Emergency Department Presentations of Pediatric Hematology Patients at a Tertiary Care Center: Clinical Characteristics and Patterns of Use

Üçüncü Basamak Bir Merkezde Çocuk Hematoloji Hastalarının Acil Servis Başvuruları: Klinik Özellikler ve Başvuru Örüntüleri

Atika ÇAĞLAR[1], Hale ÖREN[2], Murat DUMAN[2], Durgül YILMAZ[2], Özlem TÜFEKÇİ GÜROCAK[2], Şebnem YILMAZ[2]

[1]Department of Neonatology, Balikesir Atatürk City Hospital, Balikesir, Turkiye
[2]Department of Pediatric, Dokuz Eylul University Faculty of Medicine, Izmir, Turkiye

Objective: Children with hematologic diseases account for a small proportion of pediatric emergency department (PED) visits, but they often require urgent evaluation because of disease- or treatment-related complications. We aimed to evaluate the sociodemographic and clinical characteristics, management, and outcomes of pediatric hematology patients presenting to a tertiary care PED.

Materials and Methods: This retrospective observational study included children aged 0–18 years presenting to the PED of Dokuz Eylul University Faculty of Medicine between April 1, 2013 and April 1, 2014, with either a previously diagnosed hematologic disease or a new hematologic diagnosis made during emergency evaluation. The primary unit of analysis was each PED visit.

Results: Among 60,026 PED visits, 278 (0.46%) were hematology-related, corresponding to 96 individual patients. Mean age was 8.16 ± 0.52 years, and 57.3% were male. Leukemia-related visits were most common (48.6%). Monitoring, procedures, consultation, transfusion, and intravenous treatment were required in 30.6%, 51.1%, 47.8%, 23.0%, and 21.6% of visits, respectively. Hospitalization occurred in 27.3% of hematology-related visits versus 6.8% of all PED visits. All 23 febrile neutropenia visits resulted in hospitalization; mean time to antibiotics was 136.9 ± 15.9 minutes.

Conclusion: Pediatric hematology patients represent a small but clinically important PED subgroup with recurrent presentations, high resource utilization, and frequent hospitalization.

Keywords: Pediatric emergency department, hematologic diseases, leukemia, febrile neutropenia, hospitalization, resource utilization

Amaç: Çocuk hematoloji hastaları, çocuk acil servis (ÇAS) başvurularının küçük bir bölümünü oluşturmalarına rağmen, hastalığa veya tedaviye bağlı komplikasyonlar nedeniyle sıklıkla acil değerlendirme gerektirir. Bu çalışmada, üçüncü basamak bir ÇAS'a başvuran çocuk hematoloji hastalarının sosyodemografik ve klinik özellikleri, uygulanan yönetim ve sonuçlarının değerlendirilmesi amaçlandı.

Gereç ve Yöntem: Bu retrosepektif gözlemsel çalışmaya, 1 Nisan 2013–1 Nisan 2014 tarihleri arasında Dokuz Eylül Üniversitesi Tıp Fakültesi ÇAS'ına başvuran, daha önce hematolojik hastalık tanısı bulunan veya acil değerlendirme sırasında yeni hematolojik tanı alan 0–18 yaş arası çocuklar dahil edildi. Temel analiz birimi her bir ÇAS başvurusuydu.

Bulgular: Toplam 60.026 ÇAS başvurusunun 278'i (%0,46) hematoloji ile ilişkiliydi ve bu başvurular 96 farklı hastaya aitti. Ortalama yaş 8,16 ± 0,52 yıl olup hastaların %57,3'ü erkekti. En sık grup lösemi ile ilişkili başvurulardı (%48,6). Başvuruların %30,6'sında monitörizasyon, %51,1'inde girişim, %47,8'inde hematoloji konsültasyonu, %23,0'ünde transfüzyon ve %21,6'sında intravenöz tedavi uygulandı. Yatış oranı hematoloji ile ilişkili başvurularda %27,3, tüm ÇAS başvurularında ise %6,8 idi. Febril nötropeniye ait 23 başvurunun tamamı yatırıldı; ortalama antibiyotik başlama süresi 136,9 ± 15,9 dakikaydı.

Sonuç: Çocuk hematoloji hastaları, ÇAS başvurularının küçük ancak klinik olarak önemli bir alt grubunu oluşturmaktadır; tekrarlayan başvurular, yüksek kaynak kullanımı ve sık yatış gereksinimi ile dikkat çekmektedir.

Anahtar Kelimeler: Çocuk acil servisi, hematolojik hastalıklar, lösemi, febril nötropeni, hastaneye yatış, kaynak kullanımı

Corresponding Author: Atika Çağlar **e-mail:** atikacaglar@yahoo.com
Received: 19 March 2026 **Accepted:** 28 April 2026 **DOI:** 10.33716/bmedj.1912899

INTRODUCTION

Pediatric emergency departments (PEDs) provide acute care for a broad spectrum of childhood illnesses, but within this large patient population, children with chronic and medically complex disorders constitute a particularly vulnerable subgroup. Prior work has shown that children with greater medical complexity account for disproportionate emergency resource use, including more frequent visits, longer stays, and higher rates of hospital admission than the general pediatric emergency population (O'Mahony et al., 2013). Among medically complex children, those with hematologic diseases deserve special attention because they may present with rapidly evolving, disease-specific complications that require timely recognition and urgent intervention.

Pediatric hematologic disorders comprise a heterogeneous group that includes both benign and malignant conditions, such as anemia, thrombocytopenia, coagulation disorders, bone marrow failure syndromes, leukemia, and treatment-related complications. These disorders may lead to emergency presentation because of fever, bleeding, pallor, fatigue, pain, abnormal laboratory findings, transfusion requirements, or complications of chemotherapy and immunosuppression. In children with cancer, fever is consistently reported as the most common emergency department complaint, while pain, nausea or vomiting, bleeding, and abnormal laboratory findings also account for a substantial proportion of presentations (O'Connell et al., 2023; Burcham et al., 2018). In addition, the emergency department may serve not only as a site of acute management but also as the point of first recognition of a previously undiagnosed hematologic malignancy (O'Connell et al., 2023). This broad clinical spectrum makes emergency assessment of hematology patients fundamentally different from the evaluation of routine pediatric emergency visits.

The emergency care of children with hematologic disease is challenging because apparently nonspecific symptoms may reflect serious underlying pathology and clinical deterioration may occur over a short period. A child with severe anemia may initially present with weakness, pallor, or reduced exercise tolerance despite clinically significant impairment in oxygen delivery. Similarly, children with thrombocytopenia or inherited bleeding disorders may present with mucosal bleeding, ecchymosis, hematoma, or more serious hemorrhagic complications that require urgent evaluation and treatment. Contemporary hematology guidance emphasizes that management decisions in immune thrombocytopenia should be guided primarily by bleeding severity rather than platelet count alone, while emergency care in hemophilia and related bleeding disorders requires prompt treatment and familiarity with disease-specific hemostatic strategies (Neunert et al., 2019; Neunert et al., 2024; Jiménez-Yuste et al., 2024). These features underline the need for structured and timely PED-based management for this patient population.

Among pediatric hematology-oncology emergencies, febrile neutropenia remains one of the most critical conditions, as infection in a neutropenic child can progress rapidly and become life-threatening. Prompt recognition and early administration of empiric broad-spectrum intravenous antibiotics are therefore considered key quality indicators in emergency care. Quality-improvement studies in pediatric emergency and oncology settings have shown that reducing time to antibiotics is feasible, and a target of antibiotic delivery within 60 minutes of presentation has become widely used in practice (Yoshida et al., 2018; Cohen et al., 2016; De Castro et al., 2024; Wadhwa et al., 2022; Todurkar et al., 2021). Although the exact association between time-to-antibiotics and hard outcomes may vary across cohorts, rapid treatment remains the prevailing standard of care and an important indicator of system performance for febrile neutropenia pathways (Yoshida et al., 2018; Cohen et al., 2016; De Castro et al., 2024).

Beyond immediate clinical urgency, pediatric hematology patients are also important from a healthcare utilization perspective. Population-

based and institutional studies have shown that children with cancer have substantial emergency department use, often with high admission rates and repeated presentations (O'Connell et al., 2023; Mueller et al., 2015). This is particularly relevant in tertiary centers, where emergency departments frequently function as an extension of subspecialty care for children undergoing chemotherapy, transfusion support, or close monitoring for complications. In such settings, analyzing emergency use only at the level of individual patients may underestimate the operational burden on the PED, because recurrent visits may reflect ongoing disease activity, treatment intensity, and the need for repeated urgent reassessment.

Despite the clinical significance of this population, the literature remains more focused on selected diagnoses or specific oncologic emergencies than on the overall emergency department profile of pediatric hematology patients as a group (O'Connell et al., 2023; Burcham et al., 2018; Mueller et al., 2015). Broader data describing the reasons for presentation, interventions performed in the PED, need for consultation, monitoring practices, hospitalization patterns, and short-term outcomes may help identify opportunities to improve triage, streamline treatment pathways, and optimize collaboration between pediatric emergency and hematology teams. Such information may be particularly useful in tertiary-care institutions, where the diversity and acuity of hematology-related emergency presentations are likely to be greatest.

Therefore, the aim of the present study was to evaluate the sociodemographic and clinical characteristics of pediatric patients with hematologic diseases presenting to a tertiary care pediatric emergency department and to describe the management and outcomes of these emergency presentations. In addition, by considering both individual patients and total emergency visits, this study sought to provide a more comprehensive picture of emergency department utilization in pediatric hematology and to identify potential areas for improving the timeliness and quality of emergency care.

MATERIALS AND METHODS

Study design and setting

This retrospective observational study was conducted in the Pediatric Emergency Department of Dokuz Eylul University Faculty of Medicine, a tertiary care referral center, between April 1, 2013 and April 1, 2014. The study was designed to characterize the presentations of children with hematologic diseases to the pediatric emergency department and to evaluate their sociodemographic features, clinical characteristics, management, and short-term outcomes. The study protocol was approved by the Ethics Committee of Dokuz Eylul University Faculty of Medicine (approval number: 2014/09-11) and was conducted in accordance with the Declaration of Helsinki.

Study population

Children aged 0 to 18 years who presented to the pediatric emergency department during the study period and had either a previously diagnosed primary hematologic disease or a hematologic disorder newly identified during emergency evaluation were eligible for inclusion. During the study period, a total of 60,026 pediatric emergency department visits were recorded, of which 278 visits were related to hematologic disease. These 278 visits corresponded to 96 individual patients, as some children had recurrent emergency department presentations over the one-year study period.

Because the primary aim of the study was to describe emergency department utilization and management patterns in pediatric hematology, repeated visits by the same patient were analyzed as separate emergency presentations. Accordingly, the primary unit of analysis was the emergency department visit, whereas selected descriptive characteristics, such as age and sex, were summarized at the patient level where appropriate.

Hematologic diagnoses were classified into five main categories: anemia, thrombocytopenia, coagulopathy, bone marrow failure, and

leukemia. Leukemia-related visits were further categorized as febrile neutropenia, leukemia without febrile neutropenia, and newly diagnosed leukemia, in accordance with the predefined study dataset.

Data collection and variable definitions

Data were collected retrospectively using hospital information management system. All data were recorded by a single investigator in order to ensure consistency in data collection.

For each emergency department visit, the following variables were recorded: age, sex, presenting complaint or reason for attendance, referral status, level of referring healthcare facility when applicable, time of presentation, place of residence, mode of transportation, chronic medication use, hematologic diagnosis, monitoring performed in the emergency department, procedures, treatment administered, pediatric hematology consultation, hospitalization, intensive care unit admission, and final outcome. Visits were also categorized as symptom-driven presentations or presentations for routine evaluation or treatment.

Time of presentation was classified into three categories: weekday daytime (08:00–17:00), weekday after-hours (17:00–08:00), and weekend. Place of residence was categorized as metropolitan area, central districts of Izmir, peripheral districts of Izmir, rural area, or another city. Mode of transportation was grouped as private vehicle, ambulance transport via the national emergency medical service (112), or public transportation.

Emergency department monitoring was defined as the use of any noninvasive monitoring modality, including cardiac monitoring, pulse oximetry, heart rate monitoring, electrocardiography, or blood pressure monitoring. Treatments administered in the emergency department were categorized as intravenous medical treatment (including intravenous antibiotics or hydration) transfusion, or no treatment. Procedures were defined as intravenous catheter placement, lumbar puncture, and blood sampling.

Outcomes

The primary objective of the study was descriptive, namely to characterize the sociodemographic and clinical characteristics of pediatric hematology-related emergency department presentations and to describe patterns of emergency management. The primary outcome for comparative analyses was emergency department disposition, particularly hospitalization versus discharge. Secondary outcomes included need for consultation, monitoring, procedures, treatment administration, intensive care unit admission, and death.

Statistical analysis

Statistical analyses were performed using SPSS for Windows, version 15.0 (SPSS Inc., Chicago, IL, USA). Categorical variables were summarized as number and percentage. Continuous variables were expressed as mean ± standard error or as median, according to the structure of the original dataset. Associations between categorical variables were assessed using the chi-square test. Logistic regression analysis was performed to evaluate the association between emergency department disposition and selected independent variables, including age, sex, and presentation characteristics. A two-sided p value of <0.05 was considered statistically significant.

RESULTS

During the 12-month study period, a total of 60,026 visits were recorded in the pediatric emergency department (PED). Of these, 278 visits (0.46%) involved children with hematologic diseases. These 278 visits corresponded to 96 individual patients, indicating a substantial burden of recurrent emergency departmemt use in this population. The mean age 8.2 ± 0.5 years, the median age was 8 years, and 57.3% were male. Baseline

patient-level and visit-level characteristics are summarized in Table 1.

Leukemia-related presentations constituted the largest diagnostic group, accounting for 135 of 278 visits (48.6%). The remaining visits were associated with bone marrow failure (14.8%), thrombocytopenia (13.7%), coagulopathy (11.9%), and anemia (11.1%). Overall, 227 visits (81.7%) were symptom-driven, whereas 51 visits (18.3%) were for routine evaluation or treatment. Most presentations occurred outside regular working hours, with 203 visits (73.0%) taking place during weekday after-hours or weekends. In addition, 208 visits (74.8%) were direct presentations to the PED, while 70 visits (25.2%) were referrals from other healthcare facilities. The distribution of hematologic diagnoses and the extent of recurrent emergency department presentations are shown in Table 2.

Repeat utilization of the PED was common across all diagnostic groups. Thirty-nine patients with leukemia accounted for 135 visits, 9 patients with bone marrow failure for 41 visits, 19 patients with thrombocytopenia for 38 visits, 11 patients with coagulopathy for 33 visits, and 18 patients with anemia for 31 visits. These findings suggest that PED use in pediatric hematology reflects not only the number of affected children but also the recurrent care needs of a relatively small patient cohort.

Resource utilization in the PED was considerable. Monitoring was required in 85 visits (30.6%), procedures were performed in 142 visits (51.1%), and pediatric hematology consultation was requested in 133 visits (47.8%). Notably, 98 of 133 consultations (74.2%) were requested outside regular working hours. Although 154 visits (55.4%) did not require active treatment in the PED, transfusion was administered in 64 visits (23.0%) and intravenous treatment in 60 visits (21.6%). No patient required intensive care unit admission, and no deaths occurred during PED follow-up. Resource use and short-term outcomes are summarized in Table 3.

Hospitalization was required in 76 of 278 visits (27.3%), which was markedly higher than the overall hospitalization rate for all PED visits during the same period (6.8%). Admission rates varied substantially by diagnosis. All febrile neutropenia visits and all visits resulting in a new diagnosis of leukemia led to hospitalization. Admission was also frequent among thrombocytopenia-related visits (42.1%), whereas lower admission rates were observed for leukemia without febrile neutropenia (21.4%), anemia (16.1%), bone marrow failure (14.6%), and coagulopathy (6.1%). Fever was the leading symptom among hospitalized visits overall (50.0%) and was particularly common among hospitalized leukemia-related visits (70.2%). Hospitalization rates by diagnostic category are shown in Table 4.

Geographic origin was significantly associated with hospitalization. Among visits originating from within Izmir, 18.5% resulted in hospitalization, compared with 37.8% of visits from outside Izmir ($p<0.001$). A similar pattern was observed among leukemia-related visits, with admission occurring in 15.5% of visits from Izmir and 31.7% of visits from outside Izmir ($p=0.044$).

Febrile neutropenia represented one of the most clinically important subgroups. Fifteen patients accounted for 23 visits for febrile neutropenia, and all of which resulted in hospitalization. The mean time to antibiotic administration was 136.9 ± 15.9 minutes (range, 45–300 minutes). Intravenous antibiotics were initiated within the first 2 hours in 43.5% of visits, within 2 to 3 hours in 30.5%, and within 3 to 5 hours in 26.0%. Antibiotics were initiated in the PED in 60.9% of visits, with a mean time to treatment of 101.4 ± 13.2 minutes; when treatment was initiated after ward admission, the mean time from PED presentation increased to 207.2 ± 19.0 minutes. Pediatric hematology consultation was requested in 82.6% of febrile neutropenia visits, and procedures were performed in 87.0%. Detailed characteristics of febrile neutropenia visits are presented in Table 5. The PED also played an important role in the recognition of

newly diagnosed hematologic disease. During the study period, 6 patients were newly diagnosed with leukemia through their emergency department presentation, and most of these diagnoses were established outside regular working hours. New diagnoses were also made among patients presenting with anemia and thrombocytopenia, highlighting the diagnostic role of the PED in pediatric hematology alongside its acute management function.

Table 1. Baseline characteristics of pediatric hematology patients and emergency department visits

Variable	**n (%)**
Patient-level characteristics	**(n = 96)**
Age, mean ± SE, years	8.16 ± 0.52
Median age, years	8
Male sex	55 (57.3)
Metropolitan residence	61 (63.5)
Non-metropolitan residence	35 (36.5)
Chronic medication use	47 (49.0)
No chronic medication use	49 (51.0)
Visit-level characteristics	**(n = 278)**
Symptom-driven visit	227 (81.7)
Routine evaluation/treatment	51 (18.3)
Direct presentation	208 (74.8)
Referral from secondary care	15 (5.4)
Referral from tertiary care	55 (19.8)
Weekday daytime presentation (08:00–17:00)	75 (27.0)
Presentation outside working hours	203 (73.0)
Transportation by private vehicle	224 (80.6)
Transportation by public transport/other	46 (16.5)
Transportation by ambulance	8 (2.9)

Table 2. Distribution of hematologic diagnoses and recurrent emergency department presentations

Diagnosis	**No. of patients n**	**No. of visits n**	**Visits per patient**	**Patients with recurrent visits n (%)**
Leukemia (total)	39	135	3.46	31 (79.5)
Bone marrow failure	9	41	4.56	8 (88.9)
Thrombocytopenia	19	38	2.00	8 (42.1)
Coagulopathy	11	33	3.00	7 (63.7)
Anemia	18	31	1.72	4 (22.2)
Total	**96**	**278**	**2.90**	—

Recurrent visits were defined as more than one emergency department presentation by the same patient during the study period. Leukemia included all leukemia-related visits, including febrile neutropenia presentations.

Table 3. Resource utilization and short-term outcomes of hematology-related emergency department visits

Variable	No. of visits n (%)
Monitoring performed	85 (30.6)
Procedure performed	142 (51.1)
Pediatric hematology consultation requested	133 (47.8)
Consultation requested outside working hours*	98/133 (74.2)
No treatment administered in the PED	154 (55.4)
Intravenous treatment administered	60 (21.6)
Transfusion administered	64 (23.0)
Hospitalization	76 (27.3)
Intensive care unit admission	0
Death during PED follow-up	0

Among visits for which pediatric hematology consultation was requested.

Table 4. Hospitalization according to diagnostic category

Diagnosis	No. of visits n	Hospitalized visits n (%)
Anemia	31	5 (16.1)
Thrombocytopenia	38	16 (42.1)
Coagulopathy	33	2 (6.1)
Bone marrow failure	41	6 (14.6)
Febrile neutropenia	23	23 (100)
Leukemia without febrile neutropenia	112	24 (21.4)
Newly identified leukemia	6	6 (100)

Leukemia-related visits were presented in subgroups as febrile neutropenia, leukemia without febrile neutropenia, and newly identified leukemia.

Table 5. Characteristics of febrile neutropenia visits

Variable	Value
Clinical characteristics and management	
No. of patients	15
No. of visits	23
Hematology consultation, n (%)	19 (82.6)
Procedure performed, n (%)	20 (87.0)
Hospitalization, n (%)	23 (100)
Time to antibiotic administration	
Mean time to antibiotics, min ± SE	136.9 ± 15.9
Range, min	45–300
Antibiotics initiated within 0–120 min, n (%)	10 (43.5)
Antibiotics initiated within 120–180 min, n (%)	7 (30.5)
Antibiotics initiated within 180–300 min, n (%)	6 (26.0)
Antibiotics initiated in the PED, n (%)	14 (60.9)
Mean time when initiated in the PED, min ± SE	101.4 ± 13.2
Antibiotics initiated after ward admission, n (%)	9 (39.1)
Mean time when initiated after ward admission, min ± SE	207.2 ± 19.0

Time to antibiotics was calculated from PED presentation to administration of the first dose of intravenous antibiotics.

DISCUSSION

In this retrospective single-center study, pediatric hematology-related presentations accounted for only 0.46% of all pediatric emergency department (PED) visits; however, this relatively small subgroup was associated with substantial emergency department utilization, frequent repeat presentations, high rates of procedures and consultations, and a hospitalization rate markedly higher than that of the overall PED population. Taken together, these findings suggest that pediatric hematology patients represent a low-frequency but high-resource group in emergency care. This interpretation is in line with the broader literature showing that children with cancer and other medically complex conditions account for disproportionate emergency department use and hospital admission compared with the general pediatric population (O'Mahony et al., 2013; O'Connell et al., 2023).

One of the key findings of the present study was the high frequency of recurrent emergency department use. Although only 96 individual patients were included, they accounted for 278 visits over a 12-month period, and repeat presentations were especially common among patients with leukemia and bone marrow failure. This pattern highlights an important feature of pediatric hematology care: emergency utilization in this population is driven not only by the number of affected children, but also by the chronic, relapsing, and treatment-intensive course of their conditions. Recent studies of pediatric cancer-related emergency care similarly emphasizes that acute care use reflects disease burden, treatment effects, and the need for repeated urgent reassessment (O'Connell et al., 2023; Mueller et al., 2015).

Leukemia-related visits constituted the largest diagnostic category in our cohort. This is clinically plausible in a tertiary center caring for children receiving active chemotherapy, transfusion support, and close hematology follow-up. Prior studies of pediatric oncology emergency care have shown that fever is the most common presenting complaint, while pain, nausea or vomiting, bleeding, and abnormal laboratory findings also contribute substantially to emergency utilization (O'Connell et al., 2023; Burcham et al., 2018; Mueller et al., 2015). In our cohort, leukemia-related visits frequently occurred outside regular working hours and often required consultation and intervention, although many did not ultimately require hospitalization. This suggests that the PED functiones not only as a point of triage for severe illness, but also as a important interface for urgent evaluation, supportive care, and disposition decisions in children with active hematologic disease.

The hospitalization rate in our study warrants particular emphasis. More than one quarter of hematology-related visits resulted in hospital admission, compared with 6.8% of all PED visits during the same period. This marked difference strongly indicates that pediatric hematology patients require a greater degree of evaluation and clinical decision-making than the average PED population. Admission rates were particularly high among visits for febrile neutropenia, newly diagnosed leukemia, and thrombocytopenia. Recent population-based studies have likewise shown that pediatric cancer-related ED visits are associated with substantial admission rates and that disposition is influenced by both clinical and sociodemographic factors (O'Mahony et al., 2013; O'Connell et al., 2023; Mueller et al., 2015). Our finding that patients presenting from outside the metropolitan area were hospitalized more frequently may reflect greater illness severity at presentation, longer travel times, or a lower threshold for admission when rapid reassessment is not feasible.

Another major finding was the intensity of resource use in the PED. Nearly one third of visits required monitoring, approximately half required a procedure, almost half involved pediatric hematology consultation, and nearly one quarter required transfusion. These findings indicate that hematology-related PED presentations cannot be fully captured by patient volume alone; from an operational perspective, they require substantial time,

coordination, and treatment capacity. This is particularly relevant for tertiary centers, where emergency departments often function as extensions of subspecialty care for children with chronic disease. The high proportion of consultations requested outside regular working hours in our study further underscores the need for robust communication pathways between PED teams and hematology services (O'Mahony et al., 2013; O'Connell et al., 2023).

Febrile neutropenia (FN) represented as the most clinically sensitive subgroup in our cohort. All FN visits resulted in hospitalization, and the mean time to antibiotic administration was 136.9 minutes. Although antibiotics were started earlier when administered in the PED than after ward admission, only 43.5% of FN visits received antibiotics within the first 120 minutes. This finding is clinically important because rapid administration of empiric broad-spectrum antibiotics remains a central quality metric in pediatric FN care, and many institutions continue to aim for antibiotic delivery within 60 minutes of arrival. Recent quality-improvement studies have shown that substantial improvement is achievable through standardized pathways, early identification at triage, expedited laboratory workflows, and streamlined access to antibiotics (Yoshida et al., 2018; Cohen et al., 2016; Wadhwa et al., 2022; Todurkar et al., 2021; Salomon et al., 2026). Our findings therefore support the implementation of structured FN pathways in the PED, particularly in centers caring for children with hematologic malignancies (Yoshida et al., 2018; Cohen et al., 2016; Simon et al., 2023; De Gastro et al., 2024; Haeusler et al., 2024).

The findings in coagulopathy- and transfusion-related care also have practical implications. In our cohort, many coagulopathy-related visits required acute treatment, but only a small proportion required hospitalization, suggesting that the PED often functioned effectively as a settinmg for urgent replacement or supportive care without the need for inpatient admission. Contemporary reviews on urgent bleeding care in hemophilia similarly emphasize the importance of rapid, protocol-driven treatment, including the use of simple algorithms that can be applied by non-specialists in emergency settings (Jiménez-Yuste et al., 2024). These findings underscores the importance of preparedness, disease-specific expertise, and close collaboration with subspecialty teams in pediatric hematology emergency care.

An additional strength of the present study is that it highlights the diagnostic role of the PED, not only its therapeutic role. During the study period, several children received a new diagnosis of leukemia following presentation to the PED, and additional new diagnoses were made among children presenting with anemia and thrombocytopenia. This finding is clinically relevant because hematologic disease in childhood may initially present with nonspecific features such as pallor, fatigue, fever, bruising, or mucosal bleeding. In busy emergency settings, the ability to recognize these patterns and initiate appropriate diagnostic work-up remains highly important. Our findings therefore support the view that tertiary PEDs play an essential role not only in the acute management of known hematology patients, but also in the early recognition of serious hematologic disease.

Limitations

This study has several limitations. First, it was conducted at a single tertiary referral center, which may limit the generalizability of the findings to institutions with different referral structures, patient volumes, or access to pediatric hematology services. Second, because the primary unit of analysis was the emergency department visit, repeated presentations by the same patient were analyzed as separate observations; this approach was appropriate for describing emergency utilization, but it may have introduced within-patient correlation that was not specifically adjusted for in the statistical analysis. Third, the study period predates more recent emergency pathways and quality-improvement initiatives, particularly in febrile neutropenia management, and therefore the observed care processes may not fully reflect current practice. Nevertheless, these

limitations do not diminish the main value of the study, namely its demonstration of the clinical burden, recurrent utilization, and organizational importance of pediatric hematology care in the PED (Yoshida et al., 2018; Cohen et al., 2016; De Gastro et al., 2024).

CONCLUSION

In conclusion, pediatric hematology patients accounted for a small proportion of all PED visits but represented a clinically important subgroup characterized by recurrent presentations, substantial resource utilization, and a hospitalization rate markedly exceeding that of the overall PED population. Leukemia-related visits comprised the largest diagnostic category, while febrile neutropenia emerged as the most critical subgroup given its universal hospitalization and delayed time to antibiotic administration. The PED also played an key role in the recognition of newly diagnosed hematologic disease. These findings support the need for standardized emergency care pathways, close coordination between PED and pediatric hematology teams, and particular attention to time-sensitive conditions such as febrile neutropenia.

Authorship Contributions: AÇ and ŞY collected the data and wrote the main manuscript. MD, DY, ÖG analyzed and interpreted the patient data. HÖ and ŞY designed the work and substantively revised the article. All authors read and approved the final manuscript.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest: The authors have no conflicts of interest to declare.

Ethics approval and consent to participate: Ethical approval for this study was obtained from Dokuz Eylul University clinical research ethics committee Decision number: 2014/09-11

The study was conducted in line with the principles of the "Helsinki Declaration."

Availability of Data and Materials: The datasets from the current study can be obtained on request from the corresponding author.

REFERENCES

Burcham, M. D., Keim-Malpass, J., Lopez, M. E., Jenkins, C., Murry, D. J., Shah, A. N., et al. (2018). Emergency department chief complaints among children with cancer. Journal of Pediatric Hematology/Oncology, 40(6), 445–449.

Cohen, C., King, A., Lin, C. P., Friedman, G. K., Monroe, K., & Kutny, M. (2016). Protocol for reducing time to antibiotics in pediatric patients presenting to an emergency department with fever and neutropenia: Efficacy and barriers. Pediatric Emergency Care, 32(11), 739–745.

De Castro, G. C., Slatnick, L. R., Shannon, M., Goodman, K., Chima, R. S., Renaud, E., et al. (2024). Impact of time-to-antibiotic delivery in pediatric patients with cancer presenting with febrile neutropenia. JCO Oncology Practice, 20(2), e228–e238.

Jiménez-Yuste, V., Auerswald, G., Benson, G., Lambert, T., Morfini, M., Santagostino, E., et al. (2024). Management of urgent bleeding in patients with hemophilia A: Focus on the use of emicizumab. Expert Review of Hematology, 17(5), 365–376.

Haeusler, G. M., Dashti, S. G., Ammann, R. A., Phillips, R., Mechinaud, F., Rossoff, J., Anoop, P., Bhatt, J. M., Fisher, B. T., Thursky, K. A., Xu, X., Santolaya, M. E., & Sung, L. (2024). Impact of time to antibiotics on clinical outcome in paediatric febrile neutropenia: A target trial emulation of 1685 episodes. The Lancet Regional Health – Western Pacific, 53, Article 101226. https://doi.org/10.1016/j.lanwpc.2024.101226

Mueller, E. L., Sabbatini, A., Gebremariam, A., Mody, R., Sung, L., & Macy, M. L. (2015). Why pediatric patients with cancer visit the emergency department: United States, 2006–2010. Pediatric Blood & Cancer, 62(3), 490–495.

Neunert, C., Arnold, D. M., Grace, R. F., Buchanan, G., Imbach, P., Vesely, S. K., et al. (2024). The 2022 review of the 2019 American Society of

Hematology guidelines for immune thrombocytopenia. Blood Advances, 8(8), 1889–1905.

Neunert, C., Terrell, D. R., Arnold, D. M., Buchanan, G., Cines, D. B., Cooper, N., et al. (2019). American Society of Hematology 2019 guidelines for immune thrombocytopenia. Blood Advances, 3(23), 3829–3866.

O'Connell, C. P., Gattu, R., Bhatia, M., Chamberlain, L. J., Leung, K., Brousseau, D. C., et al. (2023). Pediatric cancer patient emergency department visits and hospital admissions: A population-based study. Pediatric Blood & Cancer, 70(11), e30564.

O'Mahony, L., O'Mahony, D. S., Simon, T. D., Neff, J., Klein, E. J., & Quan, L. (2013). Medical complexity and pediatric emergency department and inpatient utilization. Pediatrics, 131(2), e559–e565.

Salomon, A. L., Ammann, R. A., Haeusler, G. M., Phillips, R., Dashti, S. G., Mechinaud, F., Rossoff, J., Anoop, P., Bhatt, J. M., Fisher, B. T., Thursky, K. A., Xu, X., Santolaya, M. E., & Sung, L. (2026). Association of time to antibiotics with outcome in pediatric patients receiving chemotherapy for cancer with fever in neutropenia: An international individual patient data meta-analysis. Cancer Medicine. Advance online publication. https://doi.org/10.1002/cam4.71512

Simon, A., Ammann, R. A., Bate, J., Lehrnbecher, T., Moser, O., & Fleischhack, G. (2023). [Time to antibiotics (TTA)—Reassessment from the German Working Group for Fever and Neutropenia in Children and Adolescents (DGPI/GPOH)]. *Klinische Pädiatrie*, *235*, 331–341. https://doi.org/10.1055/a-2135-4210

Todurkar, N., Negi, V., Kaur, N., Jain, P., Bansal, D., Marwaha, R. K., et al. (2021). Time to antibiotic administration in children with febrile neutropenia: Report from a low middle-income country. Journal of Pediatric Hematology/Oncology, 43(8), e1148–e1153.

Wadhwa, A., Pantell, M. S., Steinberg, J., Yang, E., Adler, E., Kobayashi, L., et al. (2022). Time to antibiotic for pediatric oncology patients with febrile neutropenia at regional emergency departments. Pediatric Emergency Care, 38(6), e1287–e1292.

Yoshida, H., Leger, K. J., Xu, M., Sharp, S. W., Hyman, D., Hsu, A. J., et al. (2018). Improving time to antibiotics for pediatric oncology patients with febrile neutropenia in the emergency department. Pediatrics, 141(5), e201740345