 (46%)	7,850 (45%)	11,648 (46%)	22,942 (46%)	
Male	18,421 (54%)	9,598 (55%)	13,827 (54%)	26,512 (54%)	<.05 <sup>2/4 x2</sup> >.05 <sup>1/2,3,4x2</sup> >.05 <sup>3/2,4 x2</sup>
<b>Water Pollution</b>					
Yes	979 (3%)	351 (2%)	2,712 (11%)	4,305 (9%)	<.05 <sup>3/1,2,4x2</sup> <.05 <sup>4/1,2 x2</sup> <.05 <sup>1/2 x2</sup>
No	33,008 (97%)	17,097 (98%)	22,763 (89%)	45,149 (91%)	
<b>PM10 Levels</b>					
Normal	23,202 (68%)	12,322 (71%)	18,404 (72%)	38,461 (78%)	<.05 <sup>4/1,2,3x2</sup> <.05 <sup>3/1,2 x2</sup> <.05 <sup>2/1 x2</sup>
Moderate	10,785 (32%)	5,102 (29%)	7,071 (28%)	10,883 (22%)	
Poor	0 (0%)	24 (0%)	0 (0%)	110 (0%)	
<b>NOX Levels</b>					
Normal	30,516 (90%)	13,522 (77%)	23,557 (92%)	42,792 (87%)	
High	3,471 (10%)	3,926 (23%)	1,918 (8%)	6,662 (13%)	<.05 <sup>2/1,3,4 2</sup> <.05 <sup>4/1,3 x2</sup> <.05 <sup>1/3 x2</sup>
<b>Extreme Weather Conditions</b>					
Present	745 (2.2%)	198 (1.1%)	217 (0.9%)	410 (0.8%)	<.05 <sup>1/2,3,4x2</sup> <.05 <sup>2/3,4 x2</sup> >.05 <sup>3/4 x2</sup>
Absent	33,242 (98%)	17,250 (99%)	25,258 (99%)	49,044 (99%)	
<b>Diagnoses (The three most prevalent diseases)</b>					
URTI	14,893 (44%)	7,856 (45%)	11,022 (43%)	25,616 (52%)	<.05 <sup>4/1,2,3x2</sup> <.05 <sup>2/1,3 x2</sup> >.05 <sup>1/3 x2</sup>
Trauma	8,273 (24%)	4,943 (28%)	6,929 (27%)	9,384 (19%)	<.05 <sup>2/1,3,4x2</sup> <.05 <sup>3/1,4 x2</sup> <.05 <sup>1/4 x2</sup>
Gastrointestinal Infection	3,334 (10%)	1,259 (7%)	1,773 (7%)	5,924 (12%)	<.05 <sup>4/1,2,3x2</sup> <.05 <sup>1/2,3 x2</sup> >.05 <sup>2/3 x2</sup>

PM10, particulate matter; NOX, nitrogen oxides; URTI: Upper Respiratory Tract Infection, GI Infection: Gastrointestinal System Infection;

x/y,z: Comparing years with each other

K: Kruskal-wallis (Mann-whitney u test) / X<sup>2</sup>: Chi-square test (Fischer test)



patients was significantly higher than in 2019 and 2021 ( $P < .05$ ). In 2019, the age of the patients was significantly higher than in 2021 ( $P < .05$ ). The age of the patients did not differ significantly between 2020 and 2022 ( $P > .05$ ) (Table 3).

The proportion of male patients in 2020 was significantly higher compared to 2022 ( $P < .05$ ). The gender distribution did not exhibit significant differences between the years 2019 and 2020, 2021, and 2022 ( $P > .05$ ). Additionally, no significant differences were observed between 2021 and 2020, 2022 ( $P > .05$ ) (Table 3).

In 2019, under extraordinary weather conditions, the admission rate was statistically significantly higher than in 2020, 2021, and 2022 ( $P < .05$ ). In 2020, it was also significantly higher compared to 2021 and 2022 ( $P < .05$ ). No significant difference was observed in admission rates between 2021 and 2022, despite the presence of extraordinary weather conditions ( $P > .05$ ) (Table 3).

Extreme weather conditions, including excessive heat, strong winds, and heavy rainfall, were present in a small fraction of admissions, ranging from 0.8% to 2.2% over the years, with the least number of visits during extreme conditions noted in 2022 ( $P < .001$ ). Regarding diagnoses, URTI and trauma were the most common reasons for ED visits, with URTI diagnoses peaking at 52% in 2022 and 44% in 2019. The number of trauma cases decreased from 24% in 2019 to 19% in 2022 (Table 3).

## DISCUSSION

Child health is a top priority for society as it directly affects the well-being and prosperity of future generations. Environmental conditions, particularly air quality, are significant factors that affect child health. This study highlights the significant influence of environmental factors on PED visits, which can shape patient profiles and potentially alter the usage patterns of emergency services.

The demographic characteristics and reasons for ED visits among pediatric patients can vary owing to a range of geographical and cultural factors. In our study, the average age of pediatric patients presenting to the Pediatric Emergency Service was 6.8 years, and 54% were male. Similarly, a study conducted in Africa found that children under five years of age, in Arabia aged three, and in Korea, those under six were more frequently represented in ED visits compared to other age groups, with a predominance of male patients.<sup>15-17</sup> These variations may be underpinned by geographic and cultural factors in addition to regional disease prevalence. Moreover, cultural norms and family attitudes may shape these disparities.

Air pollution is defined as the presence of pollutants in the atmosphere at concentrations that are harmful to living organisms and materials. The World Health Organization (WHO) reports that 91% of the world's population lives in

places where air quality exceeds guideline limits, leading to approximately 4.2 million deaths annually due to air pollution.<sup>18-20</sup> Air pollutants can be categorized into gases and aerosol pollutants. The principal gaseous pollutants include carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO<sub>2</sub>), and volatile organic compounds (VOCs). Particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) represents the most hazardous fraction of aerosol pollutants, owing to their respiratory risks. PM<sub>10</sub> denotes coarse inhalable particles with an aerodynamic diameter smaller than 10  $\mu\text{m}$ , whereas PM<sub>2.5</sub> refers to fine inhalable particles with an aerodynamic diameter smaller than 2.5 micrometers.<sup>21</sup>

There exists a perception that inclement weather conditions correlate with a reduction in pediatric emergency visits.<sup>22</sup> One study determined that admissions for URTIs are more prevalent during the school term than during other periods.<sup>23</sup> In the United States, data from 2005 indicated that pediatric patients comprised a quarter of 55 million ED visits, with the most common issues being injuries and respiratory system problems, particularly URTIs. While injuries were more common in older children, respiratory infections were observed more frequently in younger children. Additional prevalent conditions included ear infections, unexplained fever, and viral infections.<sup>24, 25</sup> Consistently, our study also found an increased number of URTI cases in fall, coinciding with school reopening. This is particularly relevant considering children aged 6-7, who spend extended periods in crowded environments such as classrooms, may have an increased risk of transmitting infections.

The results of this study affirm that URTI symptoms constitute a significant proportion of pediatric emergency visits. Notably, even during extreme weather conditions or environmental pollution episodes, the number of patients with URTI did not decrease, remaining the largest subgroup of ED presentations. The concern among parents or caregivers about the potential for febrile convulsions during the febrile phase of a URTI could contribute to the high number of ED visits. Furthermore, the fact that URTI presentations are nearly double those of trauma cases suggests a preference for ED services over primary care facilities. The higher discharge rate from the ED compared to admission supports this hypothesis. Additionally, the ability to access pediatricians without appointments in our hospital's ED may make this option more attractive to caregivers.

Upon examination of the data over various periods, there was a notable decrease in patient numbers during the pandemic, with counts reduced by half compared with the preceding year. As the influence of the pandemic waned, a steady annual increase in presentations was observed, peaking in the most recent year of study. Similarly, the

number of admissions from the ED paralleled this trend, suggesting a rebound in healthcare utilization post-pandemic, a phenomenon that could be referred to as the 'new normal'.<sup>26</sup> The reduction in pediatric emergency visits during the pandemic likely reflects a protective approach towards the vulnerable pediatric population, which was ineligible for COVID-19 vaccination, with non-urgent cases being less frequently brought to the hospital. The increase in ambulance arrivals during the pandemic may be attributed to restrictions on movement, such as curfews, enacted as part of the COVID-19 containment measures. During the COVID-19 pandemic, emergency services were observed to cater to genuine emergencies.

Contrary to findings in the literature that air pollution and sudden temperature changes correlate with an increase in emergency visits, our study identified a sharp decline in ED presentations on and immediately after days with sudden temperature fluctuations.<sup>27, 28</sup> This divergence may be due to our specific focus on same-day visits during weather events. Nonetheless, this finding suggests that environmental conditions could impede access to the hospital, and that patients with non-urgent symptoms might defer their visits. Conversely, a consistent rate of trauma cases implies that true emergencies are less likely to be influenced by environmental factors. This could be interpreted as an indication that the ED is frequently utilized for non-urgent cases, contributing to congestion.

### Study Limitations

Several limitations of this study should be considered when interpreting the findings.

The retrospective design of this study makes it difficult to establish causal relationships between environmental factors and ED visits. Further prospective studies are needed to better determine these relationships. Additionally, the study was limited to a single tertiary care center, which may not accurately reflect the patterns seen in other settings, such as rural or non-tertiary hospitals. The findings of this study may not be generalizable to populations outside the study's geographical area due to varying environmental conditions and healthcare practices. Although the study used official sources for environmental data, the accuracy or sensitivity of the measuring instruments or methods may vary across different locations. The study spans four years, which may not capture the full variability in seasonal weather patterns or long-term environmental trends. Lastly, the study did not account for socioeconomic status, which can influence access to healthcare and the likelihood of visiting an ED.

Addressing these limitations in future research could involve multicenter studies, longitudinal analyses over a more extended period, and the consideration of a wider range of demographic and environmental variables.

### CONCLUSION

This study demonstrated a relationship between environmental factors and frequency of visits to PED. The data collected during extraordinary weather events indicated that trauma-related visits peaked during the summer months, which can be attributed to the increased outdoor activities of children during warmer weather. This study examined records from the largest hospital in the region and the primary emergency facility in the city center, providing a comprehensive overview of the reasons for PED presentations, patient outcomes, and susceptibility to external factors. The findings of this research are critical as they can serve as a guide for emergency services operating under similar conditions. Fluctuations in pediatric emergency visits are influenced by environmental factors, and anticipating these changes can facilitate strategic planning for emergency service capacity, staffing, and equipment. By understanding these patterns, healthcare systems can better allocate resources and develop response strategies to optimize care delivery for children, ultimately aiming to enhance the resilience of our emergency healthcare infrastructure against ever-changing environmental and public health challenges.

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**Hasta Onamı:** Çalışmanın retrospektif tasarımı nedeniyle hasta onamı alınamamıştır.

**Hakem Değerlendirmesi:** Dış bağımsız.

**Yazar Katkıları:** Fikir-DVK, MD, OG; Tasarım- MD, DVK, OG, SK, LT, ZT; Denetleme-DVK, MD; Kaynaklar- SK, ZT, HA, OY; Veri Toplanması ve/veya İşlemesi-SK, HA, OY; Analiz ve/veya Yorum- DVK, MD, OG, SK, LT, ZT; Literatür Taraması-DVK, MD, OG, SK, LT, ZT; Yazıyı Yazan-DVK, MD, OG, SK, LT, ZT; Eleştirel İnceleme- DVK, MD, OG, SK, LT.

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**Author Contributions:** Concept - DVK, MD, OG; Design-MD, DVK, OG, SK, LT, ZT; Supervision- DVK, MD; Resources-SK, ZT, HA, OY; Data Collection and/or Processing- SK, HA, OY; Analysis and/or Interpretation-DVK, MD, OG, SK, LT, ZT; Literature Search- DVK, MD, OG, SK, LT, ZT; Writing Manuscript- DVK, MD, OG, SK, LT, ZT; Critical Review-DVK, MD, OG, SK, LT.

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