ADDIS ABABA UNIVERSITY
College of Health Sciences

# TRAIGE AT THE PEDIATRIC EMERGENCY UNIT: ASSOCIATION BETWEEN TRIAGE LEVEL AND CLINICAL OUTCOME

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# Submission Guide

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**This proposed work has been submitted with my approval as an advisor**

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AKNOWLEDGMENT

First, I thank God, almighty, for always leading the way and my family for their unconditional support. Next, I extend my gratitude to Addis Ababa University, department of pediatrics and child health for giving me the opportunity to seek knowledge and growth, and I especially give thanks to my adviser and mentor Dr. Muluwork Tefera for her guidance, constructive criticism, determination, and continuous commitment towards this proposal. Lastly, I thank my seniors and colleagues for their comments and encouragement.

Table of contents

**List of tables and figures**



**Acronyms and abbreviations**

ETAT= Emergency Triage Assessment and Treatment

WHO= world Health Organization

LMIC= Low and Middle Income Countries

HIC= High-Income Countries

TASH= Tikur Anbesa Specialized Hospital

PEU= Pediatric Emergency Unit

ED = Emergency Department

OPD=Out-patient Department

ICU= Intensive Care Unit

U5MR= Under 5 Mortality Rate

PALS= Advanced Pediatric Life Support

HCW= Health Care Worker

**ABSTRACT**

**Background**: Triage is a preliminary process of assessing Emergency to rapidly prioritize patients based on the level of their urgency and required treatment. A big challenge in pediatric triage is that children have a variety of presentations, and a critically ill child may appear stable and suddenly deteriorate. The Emergency Triage Assessment and Treatment (ETAT) protocol is widely adopted in low- and middle-income countries (LMIC) to reduce under five mortality and ensure the appropriate prioritization of care. However,few studies have examined whether triage level predicts clinical outcomes nationwide, and even less at Tikur Anbesa Specialized Hospital (TASH), the largest referral hospital in the country. This study seeks to address this gap.

**Objective:** This research aims to study relationship between triage levels at the initial health care contact with clinical outcomes in TASH pediatric emergency.

**Method:** In this retrospective cross sectional study of children age above 7 days to 14 years, data was gathered from eligible medical records using structured questionnaire and then coded and entered using Epi Data version 4. 6. The SPSS version 25 was used for both descriptive statistics analysis and multi-variable logistic regression analysis. Statistical significance was defined as a p-value less than 0.05, a 95% confidence interval.

**Results:** A total of 405 patients who were triaged between November 2025 and January 2026 were studied. Over 91% of patients fell into the Red or Orange categories, Cases triaged as Orange, accounted for 293 patients (72.3%), Red were 77 patients (19.0%) and Green comprised the smallest group, with 35 patients (8.6%). Among Red (emergency) patients, 32 (41.6%) were discharged home, 38 (49.4%) were admitted to the ward, 1 (1.3%) required ICU admission, and 6 (7.8%) died. In contrast, Orange (priority) patients were predominantly discharged (183, 62.5%) patients were admitted to the ward (103, 35.2%), with only 3 patients (1.0%) requiring ICU care and 4 patients (1.4%) died. Green (non-urgent) patients 28/35 were discharged, with a smaller proportion admitted to the ward (7, 20.0%) and no ICU admissions or deaths.

**Conclusion:** ETAT triage system strongly predicts outcome. While it is a reliable and clinically valuable tool in this context, optimal outcomes depend on both accurate triage and timely, system-supported clinical response.

**Keyword:** Triage, Outcome, Admission, Discharge, Mortality, Association, Determinants of Death.

## Chapter 1: Introduction

1. Background

Most children who require emergency care are evaluated in emergency departments (EDs). Although children account for approximately 25% of all ED visits, only a fraction of these encounters represents true emergencies. (1) Pediatrics Emergency Room is a key area of service in every hospital where pediatric emergencies are promptly handled on a regular basis. (2)

Globally, the most common pediatric emergency triage systems falls into two main categories: five-level triage and specialized alert-based or disaster-specific systems. In resource constrained countries the World Health Organization (WHO) derived Emergency Triage Assessment and Treatment (ETAT) guidelines an adaption from Advanced Pediatric Life Support (PALS) guidelines, to readily identify children with immediate life-threatening conditions remain a key source of pediatric emergency care. (3). yet, under-five mortality and morbidity rate (U5MR) remain high, although it is rapidly declining and access to and utilization of health care is improving. (4) U5MR decreased by 60% between 1990 and 2021, from 93 deaths per 1,000 live births in 1990 to 38 in 2021. However, (WHO) cites that between 5.2 and 5.4 million children died worldwide from preventable or treatable causes. Children in sub-Saharan Africa are 9 times more likely to die before age 5 than children in the developed areas of the world, with leading causes of death being infectious and parasitic diseases, including diarrheal disease (10% of deaths) and pneumonia (15%), neonatal causes (12%), congenital defects (9%), and malaria, AIDS, and measles accounted for the other causes of death. (1)

Deaths of children in hospital often occur within the first 24 hours of admission (4) , many of which are preventable with timely and accurate triage and rapid management plan.

WHO developed the ETAT protocol, an adaption from Advanced Pediatric Life Support (PALS) guidelines, to readily identify children with immediate life-threatening conditions in resource limited settings, modified based on local expert opinions. (5)The success of the intervention is determined by assessing the outcome of health care intervention.(2) Despite implementation of

ETAT, many children in sub-Saharan Africa continue to die within the first 24-48 hours of admission, which can be explained by sub-optimal triaging systems, shortage of both equipment and manpower and gaps in knowledge. (6–9)

Initial triage and treatment for sick children in developing countries is usually inadequate with severely ill children experiencing delays in the institution of life saving treatments.(9)Malnutrition, prior treatment at home before presentation by non-doctors, low socioeconomic status and presenting to emergency room at night were significantly associated with poor outcome. (10)

## 1.2 Statement of the problem

Inconsistencies in triage practices may lead to delays in care, unnecessary admissions, or preventable mortality.

A study in Brazil, evaluating performance of ETAT in children presenting to the hospital, when carried out by nurses after a short specific training period, identified 731/3837 patients (19.05%); 98 patients (2.6%) were classified as needing emergency treatment and 633 (16.5%) as needing priority assessment. Sensitivity was 96.7% with respect to advanced paediatric life support (APLS) assessment, 91.7% with respect to all patients given priority by the pediatrician, and 85.7% with respect to patient ultimately admitted. Specificity was 90.6%, 91.0%, and 85.2%, respectively. Hence, it performed well as a screening tool to identify priority cases and as a treatment guide for emergency conditions. (11)

In a retrospective cohort study in rural Tanzania of 2,810 patients who visited the outpatient department (OPD) at Tosamaganga Voluntary Agency Hospital over a 9 month period, found that children seen by staff including health care personnel specifically trained on pediatric patient management had lower risk of hospitalization. This confirms the necessity to improve the quality of care provided to children with acute and critical illness, avoiding admissions for pathologies that could be treated in other health settings, such as primary care, if timely evaluated.(12)

Another research that used a two-arm descriptive study to evaluate the adapted ETAT tool's performance in which the retrospective case series of 902 forms were analyzed, 20% were admitted (9.8% green, 32.5% orange, and 52.9% red) and 2 patients died, both triaged red.(13) While in

the prospective cohort of children triaged over one week, 24.8% were admitted (10.1% green, 36.9% orange, and 91.7% red) and 1 patient triaged red died. In both samples up to 90% of children admitted had emergency or priority signs, and more than 90% of children categorized as having non-urgent problems were discharged. (13)This shows that there is a higher risk of admission with each higher triage level.

### 1.3 Significance of the study

Most existing triage scores were developed in western countries and include multiple physical and laboratory variables making them cost and labor intensive and difficult to implement in the ED. (14)

Although there is widespread recognition of the potential value of triage in Low- and Middle-Income Countries (LMIC), there are limited data regarding the association between the introduction of triage and enhanced quality of care. (15–19) Understanding this relationship can improve triage accuracy, resource allocation, and patient outcomes.

Therefore, there is a pressing need to assess whether the triage level assigned to pediatric patients at TASH is predictive of their clinical outcomes—including hospital admission, ICU need, or mortality.

## CHAPTER 2: Literature Review

### 2.1 Background

The burden of the world's child mortality disproportionately falls upon LMIC of Africa and Asia, with 82% of all child deaths in the world occurring in just two regions: sub-Saharan Africa (55%) and South Asia (27%), compared to the less than 1% of child deaths occurring in high-income countries (HICs). Hence, under 5 mortality reflects the quality of a country's health system and it becomes necessary to evaluate those outcomes to assess the functioning of said system. A big challenge in pediatric triage is that children have a variety of presentations, and a critically ill child may appear stable and suddenly deteriorate. (1) (4)

Children with injuries and medical conditions treated in EDs with high pediatric readiness had lower mortality during hospitalization and up to 1 year. (5) Standardized protocols ensures that a seriously ill child is met with a readiness that improves outcomes.

Most existing triage scores were developed in western countries and include multiple physical and laboratory variables making them cost and labor intensive and difficult to implement in the ED. (14)

WHO developed Emergency Triage Assessment and Treatment Plus (ETAT+) which teaches emergency, priority, or non-urgent signs and how to provide emergency treatment for life-threatening conditions. (1) This course has the advantage of being applicable to low resource set-ups, tailored to their needs and teachable to all health workers.

## 2.2 Prevalence

### 2.2.1 Globally:

Triage is a globally adopted principle, and although triage guidelines are used in many countries, no single system has been internationally adopted. (20)

The commonly used pediatric triage criteria that have been internationally recognized include paedCTAS, MTS, ESI, and ATS (Canadian Triage and Acuity Scale, Manchester Triage System, Emergency Severity Index, Australasian Triage Scale).Each of them is a 5-level triage system and has detailed guidelines to give better triage guidance for nurses. (21) Studies and systematic reviews show these tools reliably stratify children into higher- and lower-urgency groups, but performance is variable across settings and pediatric subgroups. (22)

High-acuity categories are uncommon. Across large multi-center samples and registry analyses, the highest urgency category (CTAS/ESI level 1) usually represents a very small fraction of visits (often <1–2%). Level 2 commonly ranges ~5–15%, with mid-acuity (level 3) often forming the largest single group (~30–50%), and levels 4–5 making up the remainder. Exact proportions vary by site, population, and whether the ED is pediatric-

specific or general. (23) The variety of triage tools used in different countries makes it difficult to compare them, but there is an increasing number of studies on pediatric emergency triage in many countries around the world. (14) Triage approaches used in high-resource environments do not necessarily translate to LMICs. (24)

2.2.2 Sub-sahran Africa:

Triage in low-middle income countries (LMIC) and sub-Saharan Africa is dominated by pragmatic, WHO-driven approaches such as Emergency Triage, Assessment and Treatment (ETAT) and by a small but growing literature testing simple, data-driven alternatives (e.g., "Smart Triage"). Compared with high-income settings, studies from LMICs show higher absolute mortality and more frequent early inpatient deaths, and they highlight that triage both identifies many of those at risk and—when effectively implemented—can reduce short-term mortality. (25)

A Large tertiary center series from Mozambique found that after training on ETAT triage, mortality rate was 45% lower after starting intervention. Compared to before (55%). Furthermore, 20.1% of pediatric emergency presentations resulted in hospitalization (with 62% of deaths occurring within four hours of arrival), illustrating both a substantial admission burden and concentrated early death in neonates and young infants. (26)

A systematic review of triage implementation in LMICs found that in pediatric EDs, implementing triage had positive associations for many process/outcome measures: for example, reduced waiting time, reduced ED length of stay, sometimes reduced mortality, improved satisfaction, and better "time to antibiotics" etc. (24)

ETAT prioritizes high-risk children, identifying 92.2% of emergency cases, and has demonstrated significant reductions in child mortality rates in countries like Brazil and Malawi. (27)

2.2.3 Ethiopia:

ETAT has been promoted and used as a baseline triage approach in many health facilities in Ethiopia, but implementation gaps (training, facilities, supplies) remain barriers to consistent, high-quality pediatric triage.(28) Multiple recent studies from Ethiopia report

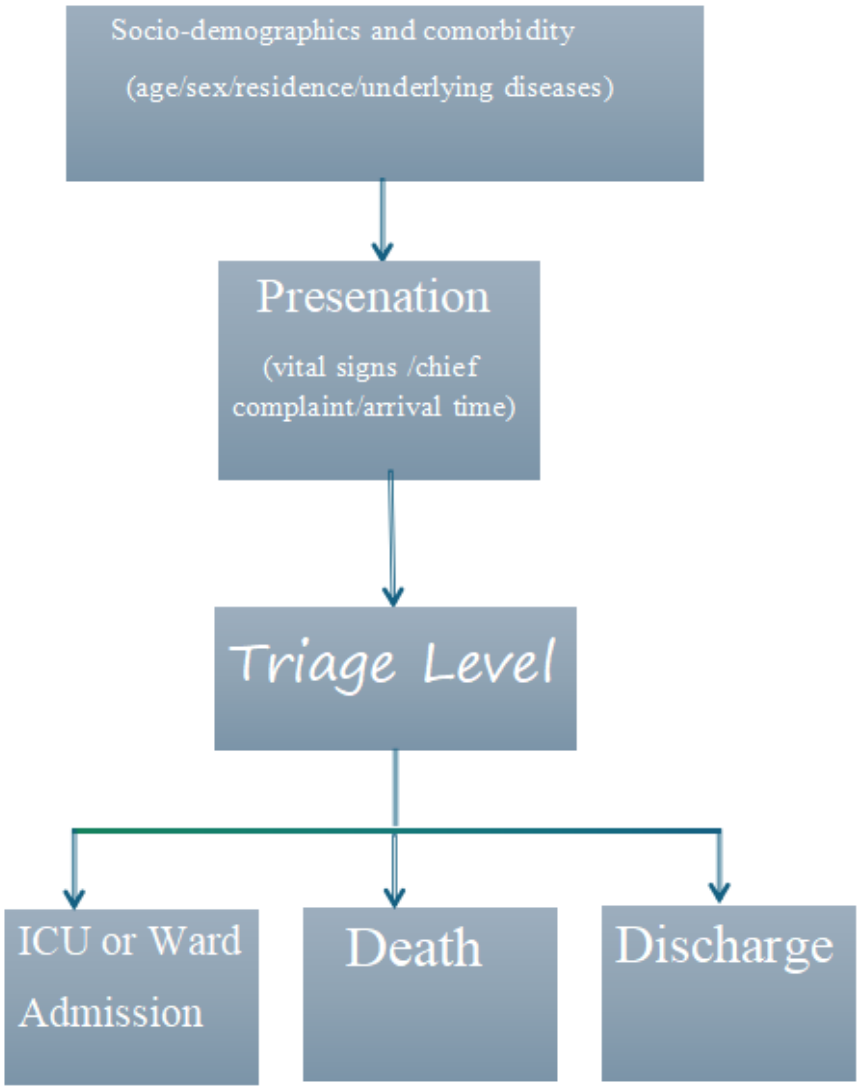
active pediatric emergency units using triage, but also high variability in quality and outcomes (e.g., prolonged length of stay, incomplete documentation, and identifiable determinants of ED mortality that include delays in recognition/triage).(29)

Single-site and region wide Ethiopian studies echo the high early-mortality problem: a five-year review at Tikur Anbessa and other Ethiopian hospitals documents frequent early deaths and multiple studies report PEU mortality figures higher than typical HIC rates (study-reported PEU mortality ~4.1% in the SNNPR analysis, with ~32% of deaths occurring within 24 hours). (29) Local operational studies at Tikur Anbessa show systems-level bottlenecks—67% of sampled PED patients experienced prolonged ED stay (>24 hours), commonly due to inpatient-bed shortages, and urgent/"red" triage status was independently associated with prolonged stay (AOR ~3.25), which both reflects and amplifies the downstream risk for critical patients. (29)

In Wolaita sodo Zone, a study showed poor quality of pediatric emergency triage: many healthcare workers (HCWs) couldn't correctly define triage; large proportions did not know triage duration or the categories; many did not correctly categorize children with urgent signs. (6)

Studies at Tikur Anbessa and regional referral hospitals show the use of triage and clear opportunities for system improvement. (29)

2.3 Conceptual framework



## *2.4 OBJECTIVES*

### 2.4.1 General:

To assess the association between triage levels and clinical outcomes among pediatric patients presenting to the emergency department at Tikur Anbessa Specialized Hospital.

### 2.4.2 Specific:

To determine the distribution of pediatric patients across triage levels using the ETAT system.

To assess the strength of association between patient presentation and assigned triage level.

To identify the proportion of patients requiring admission, ICU care, or resulting in mortality across each triage category.

To describe the most common diagnoses associated with each triage category.

### 2.4.3 Research questions:

What proportion of pediatric emergency patients are assigned to each triage level at TASH?

What are the short-term outcomes (admission, ICU, death) of these patients?

Is there a statistically significant relationship between triage level and outcome?

# CHAPTER 3: Methods and Materials

## 3.1 Study area:

This study was conducted at Addis Ababa University, College of Health Science, Tikur Anbessa Specialized Teaching Hospital, Department of Pediatrics and Child Health, located in Addis Ababa, the capital city of Ethiopia. It is the largest medical school in the country with undergraduate, postgraduate, and some sub-specialty training. It is a tertiary referral hospital that has around 700 beds and serves nearly 250,000 patients as outpatients annually. The pediatric emergency unit has 45 beds and an average of 450 - 600 patients triaged monthly (29).

## 3.2 Study design and period:

A Hospital based retrospective cross-sectional study was conducted on patients seen at the pediatric emergency unit at Tikur Anbesa Specialized Hospital from November 2025 to January 2026.

## 3.3 Population

### 3.2.1 Source Population:

All pediatric patients (age 7 days –14 years) presenting to the emergency department unit of Tikur Anbesa Specialized Hospital.

### 3.2.2 Study population:

All pediatric patients (age 7 days –14 years) triaged with ETAT at the emergency department at Tikur Anbesa Specialized Hospital in the study period.

## 3.4 Eligibility criteria:

### 3.4.1 Inclusion criteria:

- All children age above 7 days to 14 years old with complete triage data and documented clinical outcomes

### 3.4.2 Exclusion Criteria:

- Age less than 7 days or older than 14 years old

- Incomplete/duplicate records
- Referred-out patients without outcome data

3.5 Sample size:

The total sample was determined by using single population proportion formula by considering the following assumptions95% confidence level, Margin of error = 5%,

Sample size was calculated using the following formula.

$N=Z2xP(1-P)$ 1.96 2 x0.5x0.5= 384.16 approximately 385

D2 (0.05) 2

N= Sample size

Z= Z score

P= population proportion

D= Margin of error

Adding 10 % (19.25) for non-response rate, the required sample size of this study is 385+20 = 405

3.6 Variables:

3.6.1 Dependent Variables

- Disposition: discharged from PEU, admitted to ward, admitted to ICU, transferred, death in PEU; time to disposition, Length of stay
- Triage category (ETAT: Emergency / Urgent / Non-urgent or local categories) triage vitals (HR, RR, $SpO_2$, temperature)

3.6.2 Independent Variables

- Patient identifier (study ID) age (in days/months/years), sex, residence, referral source

- Time of triage/Presenting complaint/ working diagnosis on arrival.
- Process times where available: arrival→triage, arrival→first clinician assessment, arrival→antibiotics (if indicated), arrival→ imaging/labs.
- Resource bottlenecks recorded (e.g., “waiting for inpatient bed”, “awaiting lab/imaging”).
- Outcome window for early mortality: death in PEU and death within 24 hours of arrival.

3.7 Operational Definitions:

- Triage: a preliminary process of assessing causalities in order to rapidly prioritize patients based on the level of their urgency and required treatment.
- Red category: Patients with emergency signs who require immediate emergency treatment. (5)
- Yellow category: Those with priority signs, indicating that they should be given priority in the queue, so that they can rapidly be assessed and treated without delay. (5)
- Green category: Those who have no emergency or priority signs and therefore are non-urgent. (5)
- Outcome: final status such as discharge home, admitted, referred, or death. (29)
- Admission: transfer from emergency unit to inpatient ward or ICU. (13)
- Mortality: in-hospital death ocurring during the emergency unit stay. (28)
- Discharge: patients who were treated and released home directly from the emergency unit without inpatient admission. (29)
- Length of stay: duration of time the patient spent in the pediatric emergency

  Unit, measured in hours, days.
- Determinants of death: defined as variables that influence the survival outcome.

3.8 Sampling techniques:

The entire group of pediatric patients triaged with ETAT at the pediatric emergency unit were involved until the final sample size in the study period.

**Commented [M1]:** Your comment was:
"'You had three months each month we are seeing from 400 to 600 patients how did you do the sampling technique? "

**Commented [M2]:** Non random selection, I started cases seen from the date of approval of sample collection but due to many recordss not meeting eligibility criteria (missing data or unclear outcome) it extended into the next month

3.9 Data collection procedure and instrument

A validated questionnaire based on patient socio-demographics, medical background, referral details and clinical outcome was used. The feedback from the questionnaires was used to collect data from patients' charts.

3.10 Data collection tools and procedures:

A structured checklist including triage level, diagnosis, disposition, admission status, ICU admission, and mortality was developed based on findings from various studies. The questionnaire was created in English. A pretest was conducted to 5% of the sample size at TASH Prior to its use in data collection, to evaluate the tool's effectiveness. Based on the result of the pretest, unclear and confusing questions was modified accordingly.

3.11 Data quality control:

To assure data quality, the questionnaire was created in English. Three data collectors and one supervisor with the qualification of MPH was trained for one day about the objective of the study and ways of handling data. Data completeness and consistency was checked daily, and the collected data cleaned and compiled by the investigator.

3.12 Statistical Analysis:

The data was coded and entered in Epi-Data version 4.6 and exported to SPSS. A descriptive analysis was performed on the participant's background characteristics, including socio-demographics, and medical or surgical illnesses using tables and bar charts. First, bi-variable logistic regression analysis was used to select candidate variables for multivariable logistic regression analysis. The variables with a p-value <0.25 in bi-variable logistic regression were considered candidate variables, all variables meeting this criteria were then entered into a multi-variable logistic regression model to identify their independent association with the

dependent variable. In the multi-variable analysis, P-values <0.05 was considered statistically significant in the final model.

## CHAPTER 4: Ethical consideration

An ethical clearance and official letter were obtained from the Department of Pediatrics and Child Health Research and Publication Committee of Addis Ababa University. The data collection was anonymous, which did not include names of participants, and any other personal identifiers.

## CHAPTER 5: Dissemination Plan

### Academic Submission

Findings will be submitted to Addis Ababa University, College of Health Sciences, Department of Pediatrics and Child Health.

### Stakeholder Engagement

Results will be shared with governmental and non-governmental organizations interested in pediatric trauma. Dissemination is a key component to foster policy change informed by research evidence.

### Knowledge Sharing

Study results will be presented at scientific conferences and to relevant health authorities. A manuscript will be prepared and submitted to a reputable peer-reviewed journal for potential publication. Once published, findings will be accessible to all concerned bodies

The findings of this study will be submitted to Addis Ababa University, college of health science Department of pediatrics and child health. Results will be submitted to Governmental and non-governmental organizations interested in the subject matter. Dissemination will be an essential component of this project to achieve the purpose of fostering policy change based on research findings. For this intention, the study results will be presented to conference audience and scientific publication and relevant health authorities. The manuscript will be prepared and be sent to the reputable journal for potential publication and then become accessible for any concerned bodies.

## CHAPTER 6: Results

### 6.1 Sociodemographic and Arrival Characteristics

A total of **405 pediatric patients** who were triaged from November 2025 to January 2026 were included in this analysis. The age of the patients ranged from **8 days to 168 months (14 years)**, with a **mean age of 58.0 months (SD ± 46.3)**.The majority of patients were **school-aged children 36.8% (n= 149)**, followed by **infants** at **24.2% (n = 98)**. **Male patients predominated more** than half of the study, comprising **62.7% (n=254)** of the cases, while male to female ratio (1.6:1) (Table 1)

Most of the patients arrived at the pediatric emergency unit by **taxi**, representing **77.8% (n = 315)** of visit, while Ambulance **arrivals** accounted for **19.5% (n = 79),** and only **2.7% (n = 11)** of patients presented on foot.

The largest proportion of these patients presented **directly from home,** accounting for **41.2% (n = 167),** followed by referrals from **regional hospitals** (**25.9%, n = 105**) and **local health centers** (**21.0%, n = 85**). Inhospitable **referrals from outpatient departments** constituted **8.6% (n = 35)** of cases, while **tertiary hospital referrals** accounted for **3.2% (n = 13)**. (Table 1)

*Table 1. Socio-demographic and arrival characteristics (*association between triage level and clinical outcome)

| Variable | Category | n (%) | Summary statistic |
|---|---|---|---|
| **Age (months)** | | | Mean ± SD: **58.0 ± 46.3** |
| **Age category** | Neonate | 9 (2.2) | — |
| | Infant | 98 (24.2) | — |
| | Toddler | 51 (12.6) | — |
| | Preschool | 89 (22.0) | — |
| | School-aged | 149 (36.8) | — |
| | Adolescent | 9 (2.2) | — |
| **Sex** | Female | 151 (37.3) | — |
| | Male | 254 (62.7) | — |
| **Mode of arrival** | Walking | 11 (2.7) | — |
| | Taxi | 315 (77.8) | — |
| | Ambulance | 79 (19.5) | — |
| **Source of referral** | Home / self-referral | 167 (41.2) | — |
| | OPD (intra-hospital) | 35 (8.6) | — |
| | Local health center / private clinic | 85 (21.0) | — |
| | Regional hospital | 105 (25.9) | — |
| | Tertiary hospital | 13 (3.2) | — |

6.2 Distribution of ETAT Triage Levels

The Emergency Triage Assessment and Treatment (ETAT) system was used to categorize pediatric patients presenting to the emergency department according to the urgency of care required. Patients were classified into three triage levels: **Red (emergency), Orange (priority), and Green (non-urgent)**.

Over 91% of patients fell into the Red or Orange categories, and were triaged as **Orange (priority cases)**, accounting for **293 patients (72.3%)**, Red **(emergency) cases**, which constituted **77 patients (19.0%)** and Green **(non-urgent) cases** comprised the smallest group, with **35 patients (8.6%)**. (Table 6.2)

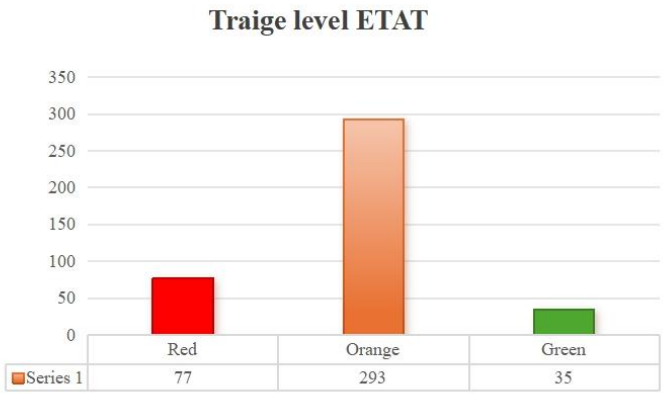



*Fig 1: ETAT triage levels using a bar chart (*association between triage level and clinical outcome)

6.4 Clinical Presentation and Process-of-Care Variables

This section describes the early clinical characteristics of pediatric patients at emergency department (ED) presentation and key process-of-care indicators, including working diagnosis, time to physician assessment, and investigations ordered.

### 6.3.1 Working Diagnosis at Presentation

Patients' working diagnoses were grouped into clinically relevant categories to facilitate analysis. As summarized in Table 6.2, infectious diseases were the most common reason for pediatric ED presentation, accounting for 152 cases (37.5%). This was followed by hematologic/oncologic conditions (44 cases, 10.9%) and gastrointestinal or surgical abdominal conditions (41 cases, 10.1%).

*Table 2: Clinical Presentation and Diagnostic Characteristics (*Association between triage level and clinical outcome)

| Working diagnosis category | Frequency | Percent (%) |
|---|---|---|
| Infectious diseases | 152 | 37.5 |
| Respiratory (non-infectious) | 30 | 7.4 |
| Gastrointestinal / Surgical abdomen | 41 | 10.1 |
| Neurologic | 32 | 7.9 |
| Hematologic / Oncology | 44 | 10.9 |
| Renal / Urological | 21 | 5.2 |
| Cardiovascular | 26 | 6.4 |
| Trauma / Injury | 22 | 5.4 |
| Nutritional / Metabolic | 14 | 3.5 |
| ENT / Eye | 9 | 2.2 |
| Drug / Toxicology | 7 | 1.7 |
| Genital / Abuse | 7 | 1.7 |
| **Total** | **405** | **100.0** |

### 6.3.2 Vital Signs at Presentation

At presentation, oxygen saturation was recorded for all 405 patients. The majority, 345 (85.2%), had oxygen saturation within the normal range, while 60 (14.8%) had abnormal oxygen saturation based on the study definition.

Most children had temperatures within the normal range (176, 43.5%). Fever was observed in 133 (32.8%), 43 (10.6%) had moderate grade of fever, 31 (7.7%) had high-grade temperature abnormalities, and 22 (5.4%) fell into other abnormal temperature categories according to the predefined classification. The majority, 300 (74.1%), had respiratory rates within the normal range, 84 (20.7%) were tachypneic, and 21 (5.2%) had bradypnea for age. Normal pulse rate was observed in 189 (46.7%), whereas 211 (52.1%) had tachycardia and 5 (1.2%) had bradycardia.

6.4 Clinical Outcomes of Pediatric Emergency Visits

Among the **405 patients** included in the study, the majority were **discharged from the pediatric emergency unit**, accounting for **60.0% (n = 243)** of visits. **Hospital admission** was required in **152 patients (37.5%)**, of whom **148 (36.5%)** were admitted to the ward and **4 (1.0%)** required **intensive care unit (ICU)** admission. **Ten patients (2.5%)** died during their emergency unit stay.(Table 6.3)

*Table 3. Clinical outcomes of pediatric emergency patients (n = 405)*

| Outcome variable | Category | n (%) |
|---|---|---|
| **Disposition** | Discharged | 243 (60.0) |
| | Admitted to ward | 148 (36.5) |
| | Admitted to ICU | 4 (1.0) |
| | Death | 10 (2.5) |

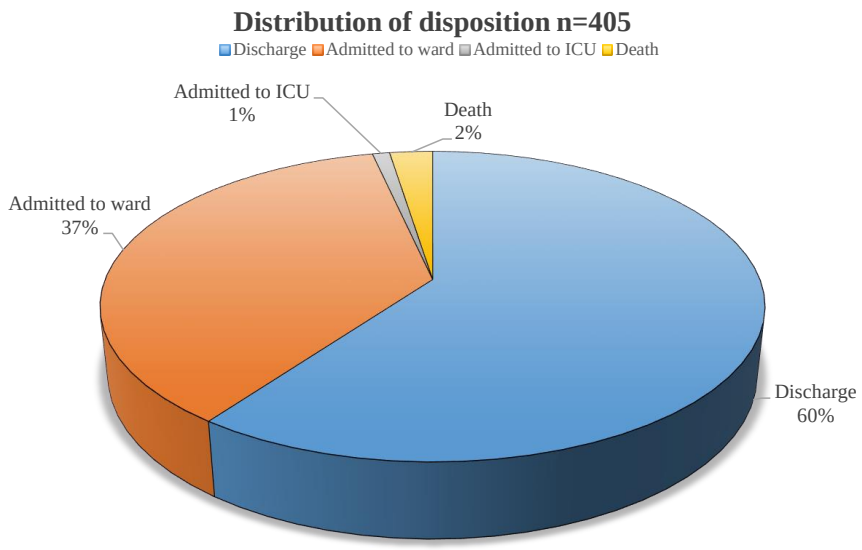



*Fig 2: Distribution of disposition outcomes*

### 6.8 Association between Triage Level and Clinical Outcomes

The association between **ETAT triage level at presentation** and clinical outcomes, including disposition, ICU admission, and mortality, was examined to assess the predictive value of the triage system in pediatric emergency care. Among **Red (emergency) patients**, **32 (41.6%)** were discharged home, **38 (49.4%)** were admitted to the ward, **1 (1.3%)** required ICU admission, and **6 (7.8%)** died. In contrast, **Orange (priority) patients** were predominantly discharged (**183 patients, 62.5%**) or admitted to the ward while **103 (35.2%**), only **3 patients (1.0%)** required ICU care and **4 patients (1.4%)** died. **Green (non-urgent) patients** were mostly discharged **28 (80.0%**), with a smaller proportion admitted to the ward **7 patients, 20.0%** and no ICU admissions or deaths (Figure 3).

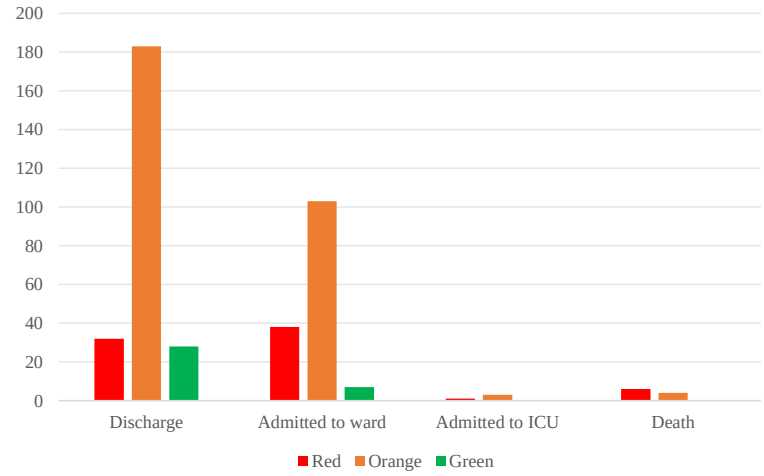



*Figure 3: distribution of outcomes visually illustrates the trends among triage levels*

6.9 Factors Associated With Adverse Outcomes (A Multivariable Analysis)

Multivariable logistic regression analyses were performed to identify factors independently associated with adverse outcomes, namely **admission versus discharge**, **ICU admission**, and **death**, using separate models for each outcome. Variables included in the final models were selected based on preliminary bivariate analyses and assessment of multicollinearity. Variance inflation factor (VIF) values were <5 for all included variables; although age showed co-linearity when entered as both continuous and categorical variables, only **age categories** were retained in the final models.

*Table 4: Association* between triage level and clinical outcomes

| **Variable** | **COR (95% CI)** | **p** | **AOR (95% CI)** | **p** |
|---|---|---|---|---|
| **Triage Red vs. Green** | 4.75 (1.83–12.31) | .001 | 2.89 (1.74–11.23) | .026 |

| | | | | |
|---|---|---|---|---|
| **Triage Yellow vs. Green** | 2.25 (0.95–5.34) | .065 | 2.29 (1.84–6.23) | .006 |
| **Oxygen sat (Desaturation vs. Maintaining)** | 1.79 (1.01–3.17) | .045 | 1.84 (1.30–2.36) | .042 |
| **RR Bradycardia vs. Tachycardia** | 0.43 (0.15–1.21) | .109 | 0.43 (0.15–0.91) | .009 |
| **RR Normal vs. Tachycardia** | 0.65 (0.39–1.07) | .092 | 0.65 (0.39–0.97) | .042 |
| **IV fluids (No vs. Yes)** | 0.30 (0.19–0.45) | <.001 | 0.34 (0.21–0.58) | <.001 |
| **IV medication (No vs. Yes)** | 0.30 (0.20–0.46) | <.001 | 0.31 (0.18–0.54) | <.001 |
| **Imaging (No vs. Yes)** | 0.34 (0.21–0.54) | <.001 | 0.54 (0.30–0.95) | .032 |

# Chapter 7: Discussion

This study assessed the association between ETAT triage levels and clinical outcomes among pediatric patients presenting to the emergency department of Tikur Anbessa Specialized Hospital (TASH). The findings demonstrate a statistically significant and graded relationship between triage acuity and adverse outcomes, including hospital admission, ICU requirement, and mortality. These results support the predictive validity of ETAT system a tertiary referral setting in Ethiopia.

Statistical analysis demonstrated a significant association between ETAT triage level and clinical outcomes. The Pearson Chi-square test showed a strong relationship ($\chi^2 = 24.797$, df = 6, $p < 0.001$). A significant linear-by-linear trend (-4.732) further indicated a graded relationship, with increasing triage acuity associated with higher rates of ward admission, ICU admission, and mortality.

Although several cells had small expected counts, exact testing confirmed the robustness of the association.

In this study, 19.0% of patients were triaged as Red (emergency), 72.3% as Orange (priority), and 8.6% as Green (non-urgent). The predominance of priority cases reflects the high burden of acute illness among pediatric emergency attendees in low-resource settings. Similar patterns have been reported in LMICs where ETAT is widely used, with the majority of children categorized as emergency or priority cases due to delayed presentation and higher disease severity (8, 24, 25).

Compared to high-income country (HIC) five-level systems such as CTAS, MTS, or ESI, where the highest acuity levels often constitute less than 2% of visits (21,23), our proportion of emergency (Red) cases is substantially higher. This difference likely reflects the referral nature of TASH as a national tertiary center, as well as the epidemiological profile of pediatric disease in Ethiopia, where infectious and preventable conditions remain prevalent (3,4).

A statistically significant association was observed between ETAT triage level and clinical disposition ($p < 0.001$). Red patients had the highest proportions of ward admission (49.4%), ICU admission (1.3%), and mortality (7.8%). Unexpectedly, (41.6%) of Red patients were discharged home which may implicate rapid stabilization, over-triage or boarding effect. Most Orange patients were discharged (62.5%) or admitted to the ward (35.2%), whereas Green patients experienced no ICU admissions or deaths and were predominantly discharged (80%). This graded relationship aligns with findings from other LMIC studies evaluating ETAT performance (11, 13, and 27).

Buys et al. (13) demonstrated that admission rates increased progressively with higher triage categories, with most Red patients requiring admission and minimal admissions among non-urgent cases. Similarly, Tamburlini et al. (11) reported high sensitivity and specificity of ETAT in identifying children requiring emergency treatment or hospital admission. Our findings are consistent with these studies and further confirm that ETAT functions effectively as a risk stratification tool in the Ethiopian tertiary hospital context. The overall hospital admission rate in this study was 37.5%, which is higher than many reports from general emergency departments in HICs but comparable to tertiary pediatric referral centers in LMICs (12, 24). Higher ETAT levels were independently associated with admission, consistent with previous findings from Tanzania and South Africa demonstrating that higher acuity triage levels predict hospitalization (12, 13).

Although mortality in our cohort was 2.5%, with deaths disproportionately concentrated in the Red category (7.8%) followed by (1.4%) in the Orange category. This pattern supports evidence from sub-Saharan Africa showing that early in-hospital deaths frequently occur among severely ill children and often within the first 24 hours (8, 24). Studies from Mozambique and Malawi have demonstrated that structured triage implementation can significantly reduce pediatric mortality when appropriately adhered to (8, 27). Therefore, strengthening ETAT adherence and timely intervention may contribute to further mortality reduction at TASH.

Although triage level was significantly associated with mortality in unadjusted analysis, no independent predictors of ICU admission or death were identified in multivariable models, likely due to the small number of ICU admissions and deaths , (n = 4) and (n = 10) respectively, limiting the statistical power and precision for this model. Similar limitations have been noted in other single-center pediatric emergency studies in LMICs (9, 10).

Nevertheless, abnormal vital signs were independently associated with higher-acuity levels and hospital admission, supporting the clinical logic embedded within ETAT criteria that higher-acuity levels require more aggressive emergency care. Vital sign abnormalities have consistently been linked to adverse outcomes in pediatric emergency settings (10, 24).

This study adds to the limited Ethiopian literature evaluating the outcome-predictive validity of ETAT. While prior Ethiopian studies have focused primarily on triage quality and implementation gaps (6, 7, 28), few have directly examined the association between triage level and patient outcomes. Our findings provide empirical evidence that ETAT categories meaningfully stratify risk at TASH.

Given the disproportionate burden of pediatric mortality in sub-Saharan Africa (3, 4), strengthening emergency triage systems remains a critical component of improving child survival. This study supports continued investment in ETAT training and quality improvement initiatives within Ethiopian tertiary hospitals.

This study benefits from a relatively large sample size (n = 405) and comprehensive inclusion of clinical, process, and outcome variables. However, several limitations should be acknowledged. *T*he retrospective design limits causal inference and depends on documentation quality, which may show bias. The small number of ICU admissions and deaths limited the power of multi-variable analyses for severe outcomes. Additionally, as a single-center tertiary referral study, findings may not be generalizable to primary or district-level hospitals.

# Chapter 8: Conclusion

This study demonstrated that ETAT triage categories were strongly associated with clinical outcomes among pediatric patients presenting to the emergency department of Tikur Anbessa Specialized Hospital. Higher triage acuity levels were significantly associated with increased rates of hospital admission, ICU requirement, and mortality. All of which confirms the predictive validity of the ETAT system in identifying children at increased risk of severe illness in a tertiary care setting. Overall, while ETAT is a reliable and clinically valuable tool in this context, optimal outcomes depend on both accurate triage and timely, system-supported clinical response.

## Recommendations

To enhance pediatric emergency outcomes, strict adherence to ETAT timelines—particularly immediate evaluation of Red cases—should be reinforced through regular refresher training, supervision, and triage audits. Additionally, continuous quality improvement initiatives that monitor key performance indicators such as admission rates by triage category, and mortality trends should be implemented.

Future prospective and multicenter studies are recommended to further evaluate ETAT performance and identify context-specific barriers to timely emergency care delivery in Ethiopia

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**Table 4 Pediatric Emergency Triage Questionnaire**

| |
|---|
| 1. Demographic Information |
| Age of patient: _____ Gender: ☐ Male ☐ Female |
| Date of visit: _____ Time of arrival: _____ |
| Mode of arrival: ☐ Walk-in ☐ Ambulance ☐ Referral ☐ other: _____ |
| 2. Triage Assessment |
| Triage level assigned: ☐Red (Resuscitation) ☐ Orange (Priority) ☐ Green (non-Urgent) |
| Triage tool used: ☐ Emergency Triage Assessment Treatment (ETAT) Scale |
| Was the triage level reassessed during the visit? ☐ Yes ☐ No |
| If reassessed, what was the final triage level? _____ |
| 3. Clinical Presentation |
| Chief complaint: _____ |
| Vital signs at triage: |
| Temperature: _____ °C Heart rate: _____ bpm |
| Respiratory rate: _____ Oxygen saturation: _____ %4. |
| 4. Management and Interventions |
| Time to physician assessment: _____ minutes |
| Investigations ordered: ☐ Blood tests ☐ imaging ☐ Urinalysis ☐ other: _____ |
| Treatments provided: ☐ IV fluids ☐ Medications ☐ Oxygen ☐ CPR ☐ other: _____ |
| 5. Outcome |
| Disposition: ☐ Discharged home ☐ admitted to ward ☐ Admitted to ICU ☐ Deceased |
| Length of stay in ED: _____ hours |
| Was outcome consistent with triage level? ☐ Yes ☐ No |
| If no, explain: _____ |
| 6. Staff Feedback<br>Was the triage level appropriate for the case? ☐ Yes ☐ No |

| **Work plan** | | | | | | |
|---|---|---|---|---|---|---|
| Activity | Month 1 | Month 2 | Month 3 | Month 4 | month 5 | Month 6 |
| **Proposal Development** | ✓ | | | | | |
| **Ethical Approval** | ✓ | ✓ | | | | |
| **Data Collection** | | ✓ | | | | |
| **Data Analysis** | | | ✓ | | | |
| **Report Writing & Dissemination** | | | ✓ | ✓ | ✓ | ✓ |

Table 5: Work plan (Association between triage and clinical outcome)

## Assurance of Principle Investigator

The author took responsibility for the research project's scientific and ethical conduct, provided timely progress reports, sought approval, and effectively communicated with all stakeholders, including funding sources related to the subject matter or materials discussed in this manuscript.

**Name of the Resident: Dr. Mijwok Bachay James**

**Signature: _____**

**Date: _____**

**Approval of Advisors**

**Name of the Primary Clinical Advisor: Dr.Muluwork Tefera**

**Signature: _____**

**Date: _____**