



**St. Paul Hospital Millennium Medical College
Graduate Study Program**

Magnitude, risk factors and treatment outcomes of acute exacerbation of Bronchial Asthma among adult patients visiting to Emergency Department of SPHMMC, Addis Ababa, Ethiopia.

By; - Belay Tessema (ECCM Resident)

Addis Ababa, Ethiopia

November, 2025



**St. Paul Hospital Millennium Medical College
Graduate Study Program**

Magnitude, risk factors and treatment outcomes of acute exacerbation of Bronchial Asthma among adult patients visiting to Emergency Department of SPHMMC, Addis Ababa, Ethiopia.

BY: Belay Tessema (ECCM Resident)

**Advisors: Dr Hana Ketema (Assistant Professor of ECCM)
Dr Mariamawit Solomon (Assistant Professor of ECCM)**

A Research thesis to be submitted to St. Paul Millennium Medical College for Partial Fulfillment of the Requirements for Specialty in Emergency and Critical Care Medicine

Addis Ababa, Ethiopia

November, 2025

Project Profile

Name of investigator	Belay Tessema
Full title of the research project	Magnitude, risk factors and treatment outcomes of acute exacerbation of bronchial Asthma at SPHMCC Addis Ababa, Ethiopia.
Duration of the project	From September 1,2024-Septmber1 2025)
Study Area	St. Paul Millennium Medical College's Hospital
Total Cost of the project	30,020 ETB
Source(s) of Funding	St Paul Millennium Medical College
Address of investigator	Cell Phone:0912780625
	Fax:
	P.O. Box:
	Email; -belaytessemahe@gmail.com
Name and address of Advisor	Dr. Hana Ketema (Assistant Professor of ECCM) Dr Mariamawit Solomon (Assistant Professor of ECCM)

Acknowledgments

First of all, I would like to thank St. Paul Hospital Millennium Medical College for giving me this opportunity to develop this thesis.

Next, I would like to express my gratitude to my advisors, Dr.Hana Ketema and Dr. Mariamawit Solomon, for their unreserved assistance in giving timely topic selection, comments and relevant guidance throughout the preparation of the thesis.

Table of Contents

Acknowledgments.....	I
Table of Contents.....	II
List of Tables	IV
ACRONYMS AND ABBREVIATIONS.....	V
Abstract.....	VI
1. INTRODUCTION	1
1.1 Background.....	1
1.2 Statement of the problem.....	3
1.3 Significance of the study.....	5
2. LITERATURE REVIEW	6
2.1 Global situation.....	6
2.2 African situations	8
2.3 Ethiopian situation	9
2.4 Conceptual framework.....	10
Figure 1: Conceptual framework on acute asthma treatment outcome and factors associated with at emergency department (1, 3, 10-12).	10
3. OBJECTIVES	10
3.1 General objective	11
3.2 Specific objectives	11
4. METHODS AND MATERIALS.....	11
4.1 Study setting and period.....	12
4.2 Study design.....	12
4.3 Population	12
4.4 Inclusion and exclusion criteria	12
4.5 Sampling size and sampling procedure.....	13
4.6 Study variables.....	14
4.9 Data collection tool and procedure	15
4.10 Data Quality Assurance	15
4.11 Data process and analysis	15
4.12 Ethical consideration.....	16
4.13 Dissemination plan.....	16

5. Results.....	16
5.1 Magnitude of Acute Exacerbation of Bronchial Asthma.....	16
5.2 Socio-demographic and baseline Characteristics of the Study Population.....	16
5.3 Asthma History and Medication Profile	18
5.5 Clinical presentation and severity of asthma exacerbations	18
5.6 Vital Signs and Clinical Parameters by Severity	20
5.7 Patient outcomes following emergency department management.....	21
5.8 Treatment Patterns and Therapeutic Interventions	23
5.9 Risk Factors for Severe Exacerbation: Bivariate and Multivariate Analyses.....	24
5.10 Factors Associated with Poor Patient Outcomes	25
6. Discussion	26
6.1 Magnitude of Acute Asthma Exacerbations	26
6.2 Patient Demographics and Clinical Presentation.....	26
6.3 Risk Factors for Severe Disease and Recurrence	26
6.4 Clinical Assessment and Predictors of Severity	27
6.5 Vital Signs as Predictors of Severity	28
6.7 Treatment Patterns and Outcomes	28
7. Limitations of the Study.....	29
8. Conclusion and recommendations	30
8.2 Conclusion	30
8.2 Recommendations.....	30
9. References	31
ANNEXES	i
Annex-I Informed Consent	i
Annex II: Questioner.....	ii
Sociodemographic data	ii
10.Assurance of Principal Investigator	v
Approval of the Primary Advisor	v

List of Tables

Table 1: Socio-demographic and baseline characteristics of Adult Asthma Patients at the SPHMMC ED	17
Table 2: Asthma History and Controller Medication Use Patterns	18
Table 3: Clinical Presentation and Severity of Asthma Exacerbation (N=277)	18
Table 4: Clinical Presentation and Management Characteristics	19
Figure 1: Asthma Exacerbation severity	20
Table 5: Vital Signs at Presentation by Asthma Exacerbation Severity	21
Table 6: Treatment Outcome Classification	22
Figure 2: Patient outcome following ED Management	22
Figure 3: Treatment patterns by severity	23
Table 7: Treatment Patterns by Asthma Exacerbation Severity	24
Table 8: Factors Associated with Severe/Life-threatening Asthma Exacerbation	25
Table 9: work plan study on magnitude, risk factor and treatment outcomes visiting SPHMMC ED of Addis Ababa, 2025	Error! Bookmark not defined.
Table 10 Budget for study on magnitude, risk factor and treatment outcomes of at SPHMCC ED, Addis abeba, 2025	Error! Bookmark not defined.

List of figures

Figure 1: Asthma Exacerbation severity	20
Figure 2: Patient outcome following ED Management	22
Figure 3: Treatment patterns by severity	23

ACRONYMS AND ABBREVIATIONS

AEBA; Acute exacerbation of bronchial asthma

ED: Emergency Department

GINA: Global Initiatives for Asthma

HMIS: Health Management of Information System

ICS: Inhaled Corticosteroid

ICU: intensive care unit

LABA: Long-Acting Beta 2 Agonist

OCS: Oral Corticosteroids

SABA: Short Acting Beta 2 Agonist

SOB: Shortness of Breath

SPSS: Statistical Package for Social Sciences

SPHMMC; St. Paul's hospital Millenium medical college

URTI: Upper Respiratory Tract Infection.

Abstract

Background: Asthma is a long-term lung condition that causes airway inflammation. Many acute exacerbation asthma attacks can be avoided with proper treatment. Poorly controlled asthma can lead to emergency department visits and hospitalizations. This places a significant burden on individuals and healthcare systems. To improve healthcare planning, management, and prevention, regular assessment on the frequency and causes of emergency room visits due to asthma is crucial. This can help reduce healthcare costs, illnesses, and deaths, ultimately leading to a healthier and more productive population.

Objective: To assess the magnitude, risk factors, treatment outcomes of acute exacerbations of bronchial asthma among adult patients visiting the SPHMMC ED.

Methods: A descriptive institutional based retrospective cross sectional study was conducted in the adult emergency department of St. Paul's Hospital Millennium Medical College. Socio-demographic, clinical and treatment related data were collected from HMIS record and then from personal health records of patients, who visited adult emergency room from September 1, 2024 to September 1, 2025. Finally, the data were analyzed by using STATA Version 17 statistical software. Logistic regression analysis was employed to assess the risk factors for the outcomes of asthma exacerbation and P-value of less than 0.05 was used to declare statistical significance. The results were presented in text, tables and graphs.

Results; A total of 277 patients were included, of whom 161 (58.1%) were female. The mean age was 48.8 ± 16.7 years. The magnitude of acute exacerbation was 3.6%, and 96% of patients had a good treatment outcome. Infection as a triggering factor was associated with a more than four-fold increase in the odds of severe exacerbation (AOR = 4.36; 95% CI: 1.27–14.93; $p = 0.019$). Each unit increase in respiratory rate was associated with a 9% increase in the odds of severe exacerbation (AOR = 1.09; 95% CI: 1.04–1.15; $p = 0.001$).

Conclusion; Infections and poor adherence remain key modifiable risk factors. Early recognition, infection prevention, and adherence to guideline-based therapy can improve outcomes and reduce severe cases.

Keywords: acute exacerbation, Risk factor, treatment outcome, SPHMCC

1. INTRODUCTION

1.1 Background

Asthma is a heterogeneous disease usually characterized by chronic inflammation and hyperresponsiveness of the airway accompanied by a history of recurrent or persistent respiratory symptoms such as wheeze, shortness of breath, chest tightness, and cough that varies over time and intensity, along with variable airflow (1-4). Asthma is the most prevalent chronic non-communicable condition impacting over 260 million individuals globally. According to the Global Burden of Disease report, asthma contributes to 420,000 deaths annually worldwide. Avoidable factors, such as under-prescription of inhaled glucocorticoids or inadequate access to medical care, contributes to the majority of asthma-related deaths.(5)

An asthma exacerbation is characterized by a steady rise in the symptoms of wheezing, coughing, or shortness of breath to the point that a change in treatment is necessary(1, 3, 6). A complicated combination between genetic, immunological, and environmental variables leads to the diverse disease of asthma(1, 2). Asthma exacerbations can be classified as mild, moderate, severe, or life threatening (7, 8). Triggers that cause the release of inflammatory mediators, such as infections, drugs, cold weather, allergens and physical exertion are what cause these exacerbations (7, 9-11).

Acute asthma attack is one of the most common reasons for emergency department (ED) visits, hospitalization, and death rate (11, 12). Acute asthma is also responsible for a significant amount of time off work, and lost productivity (7). Asthma is a major source of morbidity and mortality worldwide, putting a large financial and health burden on nations (6). If asthma is not well managed, it has been shown to have an impact on everyday activities, cause serious physical and socioeconomic hardship, and increase the expense of healthcare (4). Acute asthma frequently necessitates pricey ED visits and hospital stays. Many asthmatics have a poor quality of life and are vulnerable to relapse for weeks after receiving acute asthma treatment, which is frequently unpredictable (6, 13, 14).

The main objectives of treating an acute asthma exacerbation are to quickly identify the airflow obstruction and reverse it in order to prevent future episodes and relapses (7). The treatment of acute asthma in the ICU differs significantly from that in an outpatient setting. Various therapeutic strategies have been studied to improve outcomes for patients experiencing severe or life-threatening exacerbations (6). The revised GINA guidelines recommend that all adults and adolescents with asthma use an ICS-containing controller to lower the risk of severe exacerbations, even with infrequent symptoms. Every patient should have a reliever inhaler, preferably low-dose ICS-formoterol, as it reduces severe exacerbation risk better than SABA. (15).

To reduce the magnitude and acute exacerbation of asthma-related morbidity and mortality in developing countries, it is crucial to identify modifiable risk factors. Mortality rates may be higher among older populations due to the presence of multiple co-morbidities (1). Few research have looked at methods for enhancing acute asthma care in this population, despite the fact that there is strong evidence that excessive asthma-related morbidity occurs in adults, is associated with poverty, and is higher in areas with a high concentration of urban residents (13) . Although there is a wealth of information available globally, Ethiopia has very little written about acute exacerbation of bronchial asthma (9). This study aims to determine the magnitude, risk factors, and treatment outcomes of asthma exacerbations presenting to the emergency department at Saint Paul's Millennium Medical College in Addis Ababa, Ethiopia.

1.2 Statement of the problem

Asthma currently affects an estimated 339 million people worldwide, with projections suggesting this number could rise to 400 million by 2025. The Global Burden of Disease Collaboration estimates that at least 400,000 individuals die prematurely from asthma each year, with the majority of these deaths occurring in sub-Saharan Africa. Asthma prevalence varies significantly between countries due to differences in genetic factors, climate, and environmental conditions. Acute asthma exacerbations impact patients and their families, leading to lost productivity, frequent hospitalizations, and a diminished quality of life. Additionally, asthma-related morbidity and mortality tend to be higher in older populations due to the presence of more co-morbid conditions (1).

Asthma prevalence in Africa was projected to be 119.3 million in 2025, accounting for 12.8% of the global prevalence population. The estimated incidence of asthma in eastern Africa, including Ethiopia, Somalia, and Kenya, is 4.4%; nevertheless, the majority of prescribers do not adhere to recommended asthma care practices. The prevalence rate in Ethiopia was 9.1%, 4.3% in southern Ethiopia, and 11.4% in Addis Ababa (9). Two studies from the northern part of Ethiopia reported prevalence rates of 10.4% and 29.6% (4) .

The study done in Jimma and Adiss Ababa, Ethiopia, found that uncontrolled asthma affected 64.5% and 53.3% of the population, respectively (4). There is increasing evidence that the prevalence of asthma will continue to increase due to their sequential lifestyle changes, rapid urbanization, and increased exposure to environmental and occupational factors. The risk and intensity of exposure to these environmental and occupational pollutants continue to increase due to lack of clear Environmental regulatory policies (16).

About 10% of asthmatics experience symptoms and exacerbations despite receiving the maximum amount of standard-of-care controller therapy (17). Most asthma, 5-10% of asthma patients suffer from a severe form of asthma that is uncontrolled despite maximal pharmacological therapy (2). According to the severity of the illness, the type of treatment used, and the location, 10% to 20% of patients who visit the emergency room need to be admitted to the hospital (7). Despite this, relapse rates in patients who have been treated in the ER and then

discharged still range from 26 to 30%, indicating a continued need for ER care (12). Asthma is often underdiagnosed undertreated, and poorly controlled and its incidence is increasing globally, including in Ethiopia particularly at SPHMMC ED an average of 3 cases per day with recurrent ED visit. However, up to my knowledge there is limited research examining the magnitude, risk factors, and treatment outcomes of acute asthma exacerbations in the Ethiopian context, particularly at Saint Paul Hospital's Emergency Department in Addis Ababa so this study aims to show the magnitude, risk factor and treatment outcomes acute exacerbation of bronchial asthma

1.3 Significance of the study

This study will show the magnitude of acute exacerbations of bronchial asthma, which continue to impose a significant health burden despite the availability of effective treatments.

The findings of this study are expected to provide critical insights into factors contributing to acute asthma exacerbations, as well as the treatment outcomes. These insights will not only highlight the extent of the problem but also guide evidence-based interventions to improve patient outcomes. Additionally, the study's outcomes can help inform healthcare providers and policymakers, enabling better resource allocation and targeted strategies to enhance asthma management protocols in the hospital and across Ethiopia.

2. LITERATURE REVIEW

2.1 Global situation

Asthma is a serious global health problem, affecting approximately 300 million people around the world, and causing around 1,000 deaths per day. Most of these deaths occur in low- and middle-income countries, and most of them are preventable (18).

A systematic analysis and modelling study done 2019 The global prevalence of asthma among individuals aged 5–69 years was (11.5%). The prevalence of bronchial Asthma which was highest in the African Region (13.2%) and lowest in the Americas Region (10.0%) (19).

According to the comprehensive review of existing literatures and guidelines on the management of acute Asthma in the emergency department indicated that handheld inhalers are sufficient for most inhaled therapy; all patients on inhalers should be provided with a spacer. The severity of asthma exacerbations is determined by 3 features: (1) clinical presentation, (2) peak expiratory flow rates, and (3) vital signs. Inhaled ipratropium decreases hospitalization rates, and it should be routinely used. Magnesium sulfate may be beneficial in severe asthma exacerbations, but routine use for mild to moderate exacerbations is not indicated (3).

A cohort study done at University of Texas Southwestern Medical Center at Dallas General Clinical Research Center on the effectiveness of acute asthma care, among the total 309 participants in the study revealed that systematic corticosteroid had significantly effective for increasing percentage peak expiratory flow rate change at 2 and 3 week follow up for all asthma exacerbation severity level and severity level by the national asthma education prevention guideline(13).

A study done in Brazil on the early prediction of poor outcome in patients with acute asthma in the emergency room showed that all patients were treated with 2.5 mg albuterol delivered by nebulization every 20 min in the first hour and 60 mg of intravenous methylprednisolone. Patients were reevaluated after 60 min of treatment. Sixty-five patients (73.9%) were successfully treated and discharged from the emergency room (good responders), and 23 (26.1%) were hospitalized or were treated and discharged with relapse within 10 days (poor responders). It was possible to predict outcome in the first hour of management of acute asthma in the emergency room when the index score was 0 or 2 (12).

A systematic review done in Netherlands on the medication adherence and the risk of severe asthma exacerbations: showed that good adherence tended to be associated with lower risk of severe asthma exacerbations. A guideline on management of the acute asthma attack in children by Italian Society of Pediatrics revealed that inhaled β_2 agonists are the first line drugs for acute asthma attack in children. Ipratropium bromide should be added in moderate/severe attacks. Early use of systemic steroids is associated with reduced risk of ED visits and hospitalization. Intravenous magnesium sulphate could be used in children with severe attacks and/or forced expiratory volume₁ (FEV₁) lower than 60% predicted, unresponsive to initial inhaled therapy. Heliox could be administered in life-threatening attacks (11).

One study reviewed 51 consecutive asthma deaths in 1 state in Australia, and it found that 33% of the patients who died had a history of trivial to mild asthma, 32% had never been hospitalized, only 22% had an ICU admission in the past, and 11% were reported to be symptom-free prior to their terminal hospitalization. Only 1 patient met criteria for severe uncontrolled asthma (12). Thus, like many diseases presenting to the ED, a lack of risk factors does not necessarily confer a lack of risk (3).

According to Gina 2024 update regular utilization of SABA, even for a duration as short as one to two weeks, can lead to detrimental effects such as beta-receptor downregulation, diminished broncho-protection, and rebound hyperresponsiveness. Increased SABA usage correlates with adverse clinical outcomes; dispensing three or more SABA inhalers, annually is linked with a heightened risk of exacerbations, while dispensing twelve or more SABA inhalers annually significantly elevates the risk of mortality. GINA now advises that all adults and adolescents with asthma should have access to ICS-containing inhalers (e.g., budesonide-formoterol 80 mcg-4.5 mcg or 160 mcg-4.5 mcg), administering one to two inhalations as needed for asthma symptoms to diminish the occurrence of serious exacerbations, fatalities, hospitalizations, and exacerbations necessitating oral steroid treatment.(20)

2.2 African situations

According to the systemic review and meta-analysis to show the magnitude of asthma done in Africa for two decades (1990 to 2010) shows 74.4 million (11.7%) in 1990 , 94.8 million (12%) in 2000 and 119.3 million (12.8%) in 2010 (21).

The study on 2024 about the burden of severe asthma in sub-Saharan Africa: Findings from the African Severe Asthma Project examines the prevalence, mortality, and impact of severe asthma in Uganda, Kenya, and Ethiopia. Over 12 months, it found a high prevalence of severe asthma (25.6%) and severe refractory asthma (4.6%) and Overall mortality was 0.35% during the follow-up period among 1,086 patients. Key contributors to severe asthma include older age, hypertension, heightened bronchial hyperresponsiveness, and poor initial asthma control. (22).

A Three-year Retrospective Observational Study done in Rural South-Western Nigeria on prevalence, Risk Factors and Treatment Outcomes of Acute Asthma Exacerbations showed that the prevalence of asthma exacerbation was 5.1%, and its risk factors were family history, tobacco smoking, keeping pets, co-morbidity, numbers of co-morbidities, hypertension, obesity, obstructive sleep apnea, COPD, Diabetes mellitus, and gastro-esophageal reflux disease. The treatment outcomes showed that 85.3% of the patients were discharged, and 2.9% died on admission. The study strengthens the argument that asthma exacerbation morbidity and mortality are higher in older age population (1).

An experimental study done in Egypt on acute severe asthma in emergency department revealed that of the total, 55% of patients suffered from severe and life-threatening asthma exacerbations. The most important predictors for severe exacerbations were old age, previous history of mechanical ventilation, obstructive sleep apnea, overuse of SABA, uncontrolled asthma, moderate to severe depression, eosinophilia, $SO_2 < 90\%$, and low peak expiratory flow rates (23).

2.3 Ethiopian situation

According to the systematic reviews and meta-analysis, among adult Ethiopian patients on 2024, the pooled prevalence of bronchial asthma was 9.1%. Key predictors include childhood age, spring season, urban living, family history of asthma, exposure to insecticides, presence of cockroaches, smoking, obstructive sleep apnea, and recurrent upper respiratory infections. (24).

According to the systematic review and meta-analysis done in Ethiopia on 2023 shows, short-term mortality rate among patients hospitalized for acute asthma exacerbation was 6% and the Key factors significantly associated with short-term mortality included diabetes mellitus, pneumonia and the use of mechanical ventilation. This study highlights that diabetes, pneumonia, and mechanical ventilation are independently linked to increased mortality in these patients. It emphasizes the importance for healthcare providers to recognize comorbidities and risk factors in patients with acute asthma exacerbations to identify those at higher risk and ensure timely treatment (25).

The study done in Addis Ababa on 2018 about Treatment Outcome and Factors Associated with Uncontrolled Asthma, It found that 50.4% had uncontrolled asthma, with significant factors including multiple triggers, cold weather, recent exacerbations, moderate to severe persistent asthma, and certain medication combinations like Salbutamol with Beclomethasone and Prednisolone. The study emphasizes the need for better patient education on medication use and trigger avoidance to reduce the health and economic impacts of uncontrolled asthma (4).

A cross-sectional study conducted at Debre Berhan Referral Hospital in Ethiopia aimed to assess the prevalence and associated risk factors of bronchial asthma among adult patients. The study, which included 257 participants selected through systematic sampling, found a high prevalence of bronchial asthma at 29.6%. Key factors significantly associated with asthma included urban residence, low household income, family history of asthma, and the presence of vermin in the house (26).

2.4 Conceptual framework

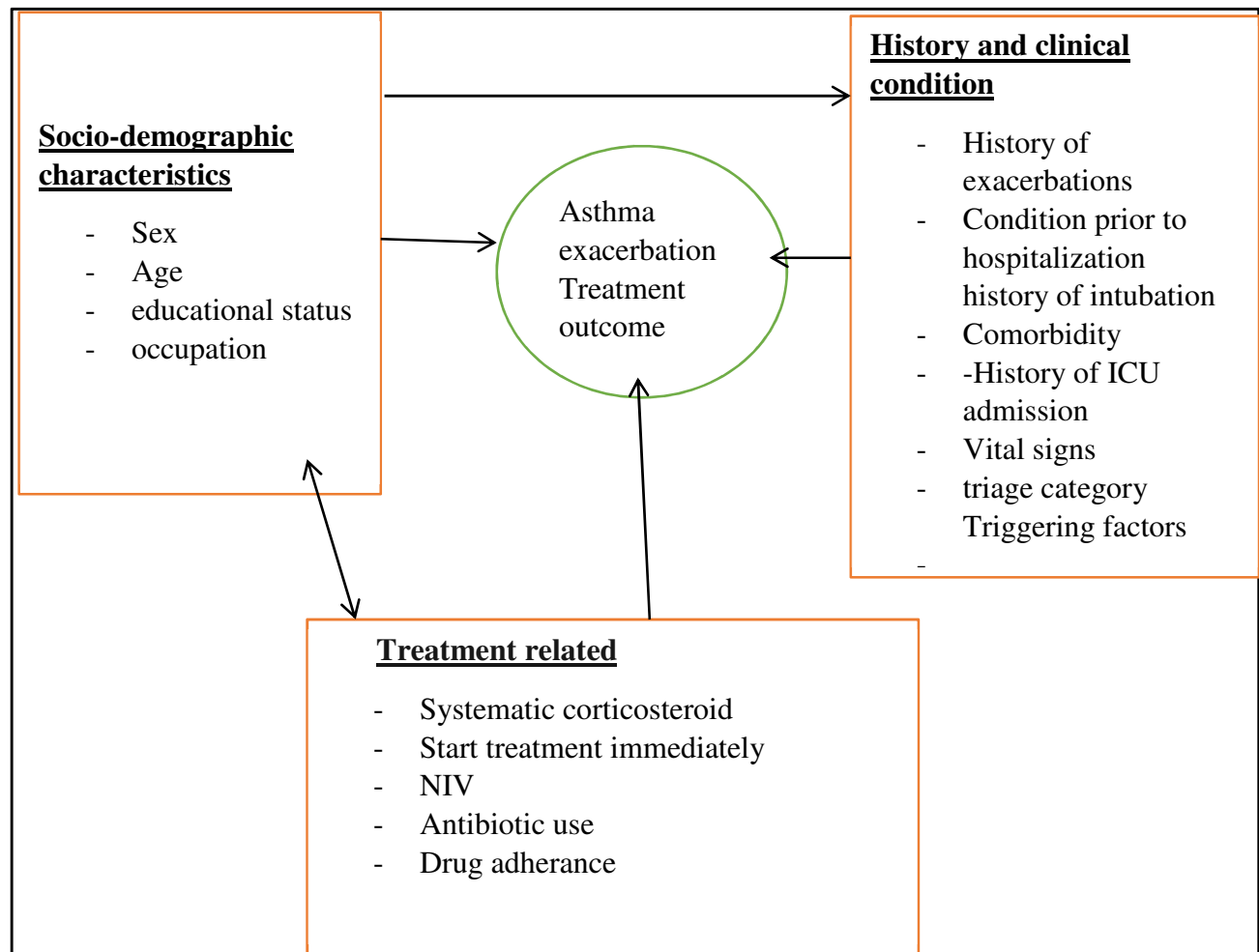


Figure 1: Conceptual framework on acute asthma treatment outcome and factors associated with at emergency department (1, 3, 10-12).

3. OBJECTIVES

3.1 General objective

- To assess the magnitude, risk factors and treatment outcomes of acute exacerbations of bronchial asthma among adult patients at SPHMMC ED, from September 1/ 2024 to September 1/2025 Addis Ababa, Ethiopia.

3.2 Specific objectives

- To determine the magnitude of acute exacerbations of bronchial asthma among adult patients at SPHMMC ED from September 2024 to September 2025.
- To identify the factors associated with the occurrence of acute exacerbations of bronchial asthma.
- To analyze the treatment outcomes of patients experiencing acute exacerbations of bronchial asthma among adult patients at SPHMMC ED from September 2024 to September 2025.

4. METHODS AND MATERIALS

4.1 Study setting and period

This study was conducted at St. Paul's Millennium Medical College's Hospital (SPHMMC) in Addis Ababa, which is the capital city of Ethiopia.

St Paul's Millennium Medical College, was established through a decree of the Council of Ministers in 2010, although the medical school opened in 2007 and the hospital was established in 1968 by the late Emperor Haile Selassie. It is governed by a board under the Federal Ministry of Health. The college has more than 2800 clinical, academic and administrative and support staffs that provide medical specialty services to patients who are referred from all over the country, teaching medicine and nursing students and doing basic and applied researches. While the inpatient capacity is more than 700 beds, The College sees an average of 1200 emergency and outpatient clients daily and a catchment population of 5 million.

Emergency department receives nearly 10,000 patients yearly and has the capacity of more than 20 beds organized into Red, Orange, Yellow and Green. According to the hospital HMIS report, there are around 3 adult asthma patients attended the emergency department on daily basis, which mean around 1000 acute asthmatic patients attending the emergency over one year. This study conducted at SPHMMC Emergency department.

This study was conducted from September 1/2024 to September 1/2025

4.2 Study design

An institutional based retrospective cross-sectional study

4.3 Population

4.3.1 Source population

- All patients who visited ED of SPHMMC during study period.

4.3.2 Study population

- All adult patients who presented with acute exacerbation of bronchial asthma and visited adult emergency department

4.4 Inclusion and exclusion criteria

Inclusion

- All adult (age greater than 18 years of age) patients with acute exacerbation of bronchial asthma who Visited adult Emergency Department of SPHMCC was included.

Exclusion

- A patient with incomplete chart records

4.5 Sampling size and sampling procedure

- A single population proportion formula used to estimate the sample size of acute asthma magnitude, risk factor and treatment outcome amongst asthmatic patients attending emergency department and the following assumptions was made: proportion of treatment outcome of acute asthma patients attending emergency department 50.0% ($p = 0.5$) (Since the prevalence of the problem in the study is not well known in our setting), level of significance to be 5% ($\alpha = 0.05$), 95 % confidence level ($Z_{\alpha/2} = 1.96$) and absolute precision or margin of error to be 5% ($d = 0.05$).

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

$$d^2$$

Where, n = sample size

p = proportion of treatment outcome of acute asthma (50%)

Z = standard normal distribution curve value for the 95% confidence interval

(1.96)

d = the margin of error or accepted error

$$n = \frac{(1.96)^2 0.5(1-0.5)}{(0.05)^2} = 384$$

$$(0.05)^2$$

Since the source population is 1000, which is less than $< 10,000$, population correction formula is used to determine adjusted minimum sample size.

$$n_f = \frac{n}{1 + n/N}$$

$$1 + n/N$$

Where n = initial sample size was 384

N = total number of patients admitted during the study period

n_f – minimum sample size

$$\text{Thus, } n_f = \frac{n}{1 + n/N} = \frac{384}{1 + 384/1000} = 277$$

Sampling procedures

A systematic random sampling was held. So, K_{th} for this study took by taking the ratio of average patient number over the year divided to the calculated sample size. So K was selected by simple random sampling using the lottery method was selected by listing 1,2,3... then finally we continued with K_{th} interval until we were contact the calculated sample size.

4.6 Study variables

Dependent variables

- Outcome of acute asthma exacerbations (Good, Poor)

Independent variable

- **Socio-demographic variables:** Age, sex, Residency, educational status
- **History of disease:** History of recurrence, Condition prior to hospitalization, History of ICU admission, Duration of illness, durations of symptoms, Frequency of exacerbation
- **Clinical Condition:** Mode of arrival, Clinical presentation, Vital signs, Comorbidity, triage category, Current treatment
- **Treatment related factors:** Multiple inhaled drug, systematic corticosteroid, Start treatment immediately, Time of evaluation, Length of stay in ED

4.8 Operational Definition.

Asthma: is a chronic inflammatory disease of the air ways characterized by variable and recurring symptoms, reversible air way obstruction and bronchospasm

Acute Exacerbations of Bronchial Asthma: are episodes of progressive increase in shortness of breath, cough, wheezing, chest tightness, or a combination of these symptoms

Mild asthma; if the speech is in sentences, not use accessory muscle, respiratory rate is in 12 to 20, heart rate is in 60 to 100, oxygen saturation is $\geq 95\%$

Moderate asthma; if the speech is in phrases, mental status is agitated, sometimes use of accessory muscle, respiratory rate is in 20 to 30, heart rate is in 100 to 120, oxygen saturation in 90% to 95%.

Severe asthma; if the speech is in words, mental status is decreased, using of accessory muscle, respiratory rate is >30 , heart rate is >120 , oxygen saturation $<90\%$

Good outcome: Patient disposition from emergency department either improved or admitted to ward

Poor outcome: Patient disposition from emergency department either died or transfer to intensive care unit and intubated patients.

4.9 Data collection tool and procedure

First patients with the diagnosis of acute exacerbation of asthma was retrieved from HMIS log book, then the data was collected through gathering all medical records of patients with acute exacerbation of asthma who came in the study period. Structured questionnaire, adopted from relevant literatures & previous studies developed for similar purposes. The data was collected by the researcher and by other assistant, clinical year medical student, after given a proper training.

4.10 Data Quality Assurance

In ensuring the quality of data, all the data for each patient was checked for completeness, accuracy, clarity and consistency by the principal investigator, immediately after data was collected. Care on questionnaire design by principal investigator and checked all questionnaires (on regular basis) for completeness. Those data which are undocumented on the patient's charts are taken as unknown as reference reported on the other researches

4.11 Data process and analysis

After the data was collected and the responses are coded, the data was entered into a computer

epi data and analyzed using STATA version 17. In the analysis process, frequency distribution of variables worked out in order to describe them. Logistic regression analysis was employed to assess the risk factors for the outcomes of asthma exacerbation and p-value of less than 0.05 was used to declare statistical significance. whereas, 95% confidence interval was used for the strength of association between dependent and independent variables

4.12 Ethical consideration

Ethical clearance was obtained from the Department of Emergency and Critical Care Medicine, and from the SPHMMC ethical review committee. The importance of the study was explained to the participant and confidentiality was maintained throughout the study by removing patient identifiers and using only code numbers generated for this purpose

4.13 Dissemination plan

After completion, the result of this study will be presented in emergency Medicine and critical care department as a defense. The copies of final results will be submitted to St. Paul millennium medical college and will be distributed to library, to postgraduate office and St Paul Hospital administration office and Federal Ministry of Health. Lastly it will be presented on workshops and seminars and will be sent for publication in international journal.

5. Results

5.1 Magnitude of Acute Exacerbation of Bronchial Asthma

During the one-year study period, a total of 7,616 adult patients were seen in the Emergency Department of SPHMMC. Among these, 277 patients presented with acute exacerbation of bronchial asthma, giving a magnitude of 3.6%.

5.2 Socio-demographic and baseline Characteristics of the Study Population

The socio-demographic profile of the 277 patients analyzed in this study is summarized in Table 1. The population had a nearly equal gender distribution, with a slight predominance of females, who accounted for 161 (58.1%) of the participants. The mean age of the patients was 48.8 ± 16.7 years, with an age range from 19 to 95 years. The study population comprised

predominantly middle-aged adults, with nearly half (49.5%) belonging to the 36-60 years age group

Table 1: Socio-demographic and baseline characteristics of adult asthma patients at the SPHMMC ED

Characteristic	Category	Frequency (n)	Percentage (%)
Age group	18-35 years	69	24.9
	36-60 years	137	49.5
	>60 years	71	25.6
Sex	Female	161	58.1
	Male	116	41.9
Mode of arrival	Public Transport	170	61.4
	Ambulance	79	28.5
	Walking/Private car	28	10.1
Time of arrival	Day	173	62.5
	Night	104	37.5
Triage category	Red	26	9.4
	Orange	56	20.2
	Yellow/Green	195	70.4

The majority of patients, 167 (60.3%), were from Addis Ababa, followed by 66 (23.8%) from Oromia Regional State. Regarding religious affiliation, more than half of the patients, 145 (52.3%), were Orthodox Christian. The vast majority of patients, 221 (79.8%), were married. Most patients (61.4%) arrived via public transport, and the majority (62.5%) presented during daytime hours. Regarding triage acuity, 70.4% were classified as Yellow/Green, while 9.4% required immediate resuscitation (Red category) (Table 1).

5.3 Asthma History and Medication Profile

Nearly half (44.0%) of the patients had at least one previous ED visit for asthma exacerbation in the past one year, indicating a population with recurrent severe disease. Among those with previous admissions, 38.8% experienced three or more exacerbations in the past one year. Regarding controller medication, only 27.4% were on appropriate controller therapy, while 40.1% relied solely on SABA for maintenance.

Table 2: Asthma history and controller medication use patterns among patients presented with acute bronchial asthma exacerbations in the emergency department of SPHMMC,2025 (N=277).

Characteristic	Category	Frequency (n)	Percentage (%)
Previous ED admission (past year)	Yes	122	44.0
	No	155	56.0
Recurrence frequency	Once	31	25.6
	Twice	43	35.5
	Three or more times	47	38.8
Controller medication Use	Not on controller	90	32.5
	Salbutamol puff only	111	40.1
	Salbutamol with controllers	76	27.4

5.5 Clinical presentation and severity of asthma exacerbations

Concerning the severity of the asthma exacerbation itself, the majority of patients, 216 (78.0%), were diagnosed with a mild exacerbation. Moderate exacerbations were present in 32 (11.6%) patients, while severe and life-threatening exacerbations were found in 24 (8.7%) and 5 (1.8%) patients, respectively. The most commonly identified triggering factor for the exacerbation was infection, reported in 151 (54.5%) of cases, followed by cold weather (31.0%) and poor adherence to maintenance medication (19.9%).

Table 3: Clinical presentation, triggering factors and severity of asthma exacerbations SPHMMC,2025(N=277)

Clinical Feature	Category	Frequency (n)	Percentage (%)
	Mild	216	78.0

Clinical Feature	Category	Frequency (n)	Percentage (%)
Asthma severity	Moderate	32	11.6
	Severe	24	8.7
	Life-threatening	5	1.8
Triggering factors	Infection	151	54.5
	Cold Weather	86	31.0
	Poor Drug	55	19.9
	Pollen/Dust/Bad	31	11.2

Shortness of breath was the predominant presenting complaint, either alone (45.1%) or in combination with other symptoms. More than half of the patients (53.8%) received antibiotics during their ED management. The average length of stay in the emergency department was 1.71 days (SD = 1.25), ranging from 1 to 10 days.

Table 4: Clinical Presentation and management characteristics patients presented with acute bronchial asthma exacerbations in the emergency department of SPHMMC, 2025

Characteristic	Category	Frequency (n)	Percentage (%)
Primary complaint	Shortness of breath	125	45.1
	Cough	24	8.7
	Shortness of breath with cough	80	28.9
	Chest tightness ± other symptoms	48	17.3
Antibiotics use	Yes	149	53.8
	No	128	46.2
Length of ED stay	Mean ± SD	1.71 ± 1.25	
	Range	1 - 10 days	

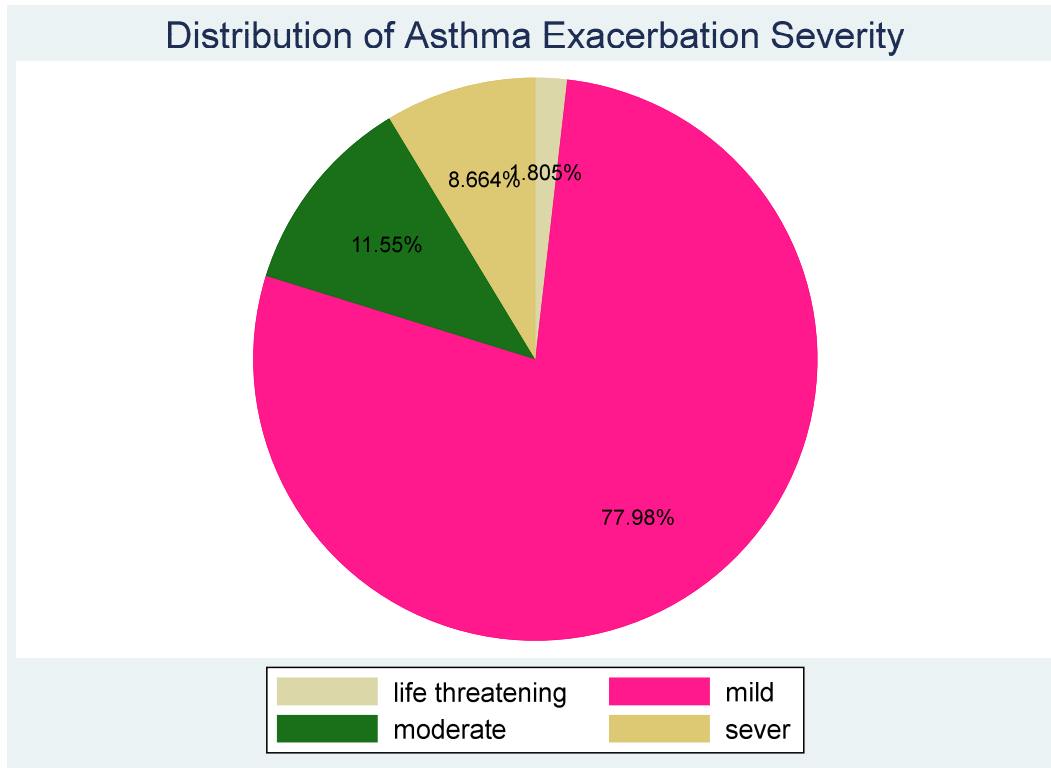


Figure 2: Asthma Exacerbation severity

5.6 Vital Signs and Clinical Parameters by Severity

A comparative analysis of vital signs at presentation, stratified by the severity of the exacerbation, revealed clinically and statistically significant differences, as shown in Table 3. Patients with severe or life-threatening exacerbations had a markedly higher respiratory rate (Mean = 34.2 breaths/min, SD = 9.2) compared to those with mild or moderate exacerbations (Mean = 24.7 breaths/min, SD = 6.9), a difference that was highly statistically significant ($p < 0.001$).

Similarly, oxygen saturation was significantly lower in the severe group (Mean = 74.1%, SD = 12.3) compared to the mild/moderate group (Mean = 84.3%, SD = 9.0), with a p-value of < 0.001 . Pulse rate was also significantly elevated in the severe exacerbation group (111.0 vs. 101.1 bpm, $p = 0.014$). No significant difference was observed in the mean age between the two groups.

Table 5: Vital signs at presentation by asthma exacerbation severity among patients presented with acute bronchial asthma exacerbations in the emergency department of SPHMMC,2025 (N=277).

Vital Sign	Mild/Moderate (n=248) Mean $\pm$ SD	Severe/Life-threatening (n=29) Mean $\pm$ SD	p-value
Age (years)	48.7 $\pm$ 16.4	49.8 $\pm$ 19.7	0.752
Pulse Rate (bpm)	101.1 $\pm$ 19.6	111.0 $\pm$ 27.3	0.014
Respiratory Rate (breaths/min)	24.7 $\pm$ 6.9	34.2 $\pm$ 9.2	< 0.001
Oxygen Saturation (%)	84.3 $\pm$ 9.0	74.1 $\pm$ 12.3	< 0.001

5.7 Patient outcomes following emergency department management

The outcomes for patients after receiving care in the Emergency Department are presented in Table 5. The majority of patients, 200 (72.2%), were discharged home. A significant proportion, 66 (23.8%) patients, required admission to the hospital ward for further management. A small number of patients experienced critical outcomes: 4 (1.4%) were admitted to the Intensive Care Unit (ICU), 2 (0.7%) required intubation, and 1 (0.4%) died. Four patients (1.4%) left against medical advice.

When classified as good (discharge or ward admission) versus poor (ICU admission, intubation, or death), 96.0% of patients had good outcomes, while 2.5% had poor outcomes. Four patients (1.4%) left against medical advice.

Table 6: Treatment Outcome Classification

Outcome Category	Specific Outcome	Frequency (n)	Percentage (%)
Good outcome	Discharged	200	72.2
	Admitted to Ward	66	23.8
	Subtotal	266	96.0
Poor outcome	Admitted to ICU	4	1.4
	Intubated	2	0.7
	Died	1	0.4
	Subtotal	7	2.5

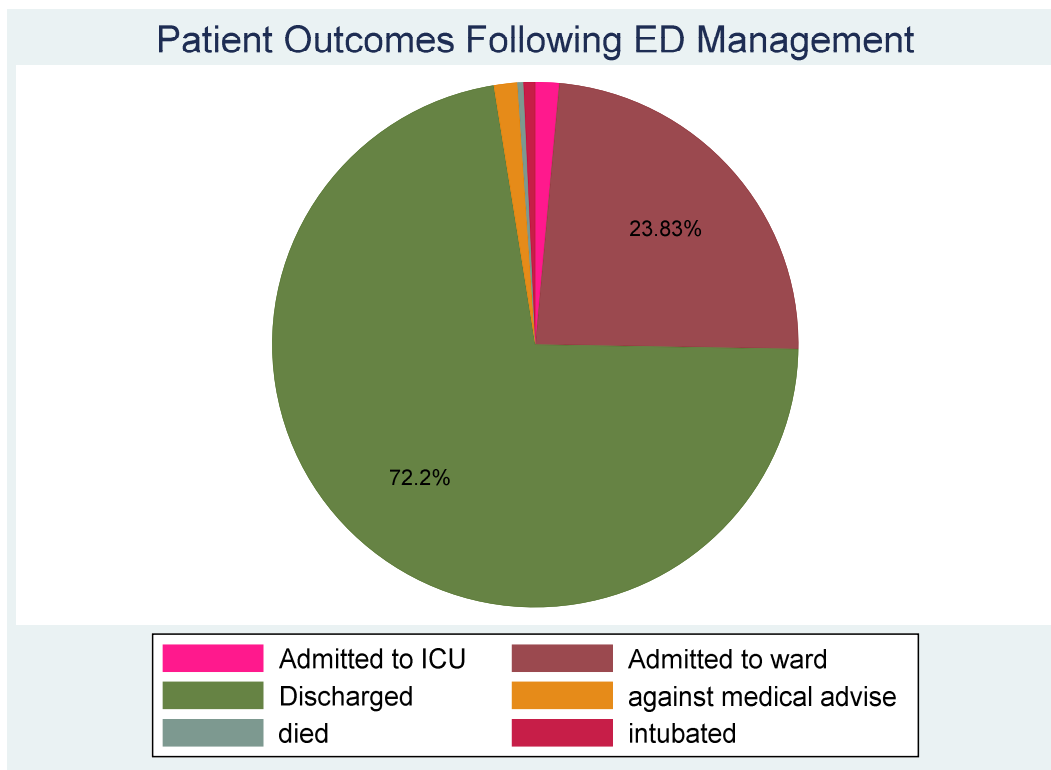


Figure 3: Patient outcome following ED Management

5.8 Treatment Patterns and Therapeutic Interventions

The treatments administered in the Emergency Department varied considerably based on the severity of the exacerbation. Short-acting beta-agonists (SABA) and systemic corticosteroids were used almost universally, in 99.3% and 98.2% of all patients, respectively.

In contrast, the use of oxygen therapy and magnesium sulfate was strongly associated with severity. Oxygen was administered to 96.6% of patients with severe/life-threatening exacerbations, compared to 75.4% in the mild/moderate group ($p = 0.010$). The most pronounced difference was seen in the use of magnesium sulfate, which was administered to 23 (79.3%) patients in the severe group versus only 37 (14.9%) in the mild/moderate group, a difference that was highly statistically significant ($p < 0.001$).

Figure 4: Treatment patterns by severity

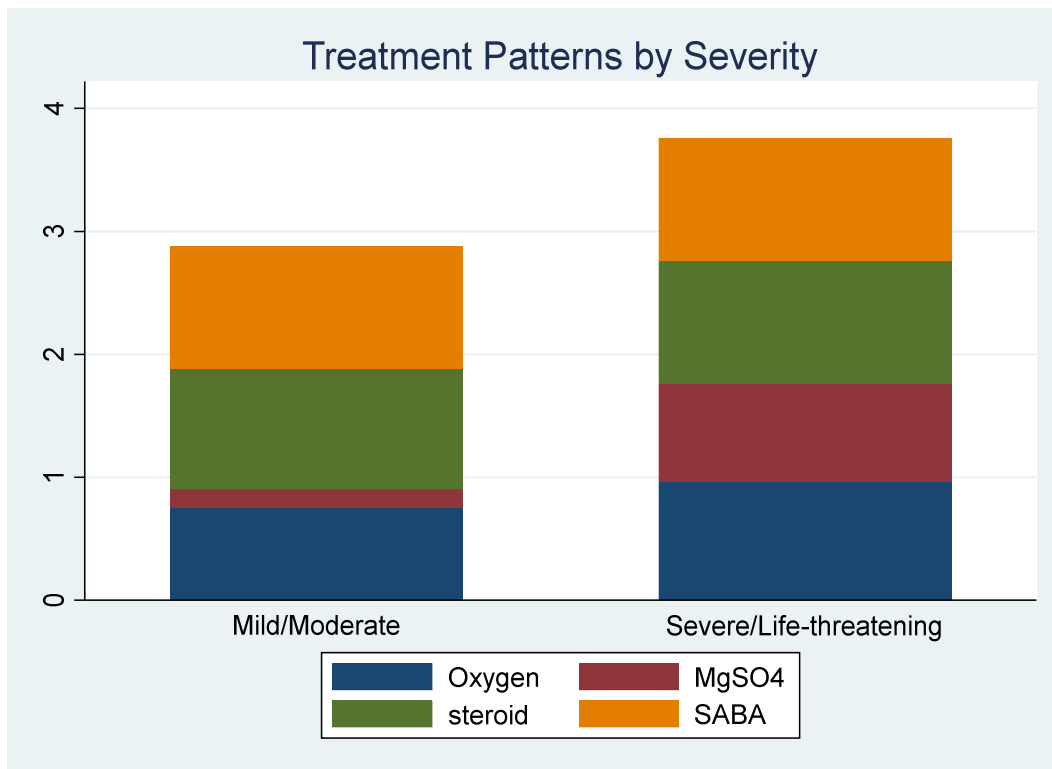


Table 7: Treatment Patterns by Asthma Exacerbation Severity among patients presented with acute bronchial asthma exacerbations in the emergency department of SPHMMC,2025 (N=277).

Treatment	Overall (N=277) n (%)	Mild/Moderate (n=248) n (%)	Severe/Life- threatening (n=29) n (%)	p- value
Oxygen Therapy	215 (77.6)	187 (75.4)	28 (96.6)	0.010
Systemic Corticosteroids	272 (98.2)	243 (98.0)	29 (100)	0.440
SABA	275 (99.3)	246 (99.2)	29 (100)	0.627
Magnesium Sulfate	60 (21.7)	37 (14.9)	23 (79.3)	< 0.001

5.9 Risk Factors for Severe Exacerbation: Bivariate and Multivariate Analyses

A binary logistic regression model was constructed to identify factors independently associated with severe or life-threatening exacerbation.

In the final adjusted multivariate model, three factors emerged as statistically significant independent predictors. The presence of infection as a triggering factor substantially increased the odds of a severe exacerbation by more than four-fold (Adjusted Odds Ratio [AOR] = 4.36; 95% Confidence Interval [CI]: 1.27 – 14.93). Physiological parameters were also strong predictors; each unit increase in respiratory rate was associated with 9% higher odds of severe exacerbation (AOR = 1.09; 95% CI: 1.04 – 1.15), while Lower oxygen saturation was associated with higher odds of severe exacerbation (AOR=0.95 95% CI: 0.91 – 0.99) per 1% increase .

Conversely, the presence of comorbidities was associated with an 85% reduction in the odds of having a severe exacerbation (AOR = 0.15; 95% CI: 0.04 – 0.61). Factors such as age,

pulse rate, and a history of previous ED admission for asthma were not found to be independent predictors in the multivariate model.

Table 8: Factors Associated with Severe/Life-threatening Asthma Exacerbation

Predictor	(AOR)	95% CI	p-value
Infection as Trigger	4.36	1.27 – 14.93	0.019
Presence of Comorbidities	0.15	0.04 – 0.61	0.008
Respiratory Rate (per 1 breath/min increase)	1.09	1.04 – 1.15	0.001
Oxygen Saturation (per 1% increase)	0.95	0.91 – 0.99	0.008
Previous ED Admission	1.70	0.66 – 4.35	0.271
Age (per 1 year increase)	1.02	0.99 – 1.05	0.284
Pulse Rate (per 1 bpm increase)	1.01	0.99 – 1.03	0.334

5.10 Factors Associated with Poor Patient Outcomes

An analysis of factors associated with a composite poor outcome (defined as death, ICU admission, or intubation) revealed that the severity of the exacerbation was the most potent predictor. Patients presenting with a severe or life-threatening exacerbation had dramatically higher odds of a poor outcome, with an Odds Ratio of 78.48 (95% CI: 3.13 – 1969.98; $p = 0.008$). Overall, only 7 (2.5%) of the 277 patients experienced one of these poor outcomes.

6. Discussion

This study provides a critical analysis of the magnitude, risk factors, and treatment outcomes of acute exacerbations of bronchial asthma (AEBA) at the SPHMMC Emergency Department. The findings both resonate with and contrast existing literature, offering valuable insights specific to the Ethiopian context.

6.1 Magnitude of Acute Asthma Exacerbations

The magnitude of AEBA in our ED was found to be 3.6%. This figure is lower than the 5.1% prevalence of asthma exacerbations reported in a Nigerian study (1), but provides a crucial baseline for a tertiary hospital in Addis Ababa. While the global prevalence of asthma is high, affecting an estimated 300 million people (20), our finding reflects the proportion of these cases that escalate to require emergency care. This burden is significant, representing a substantial number of the 7,616 adult visits, and underscores asthma as a key concern for emergency services in our setting, consistent with its status as a serious global health problem causing significant, often preventable, mortality, particularly in low- and middle-income countries (20).

6.2 Patient Demographics and Clinical Presentation

Our cohort, with a mean age of 48.8 years and nearly half (49.5%) aged 36-60, aligns with studies identifying older age as a risk factor for severe exacerbations (1, 27). This contrasts with the broader Ethiopian meta-analysis which identified childhood as a predictor for asthma prevalence (24), suggesting that while asthma may begin in youth, its most acute complications burden adults in our ED. The primary complaint of shortness of breath (45.1%) highlights the typical distressing presentation of AEBA, which guides initial clinical assessment. The high rate of ambulance use (28.5%) further indicates the perceived severity of these episodes by patients and first responders.

6.3 Risk Factors for Severe Disease and Recurrence

A critical finding was that infection was the dominant trigger, present in 54.5% of cases and increasing the odds of a severe exacerbation four-fold. This is a well-documented phenomenon globally, with respiratory viral infections being a primary precipitant of acute

attacks (20). This reinforces the importance of public health measures, including vaccination, as a preventive strategy.

Furthermore, this study reveals a concerning pattern of recurrent exacerbations and suboptimal long-term management. A high proportion of patients (44.0%) had a previous ED visit within the year, with 38.8% of those experiencing three or more exacerbations. This indicates a population with frequent, severe disease, similar to the high burden of severe asthma noted in the African Severe Asthma Project (22). Alarming, only 27.4% of patients were on appropriate controller medication (ICS-containing inhalers), while 40.1% relied solely on SABA puffers. This practice is dangerously incongruent with the 2024 GINA guidelines, which warn that over-reliance on SABA is linked with increased risk of exacerbations and mortality, and recommend that all patients have access to ICS-containing inhalers for both maintenance and relief (GINA, 2024; Update on Asthma Management Guidelines, 2024). This finding mirrors the situation in Addis Ababa described by Tsegaye et al. (2022), where 50.4% had uncontrolled asthma, often linked to medication use patterns.

The paradoxical finding that comorbidities were associated with an 85% reduction in the odds of a severe exacerbation is intriguing. It contradicts some international literature (Sweeney et al., 2023) and the meta-analysis by Idanesimhe Sado et al. (2023) which identified comorbidities like diabetes as predictors of mortality. However, it is plausible that patients with known comorbidities are more engaged with the healthcare system, leading to earlier presentation and thus a "milder" classification at triage. This warrants further investigation into health-seeking behaviors in our population.

6.4 Clinical Assessment and Predictors of Severity

Our results strongly validate the use of simple, objective measures for severity assessment, as emphasized in international guidelines (3). The dramatic differences in respiratory rate (34.2 vs. 24.7 breaths/min) and oxygen saturation (74.1% vs. 84.3%) between severity groups are clear, quantifiable indicators that can be rapidly deployed in a busy ED. This aligns with the Brazilian study by Mallmann et al.(12), which found that early assessment of clinical parameters could predict patient outcomes. The fact that these vital signs were independent predictors in our multivariate model confirms their utility over subjective assessment alone.

The multivariable logistic regression analysis yielded crucial insights into independent risk factors. The finding that infection as a trigger increased the odds of a severe exacerbation by more than four-fold (AOR=4.36, $p=0.019$) is clinically significant. It reinforces the need for proactive management strategies, such as providing asthma action plans that specifically advise on early intervention during intercurrent infections (18).

6.5 Vital Signs as Predictors of Severity

This study robustly demonstrates that simple, routinely measured vital signs are powerful discriminators of exacerbation severity. Patients with severe/life-threatening exacerbations had significantly higher respiratory rates (34.2 vs. 24.7 breaths/min, $p<0.001$) and lower oxygen saturation (74.1% vs. 84.3%, $p<0.001$). These findings are consistent with established asthma severity scores, such as the Pulmonary Index Score and the Asthma Severity Score, which heavily weight respiratory rate and oxygen saturation (28). The significant elevation in pulse rate among severe cases (111.0 vs. 101.1 bpm, $p=0.014$) further reflects the physiological stress and potential hypoxemia associated with severe asthma attacks (National Asthma Education and Prevention Program, 2020).

The strong predictive value of these parameters underscores their indispensability in the initial triage and ongoing assessment of asthmatic patients in the ED. They provide an objective, rapid means of identifying high-risk patients who require more aggressive therapy and closer monitoring.

6.7 Treatment Patterns and Outcomes

The treatment patterns observed demonstrate both adherence to and deviations from guideline-based care. The near-universal use of systemic corticosteroids (98.2%) is exemplary and aligns with robust evidence demonstrating their effectiveness in improving outcomes across all severity levels (11, 13). Similarly, the targeted use of magnesium sulfate in 79.3% of severe cases is commendable and reflects evidence supporting its use in severe, refractory exacerbations (3).

However, the high rate of antibiotic use (53.8%) is a notable deviation. Given that the primary trigger was likely viral in most cases, this practice may indicate a need for antimicrobial

stewardship programs to reduce unnecessary antibiotic exposure, a common challenge in resource-limited settings.

The patient outcomes were largely positive, with 96.0% experiencing a good outcome (discharge or ward admission). This low rate of poor outcomes (2.5%) compares favorably to the 6% short-term mortality found in a recent Ethiopian meta-analysis (Idanesimhe Sado et al., 2023) and the 2.9% mortality in the Nigerian study (Azeez, 2023), suggesting effective acute care at our institution. The strong association between severe exacerbation and poor outcome (OR=78.5) is a critical reminder of the life-threatening nature of these events and echoes findings that a lack of obvious risk factors does not eliminate risk (3).

7. Limitations of the Study

Several limitations should be considered when interpreting these results. First, the study was conducted in a single tertiary center, which may limit the generalizability of the findings to primary care settings or other regions of Ethiopia. Second, being a retrospective study based on chart review, it is subject to potential missing data and documentation errors, as evidenced by the incomplete blood pressure recordings. Third, the definition of some variables, such as "poor drug adherence," was based on patient self-report or clinician documentation, which can be subjective. Finally, the study was not designed to explore the specific types of infections or comorbidities in detail, which could have provided deeper insights into the observed associations.

8. Conclusion and recommendations

8.2 Conclusion

This study demonstrated that acute exacerbations of bronchial asthma continue to be a significant cause of emergency department visits at SPHMMC. Although most patients experienced good treatment outcomes, a notable proportion presented with recurrent attacks, poorly controlled disease, and preventable triggers. Infection was identified as the strongest independent predictor of severe exacerbation, while higher respiratory rate and lower oxygen saturation also correlated with increased severity. The widespread use of short-acting bronchodilators without controller therapy further highlights gaps in long-term asthma management.

Overall, the findings emphasize that most severe exacerbations are preventable. Improving adherence to controller medications, ensuring early recognition of worsening symptoms, and timely management of infections can substantially reduce the burden of severe attacks and improve patient outcomes.

8.2 Recommendations

Public Health:

- Strengthen patient education on the role of infection as a trigger and promote preventive measures, including annual influenza vaccination.

Clinical Practice:

- Strengthen early identification and management of infections, as these are major triggers of severe exacerbations.
- Promote consistent use of guideline-recommended controller therapy, especially inhaled corticosteroids (ICS).
- Use vital signs—particularly respiratory rate and oxygen saturation—as rapid severity indicators during triage.

Further Research:

- Conduct prospective studies to better assess environmental triggers, adherence behavior, and long-term outcomes.
- Investigate the unexpectedly low severity among patients with comorbidities to clarify underlying factors.

9. References

1. Azeez OI. <Prevalence, Risk Factors and Treatment Outcomes of Acute Asthma Exacerbations in Rural South-Western Nigeria.pdf>. Journal of Research In Medicine And Medical Siciences. 2023;4:017-24.
2. Liotta M, Liotta M, Saitta S, Ricciardi L. Severe allergic asthma: Does alexithymia interfere with omalizumab treatment outcome? Asian Pac J Allergy Immunol. 2023;41(1):53-9.
3. Schauer SG, Cuenca P, Johnson J, Ramirez S. <Management Of Acute Asthma In The Emergency Department.pdf>. Emerg Med Pract [en línea] 2013.
4. Tsegaye T, Gebretekla GB, Ahmed MH, Bayissa T, Habte BM. Asthma Treatment Outcome and Factors Associated with Uncontrolled Asthma Among Adult Patients with Asthma in Addis Ababa, Ethiopia. J Asthma Allergy. 2022;15:1055-63.
5. Rajvanshi N, Kumar P, Goyal JP. Global initiative for asthma guidelines 2024: an update. Indian pediatrics. 2024;61(8):781-6.
6. Maselli DJ, Peters JI. Medication regimens for managing acute asthma. Respiratory care. 2018;63(6):783-96.
7. Urso D. Treatment for acute asthma in the Emergency Department: practical aspects. European Review for Medical & Pharmacological Sciences. 2010;14(3).
8. Pollart SM, Compton RM, Elward KS. Management of acute asthma exacerbations. American Family Physician. 2011;84(1):40-7.
9. Dalo A. <Assessment-of-Asthma-Treatment-Outcomes-among-Adult-Outpatients-at-Nemmh-Chest-Clinic-in-Hadiya-Zone-Southern-Ethiopia.pdf>. J Basic Clin Pharm 2017;8.
10. Hussein MH, Elshazli RM, Attia AS, Nguyen TP, Aboueisha M, Munshi R, et al. Asthma and COVID-19; different entities, same outcome: a meta-analysis of 107,983 patients. Journal of Asthma. 2022;59(5):851-8.

11. Indinnimeo L, Chiappini E, Miraglia del Giudice M. Guideline on management of the acute asthma attack in children by Italian Society of Pediatrics. *Italian Journal of Pediatrics*. 2018;44:1-10.
12. Mallmann F, Fernandes A, Ávila EM, Nogueira FL, Steinhorst AMP, Saucedo DZ, et al. Early prediction of poor outcome in patients with acute asthma in the emergency room. *Brazilian journal of medical and biological research*. 2002;35:39-47.
13. Coyle YM, Aragaki CC, Hynan LS, Gruchalla RS, Khan DA. Effectiveness of acute asthma care among inner-city adults. *Archives of Internal medicine*. 2003;163(13):1591-6.
14. Engelkes M, Janssens HM, de Jongste JC, Sturkenboom MC, Verhamme KM. Medication adherence and the risk of severe asthma exacerbations: a systematic review. *European Respiratory Journal*. 2015;45(2):396-407.
15. Reddel HK, Bacharier LB, Bateman ED, Brightling CE, Brusselle GG, Buhl R, et al. Global Initiative for Asthma Strategy 2021: executive summary and rationale for key changes. *American journal of respiratory and critical care medicine*. 2022;205(1):17-35.
16. Moyo D, Zungu M, Erick P, Tumoyagae T, Mwansa C, Muteti S, et al. Occupational health and safety in the Southern African Development Community. Oxford University Press UK; 2017. p. 590-2.
17. Menzies-Gow A, Corren J, Bourdin A, Chupp G, Israel E, Wechsler ME, et al. Tezepelumab in adults and adolescents with severe, uncontrolled asthma. *New England Journal of Medicine*. 2021;384(19):1800-9.
18. Reddel HK, FitzGerald JM, Bateman ED, Bacharier LB, Becker A, Brusselle G, et al. <GINA-2024-Strategy-Report-24_05_22_WMS.pdf>. *American journal of respiratory and critical care medicine* 2024.
19. Song P, Adeboye D, Salim H, Dos Santos JP, Campbell H, Sheikh A, et al. Global, regional, and national prevalence of asthma in 2019: a systematic analysis and modelling study. *J Glob Health*. 2022;12:04052.
20. <Update on Asthma Management Guidelines 2024.pdf>.
21. Adeboye D, Chan KY, Rudan I, Campbell H. An estimate of asthma prevalence in Africa: a systematic analysis. *Croatian medical journal*. 2013;54(6):519-31.

22. Kirenga BJ, Chakaya J, Yimer G, Nyale G, Haile T, Muttamba W, et al. The burden of severe asthma in sub-Saharan Africa: Findings from the African Severe Asthma Project. *J Allergy Clin Immunol Glob*. 2024;3(2):100209.
23. Mohamed AZEL-A, Shaaban LH, Gad SF, Azeem EA, Gamal Elddin W. Acute severe asthma in emergency department: clinical characteristics, risk factors, and predictors for poor outcome. *The Egyptian Journal of Bronchology*. 2022;16(1):57.
24. Adal O, Mamo ST, Belay AE, Tsehay YT, Netsere HB, Mulatu S, et al. The prevalence of asthma and its predictor among patients presenting in Ethiopian public hospitals: systematic review and meta-analysis, 2024. *Therapeutic Advances in Respiratory Disease*. 2024;18:17534666241275336.
25. Idanesimhe Sado A, Afzal MS, Kannekanti L, Pamreddy HR, Pimentel Campillo J, Kandukuri V, et al. A Meta-Analysis on Predictors of Mortality Among Patients Hospitalized for Acute Exacerbation of Asthma. *Cureus*. 2023;15(2):e35225.
26. Shine S, Muhamud S, Demelash A. <Prevalence and associated factors of bronchial asthma.pdf>. 2019.
27. Mohamed AZELA, Shaaban LH, Gad SF, Azeem EA, Gamal Elddin W. Acute severe asthma in emergency department: clinical characteristics, risk factors, and predictors for poor outcome. *The Egyptian Journal of Bronchology*. 2022;16(1).
28. Belachew EA, Tadess S, Alemayehu M, Ayele EM. Level of asthma control and its determinants among adults living with asthma attending selected public hospitals in northwestern, Ethiopia: using an ordinal logistic regression model. *Asthma Res Pract*. 2022;8(1):5.

ANNEXES

Annex-I Informed Consent

Saint Paul Hospital Millennium Medical College Department of Emergency and critical care
Consent form for participation in a research study

I am being invited to allow the use of my past medical records for a retrospective study led by Belay Tessema, Year 3 Emergency and Critical Care Medicine, at St. Paul's Hospital Millennium Medical College. The study aims to assess the magnitude, risk factors, and treatment outcomes of acute exacerbations of bronchial asthma using information already documented in my medical chart. No interviews, procedures, or tests will be performed, and there is no physical risk involved. My identity will remain confidential, and no personal identifiers will appear in the research. Participation is voluntary, and choosing not to participate or withdrawing later will not affect my medical care. By signing below, I confirm that I understand the study and consent to the use of my medical records for this research.

Annex II: Questioner

Sociodemographic data

1. Patient card number-----
2. Age of a patient in years-----
3. Sex of a patient A. Male B. Female
4. Ethnicity A. Addis Ababa B. Oromia C. Amhara D. SNNPR. E. Others
5. Religion A. Orthodox B. Muslim C. Protestant D. Others
6. Marital status A. Single B. Married C. Divorced D. Widowed E. unknown
7. Occupation A. Farmer B. Trader C. Government employer
D. self-employee E. Un employed F. Others
8. Residency A. urban B. rural
9. Smoking status A. smoker B. Non-smoker C. unknown

2. clinical presentation

10. patient triage to A. red B. orange C. yellow D. green
11. Wheezing A. YES B. NO
12. Cough A. YES B. NO
13. Dyspnea A. YES B. NO
14. Limits daily activity A. YES B. NO
15. Rhinitis A. YES B. NO
16. Sinusitis A. YES B. NO
17. Atopic dermatitis A. YES B. NO
18. Altered mental status A. YES B. NO

19. Cyanosis A. YES B. NO

3. Physical Examination at Presentation

20. Heart rate A. 80-100 B. 101-120 C. >120 D. <60

21. Respiratory rate A. 16-20 B. 21-30 C. >30 D. <16

22. Oxygen saturation A. >90% B. 80%-89% C. 70% - 79% D. <70% 28

23. Mental status A. Comatose B. Agitated C. Distressed D. Conscious

24. Severity A. Mild B. Moderate C. Severe D. Life-threatening

4. Acute Triggers

A. cold air A. yes B. no

B. URTI A. yes B. no

C. poor adherence A. yes B. no

D. Allergens A. yes B. no

E. Drugs A. yes B. no

F. Exercise A. yes B. no

G. Stress A. yes B. no

H. Smoking A. yes B. no

25. Do you have family history of asthma? A. yes B. no

26. No of hospital admission of the patient per year A. once B. twice C. three times D. four & more

7. Pattern of medication given;

27. Bronchodilators

A. SABA

B. LABA

C. Theophylline

D. Anticholinergic (Ipratropium)

29. Anti-inflammatory

A. ICS B. OCS C. parenteral CS D. Antileukotrienes E. others

30. Adjunctive

A. Oxygen B. Antibiotics C. Analgesics D. others

31. ICU Admission A. yes B. no

32. MgSo4 A. yes B. no

33. Intubation A. yes B. no

34. Presence of comorbidity

A. CAP B. HTN C. DM D. CHF E. UTI F. others

35. Outcomes

A. discharged

B. admitted to ward

C. Admitted to ICU

D. Died

E. intubated

10.Assurance of Principal Investigator

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide timely progress reports to my advisor and seek the necessary advice and approval from my primary advisors in the course of the research. I will communicate timely to my advisors all stakeholders involved in the study including any source of funding for this research.

Name of the student: _____

Signature: _____

Date: _____

Approval of the Primary Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____

Approval of the Co-Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____