Research Square

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Patient Profiles and Factors Associated with Escalated Care in a Southeast Ethiopian Pediatric Emergency Department: A Three-Year Retrospective Analysis

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Abstract

Background

Pediatric emergency departments (PEDs) play a critical role in reducing childhood morbidity and mortality, particularly in low- and middle-income countries (LMICs), where infectious diseases and delayed healthcare-seeking remain prevalent. Evidence regarding treatment outcomes and predictors of escalated care in Ethiopian pediatric emergency settings are limited.

Objective

To assess patient profiles, treatment outcomes, and factors associated with escalated care among children presenting to the pediatric emergency department of Asella Referral and Teaching Hospital (ARTH), Southeast Ethiopia.

Methods

A retrospective cross-sectional study was conducted among pediatric emergency visits between 10 September 2022 and 10 September 2025. A total of 407 medical records were systematically sampled. Data were entered into KoboCollect and analyzed using SPSS version 27. Variables with $p < 0.25$ in bivariable analysis were entered into multivariable logistic regression. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported. Statistical significance was declared at $p < 0.05$.

Results

Of 407 visits, 63.9% were male and 75.9% were under five years of age. Rural residents constituted 55.3% of cases. Pneumonia (19.2%) was the leading diagnosis. Nearly half (49.6%) required escalated care (admission, referral, ICU transfer, or death). Independent predictors included malnutrition (AOR = 13.25; 95% CI: 3.40–51.61), true emergency presentation (AOR = 7.59; 95% CI: 2.59–22.20), comorbidity (AOR = 7.30; 95% CI: 1.30–40.94), altered mental status (AOR = 5.75; 95% CI: 1.67–19.83), delayed presentation > 3 days (AOR = 5.66; 95% CI: 2.22–14.40), diarrhea complaint (AOR = 5.99; 95% CI: 1.09–39.30), presence of danger signs (AOR = 2.06; 95% CI: 1.09–3.86), and referral status (AOR = 1.91; 95% CI: 1.05–3.46).

Conclusion

Nearly half of pediatric emergency visits required escalated care. Clinical severity indicators, malnutrition, comorbidity, and delayed presentation were strong predictors. Strengthening triage systems and early risk identification is critical to improving pediatric emergency outcomes in resource-limited settings.

Introduction

Globally, emergency care contributes substantially to child survival. Despite major reductions in under-five mortality, preventable conditions such as pneumonia, diarrhea, sepsis, and malnutrition remain leading causes of pediatric morbidity and mortality, particularly in sub-Saharan Africa [1–4]. Pediatric emergency departments (PEDs) are often the first point of contact for critically ill children and serve as a key determinant of outcomes.

In LMICs, pediatric emergency utilization has increased due to infectious diseases, trauma, urbanization, and gaps in primary healthcare access [5–8]. However, emergency units frequently operate under constraints including workforce shortages, limited diagnostic capacity, and delayed presentation of severe cases [9, 10].

In Ethiopia, infectious diseases remain predominant among pediatric emergency admissions [11–14]. Studies from Addis Ababa, Dilla, and Tikur Anbessa have shown high admission rates and identified malnutrition, delayed care-seeking, comorbidity, and clinical severity as predictors of unfavourable outcomes [12–15]. Evidence from other African contexts similarly demonstrates high admission and mortality rates in pediatric emergency settings [16–18].

The World Health Organization (WHO) emphasizes standardized pediatric emergency triage through the Emergency Triage, Assessment and Treatment (ETAT) guidelines to reduce preventable mortality [19]. Identifying predictors of escalated care—defined as admission, referral, ICU transfer, or death—is crucial for strengthening triage systems and resource allocation.

Despite increasing demand for pediatric emergency services in Ethiopia, evidence from south eastern regions remains scarce. This study therefore aimed to determine patient profiles, treatment outcomes, and factors associated with escalated care among pediatric patients attending the PED of ARTH.

Methods

Study design and setting

Institution-based retrospective cross-sectional study conducted at Asella Referral and Teaching Hospital (ARTH), located in Asella town, Oromia Regional State. The hospital features a capacity of 321 beds and operates as a multidisciplinary hub for surgical, medical, and pediatric care. The institutional framework of ARTH is reflective of the broader Ethiopian health system's tier-based model. As a tertiary facility, it is expected to handle complex cases referred from primary and secondary tiers; however, the reality of health utilization in Ethiopia often involves a "bypass" phenomenon where patients seek care directly at referral centers due to perceived or actual resource gaps at lower-level facilities [5]. The pediatric emergency unit at ARTH is staffed by a dedicated team of pediatricians, residents, general practitioners, and specialized nurses, yet it operates under significant pressure from high patient volumes and a limited supply of advanced diagnostic tools [9]. In comparison to other leading medical institutions such as Adama Comprehensive Specialized Hospital (ACSH), which maintains 75 pediatric beds, ARTH's infrastructure must absorb a diveARTH serves as a tertiary referral center for the Arsi Zone and surrounding areas, providing inpatient and outpatient pediatric services. The pediatric department itself is organized into specialized units, including a neonatal intensive care unit (NICU), pediatric wards, and a 24-hour functional pediatric emergency department [9]. Medical records of pediatric patients who visited the pediatric emergency department between September 10, 2022, and September 10, 2025, were reviewed.

Study population

The source population included all pediatric patients who attended the pediatric emergency department at ARTH during the study period. The study population consisted of systematically sampled pediatric emergency visits that met the eligibility criteria.

Children aged 29 days to 14 years were included. Patients younger than 29 days or older than 14 years, and those with incomplete documentation or lost medical charts were excluded. Incomplete charts were defined as absence of essential clinical information, consistent with previous evidence on barriers to administrative health data quality [8].

Sample size determination and sampling procedure

The sample size was calculated using a single population proportion formula with a 95% confidence level, a 5% margin of error, and an expected proportion (p) of 39.6% based on a previous Ethiopian retrospective study [12]. After adding a 10% allowance for incomplete records, the final sample size was 407.

The sample size calculation formula follows here under:

$$n = \frac{(Z_{\alpha/2})^2 \cdot p(1-p)}{d^2}$$

A systematic random sampling technique was employed to select 407 patient records from the total number of children aged 29 days to 14 years attended the pediatric emergency department between September 10, 2022, and September 10, 2025. The sampling process began by generating a sampling frame—consisting of a chronological list of all eligible cases—from the pediatric emergency unit registration book. With an estimated 12,750 pediatric emergency visits during the three-year period, the sampling interval (k) was determined by dividing the total number of eligible patients (N = 12, 750) by the required sample size (n = 407) as K = 31. With an estimated 12,750 pediatric emergency visits during the three-year period, the sampling interval was calculated as K = 31. The first chart was selected by lottery from the first 31 records, and every 31th chart was included until the required sample size was achieved.

Variables and operational definitions

The primary outcome variable was treatment outcome of pediatric emergency visits, categorized as stable/good outcome (discharge with improvement) or escalated care outcome (admission, referral, ICU transfer, or death), similar to definitions used in prior pediatric emergency outcome studies [6].

True pediatric emergency was defined as presentation with at least one WHO emergency sign such as airway compromise, shock, coma, convulsions, severe dehydration, or severe respiratory distress [7]. Avoidable visits were defined as non-urgent pediatric emergency visits that could have been managed at primary care level without risk to the child’s health [10].

Data collection tools and procedure

Data were extracted using a structured checklist adapted from the WHO emergency care assessment tool [7]. Data collectors received training prior to data extraction, and a pretest was conducted on 5% of records before the main data collection. Data were entered using Kobo Collect and exported to IBM SPSS Statistics version 27 for analysis.

Data were collected using a structured abstraction form adapted from the WHO pediatric hospital care manual [7]. The tool was digitized using the Kobo Toolbox mobile application, which facilitated real-time data validation. The procedure involved a retrospective review of pediatric ward registers and individual medical charts. Two

trained BSc nurses served as data collectors, and the principal investigator provided daily on-site supervision.

Data Quality Assurance

The data abstraction tool was pre-tested on 5% of the total sample size (20 records). Data collectors underwent a one-day intensive training session. During the data collection phase, the principal investigator performed daily audits of uploaded electronic forms. Before final analysis, data underwent a cleaning process to identify and manage outliers.

Statistical Analysis

The collected data were cleaned, coded, and entered into Epi-Data version 4.6 and subsequently exported to SPSS version 27.0 for analysis. Descriptive statistics were utilized to summarize categorical and continuous variables. A Binary Logistic Regression model was employed to identify predictors. Variables with a p-value < 0.25 in the bivariable analysis were entered into the multivariable model. The fitness of the final model was verified using the Hosmer-Lemeshow test. Strength of associations was expressed through Adjusted Odds Ratios (AOR) with 95% Confidence Intervals (CI).

Results

A total of 407 pediatric patient records were reviewed from visits to the PED of ARTH between September 10, 2022, and September 10, 2025.

Baseline Sociodemographic and Clinical Characteristics

A total of 407 PED records were reviewed for the period between September 2022 and September 2025. The study population was predominantly male 259 (63.9%) and under five years of age 309 (75.9%), with more than half 225 (55.3%) of the patients residing in rural areas. Regarding health service utilization and contextual factors, self-referred visits 237 (58.2%) were more frequent than institutional referrals 170 (41.8%). Peak arrival times occurred during the evening hours 150 (36.9%), and a significant majority of visits 287 (70.5%) took place during the dry season.

Clinically, while most children presented in an alert mental state 351(86.2%), approximately 56 (13.8%) presented with altered consciousness, including lethargy or coma. The prevalence of malnutrition was 63 (15.5%), and nearly one in ten children 39 (9.6%) had at least one comorbid condition. Notably, 246 (60.4%) of the patients presented with at least one WHO-defined danger sign, reflecting a high burden of clinical

severity among the visits. These comprehensive baseline sociodemographic, clinical, and health service characteristics are detailed in Table 1.

Table 1
Sociodemographic, clinical, and health service characteristics of pediatric patients attending the PED at ARTH, Ethiopia, 2025 (n = 407)

Characteristic	Category	n	%
Sex	Male	260	63.9
	Female	147	36.1
Age group	< 5 years	309	75.9
	≥ 5 years	98	24.1
Residence	Rural	225	55.3
	Urban	182	44.7
Referral status	Self-referred	237	58.2
	Referred	170	41.8
Season of visit	Dry season	287	70.5
	Rainy season	120	29.5
Time of arrival	Morning	104	25.6
	Daytime	118	29.0
	Evening	150	36.9
	Night	35	8.6
Mental status	Alert	351	86.2
	Lethargic	52	12.8
	Comatose	4	1.0
Comorbidity	Yes	39	9.6
	No	368	90.4
Nutritional status	Well nourished	344	84.5
	Malnourished	63	15.5
Danger signs present	Yes	246	60.4
	No	161	39.6

Presenting Complaints and Primary Diagnoses

The most frequently reported presenting complaints were cough 115 (28.3%), fever 81 (19.9%), trauma-related injuries 37 (9.1%), vomiting 28 (6.9%), diarrhea 26 (6.4%), and fast breathing 21(5.2%). When categorized by organ system, respiratory-related issues accounted for approximately one-third of all presentations. Consistent with these complaints, pneumonia was identified as the leading primary diagnosis, accounting for 78 (19.2%) of pediatric emergency visits. Other prevalent diagnoses included trauma 40 (9.8%), acute gastroenteritis 39 (9.6%), and malnutrition 28 (6.9%). These findings underscore the continued predominance of infectious diseases and injury-related conditions as the major drivers of pediatric emergency utilization in this setting.

Treatment Outcomes and Predictors of Escalated Care

Regarding treatment outcomes, approximately half of the pediatric emergency visits resulted in discharge with clinical improvement 205 (50.4%). The remaining 202(49.6%) of cases required escalated care, which included hospital admission 185 (45.5%), intensive care unit transfer 8(2%), referral to other facilities 6 (1.5%), or resulted in death 9 (2.2%).

As shown on Fig. 1, overall, a substantial proportion of children required escalated care beyond basic emergency treatment, demonstrating the high acuity of presentations to the PED.

Multivariable logistic regression analysis identified several independent predictors of escalated care. Malnutrition was the strongest predictor, with malnourished children having more than thirteen-fold higher odds of requiring escalated care compared to well-nourished children (AOR = 13.25; 95% CI: 3.40–51.61). Other significant clinical predictors included true emergency presentations (AOR = 7.59; 95% CI: 2.59–22.20), the presence of comorbid illness (AOR = 7.30; 95% CI: 1.30–40.94), diarrhea complaints (AOR = 5.99; 95% CI: 1.09–39.30), and altered mental status at presentation (AOR = 5.75; 95% CI: 1.67–19.83). Furthermore, delayed presentation of more than three days (AOR = 5.66; 95% CI: 2.22–14.40), the presence of danger signs (AOR = 2.06; 95% CI: 1.09–3.86), and referred status (AOR = 1.91; 95% CI: 1.05–3.46) were also independently associated with an increased likelihood of escalated care. These associations are summarized in Table 2.

Table 2
Factors associated with escalated care outcome among pediatric emergency patients at ARTH, Ethiopia, 2025 (n = 407)

Variable	Category	AOR	95% CI
Mental status	Altered vs alert	5.75	1.67–19.83*
Comorbidity	Yes vs no	7.30	1.30–40.94*
Malnutrition	Yes vs no	13.25	3.40–51.61 ***
Danger signs	Present vs absent	2.06	1.09–3.86*
Referral status	Referred vs self	1.91	1.05–3.46*
True emergency	Yes vs no	7.59	2.59–22.20 ***
Delayed presentation	> 3 days vs ≤ 3 days	5.66	2.22–14.40 ***
Diarrhea complaint	Yes vs no	5.99	1.09–39.30*

*Note: CI = Confidence Interval; COR = Crude Odds Ratio; AOR = Adjusted Odds Ratio; 1 = Reference group. Escalated care outcome includes admission, ICU transfer, referral, or death. Statistical significance is indicated as follows: *p < 0.05; **p < 0.01; and ***p < 0.001.*

Discussion

The present study assessed the epidemiologic profile, treatment outcomes, and predictors of escalated care among pediatric patients at Asella Referral and Teaching Hospital over a three-year period. Our findings demonstrate that pediatric emergency utilization is largely driven by children under five years of age, rural residents, and infectious disease presentations, with a substantial proportion (49.6%) requiring escalated care beyond basic emergency management.

Patient Profiles and Utilization Patterns

The observed male predominance (63.9%) and the high proportion of patients under five years of age (75.9%) align with findings from other African and Ethiopian pediatric emergency studies [11, 12]. This demographic is particularly susceptible to pneumonia, diarrhea, and malnutrition, which were the leading diagnoses in this study. Furthermore, the majority of visits (55.3%) originated from rural areas, suggesting that tertiary centers like ARTH continue to serve as a critical safety net for rural populations with limited access to primary healthcare [13].

Treatment Outcomes and Predictors of Escalated Care

While nearly half of the children were discharged with improvement, the 2.2% mortality rate and the high admission rate (45.5%) underscore the severity of cases presenting to the PED [6, 9]. Clinical severity indicators were the strongest predictors of these outcomes. Most notably, malnutrition was the strongest independent predictor identified, with malnourished children having more than thirteen-fold higher odds of requiring escalated care (AOR = 13.25) [6, 17].

The study also highlighted the critical role of timely care-seeking; children presenting more than three days after symptom onset had nearly six-fold higher odds of escalated care (AOR = 5.66) [6, 18]. This, combined with the significant associations found for altered mental status, comorbidities, and the presence of WHO-defined danger signs, emphasizes the urgent need for standardized triage systems to ensure early identification and stabilization of high-risk children [7, 16].

Strengths and Limitations

This study provides three years of pediatric emergency department data from a tertiary hospital in southeastern Ethiopia, a region where published emergency care outcome evidence remains limited [12–14]. By incorporating demographic, clinical, and system-related predictors into a multivariable logistic regression framework, the study strengthens inference regarding independent determinants of escalated care, consistent with methodological approaches used in comparable pediatric emergency research [16, 17, 31]. The operational definition of escalated care—comprising admission, referral, intensive care transfer, or death—aligns with internationally recognized pediatric emergency outcome frameworks [31, 32], thereby enhancing comparability with global literature. Furthermore, the integration of the World Health Organization's Emergency Triage, Assessment and Treatment (ETAT) criteria increases the policy relevance of the findings and supports applicability to emergency care strengthening initiatives recommended for low-resource settings [19, 33].

However, several limitations should be considered. The retrospective design relied on secondary chart review, which may be affected by incomplete documentation, missing variables, or potential misclassification bias, challenges commonly reported in administrative health data systems in LMICs [6, 34]. Important socioeconomic determinants such as caregiver education, household income, and transportation access were unavailable in the medical records, although these factors are known to influence healthcare-seeking behavior and delayed presentation in sub-Saharan Africa [24, 26, 35]. Additionally, as the study was conducted at a single tertiary referral center, the findings may not be fully generalizable to primary-level facilities or other Ethiopian regions, given documented variations in health system performance and quality of care across settings [28, 36]. Finally, the outcome measure focused on short-term emergency disposition rather than long-term clinical outcomes, preventing assessment of post-discharge

morbidity or mortality, which are increasingly emphasized in global pediatric critical care evaluations [31, 39].

Conclusions and implications

Conclusions

This study demonstrates that nearly half of pediatric emergency department (PED) visits at Asella Referral and Teaching Hospital (ARTH) resulted in escalated care outcomes, including admission, referral, intensive care unit transfer, or death, reflecting a substantial burden of severe childhood illness in this tertiary setting. The patient profile was dominated by under-five children and infectious conditions, consistent with national and regional epidemiologic patterns in Ethiopia and sub-Saharan Africa [12–14, 29]. Clinical severity indicators—particularly malnutrition, altered mental status, comorbidity, presence of World Health Organization (WHO) danger signs, and delayed presentation—were strong independent predictors of escalated care. These findings underscore the importance of systematic early risk identification through strengthened Pediatric Emergency Department (PED) triage systems and full implementation of Emergency Triage, Assessment and Treatment (ETAT) guidelines [19, 27, 33]. Addressing modifiable risk factors such as delayed care-seeking and malnutrition, while strengthening referral coordination and rural primary healthcare capacity, is essential to improving pediatric emergency outcomes in Ethiopia and comparable low-resource settings [21, 24, 28, 36].

Recommendations and Policy Implications

Based on these findings, several actionable recommendations emerge:

1. Strengthen ETAT Implementation

Full implementation of the World Health Organization Emergency Triage, Assessment and Treatment (ETAT) guidelines should be reinforced to improve early identification and stabilization of high-risk children in pediatric emergency settings [19, 33].

2. Integrate Malnutrition Screening at Triage

Given its strong association with escalated care, routine nutritional assessment should be incorporated into emergency triage protocols, consistent with global child survival and nutrition strategies [21, 37].

3. Promote Community-Level Education to Reduce Delays

Public health interventions targeting early care-seeking behavior are critical, as delayed presentation significantly increased the likelihood of escalated care in this study [24, 26,

35].

4. Strengthen Referral Pathways and Rural Primary Care Capacity

The high proportion of rural patients highlights persistent inequities in access to quality primary healthcare. Strengthening district-level pediatric services and improving referral coordination may reduce unnecessary tertiary-level overload and improve system efficiency [28, 36, 38].

5. Invest in Emergency Care System Strengthening

Broader health system investments—including workforce training, pediatric intensive care expansion, and emergency transport infrastructure—are aligned with global recommendations for strengthening emergency care systems in low- and middle-income countries [9, 39, 40].

Abbreviations

Abbreviation	Full Term
AGE	Acute gastroenteritis
AOR	Adjusted odds ratio
ARTH	Asella Referral and Teaching Hospital
CI	Confidence interval
CoHS	College of Health Sciences
COR	Crude odds ratio
ED	Emergency department
EDHS	Ethiopian Demographic and Health Survey
ETAT	Emergency Triage, Assessment and Treatment
ICU	Intensive care unit
LMICs	Low- and middle-income countries
LRI	Lower respiratory infection
OR	Odds ratio
PED	Pediatric emergency department
PI	Principal investigator
SDGs	Sustainable Development Goals
SPSS	Statistical Package for the Social Sciences
SSA	Sub-Saharan Africa
U5MR	Under-five mortality rate
WHO	World Health Organization
UNICEF	United Nations Children’s Fund

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from the Ethical Review Committee (ERC) of Arsi University, College of Health Sciences (Protocol Number: COHS/R/227/2025). A formal letter of cooperation was submitted to the management of Asella Referral and Teaching Hospital to secure access to the pediatric medical records. Given the retrospective nature of the study and the use of de-identified secondary data, the ERC granted a waiver of

informed consent. All data were anonymized using unique identification codes to ensure patient confidentiality in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable.

Data availability statement

Findings from this study are based on hospital medical records from ARTH. The raw data set is attached to this submission; further inquiries regarding data usage may be directed to the corresponding author, subject to Arsi University guidelines.

Competing interests

The authors declare that they have no competing interests.

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Authors’ contributions

TN conceived the study, collected the data, performed the analysis, and drafted the manuscript. AM and AD supervised the study, AM, AD, TG and AB validation, contributed to interpretation of results, and critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

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Figures

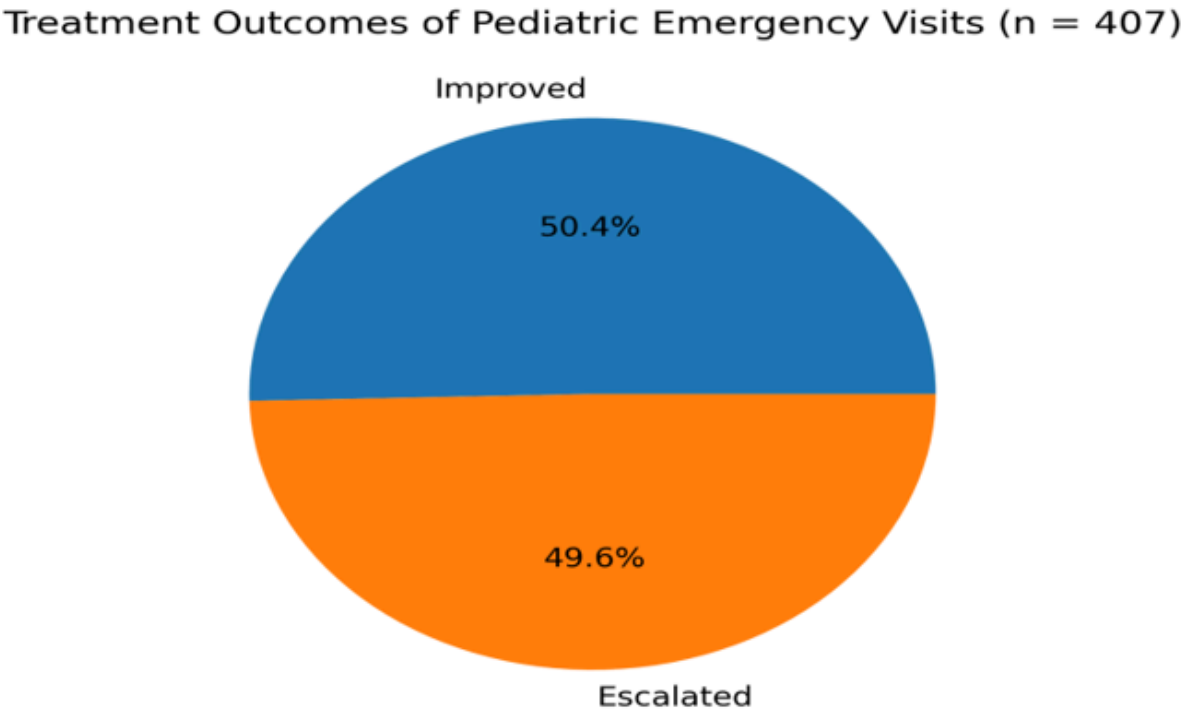


Figure 1

Pie chart showing treatment outcomes of pediatric emergency visits at ARTH, Ethiopia, 2025 (n = 407)