WOLKITE UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCES,

DEPARTMENT OF INTERNAL MEDICINE

ASTHMA CONTROL STATUS AND ASSSOCIATED FACTORS AMONG ADULTS WITH BRONCHIAL ASTHMA ON FOLLOW-UP AT PUBLIC HOSPITAL IN GURAGHE ZONE, CENTRAL ETHIOPIA, 2025.

BY: DR. AKMEL MOHAMED (IMR3)

A RESEACH THESIS TO BE SUBMITTED TO DEPARTMENT OF PUBLIC HEALTH, COLLEGE OF MEDICINE AND HEALTH SCIENCES, WOLKITE UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR IN INTERNAL MEDICINE PROGRAM SPECIALITY.

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WOLKITE UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCES, DEPARTMENT OF INTERNAL MEDICINE BY DR. AKMEL MOHAMED (MD, SENIOR RESIDENT IN INTERNAL MEDICINE) A THESIS REPORT SUBMITTED TO COLLEGE OF MEDICINE AND NATURAL SCIENCE SCHOOL OF MEDICINE DEPARTMENT OF INTERNAL MEDICINE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE INTERNAL MEDICINE SPECIALITY TRAINING

Full Title of The Research Project	ASTHMA CONTROL STATUS AND ASSSOCIATED FACTORS AMONG ADULTS WITH BRONCHIAL ASTHMA ON FOLLOW-UP AT PUBLIC HOSPITALS IN GURAGHE ZONE, CENTRAL ETHIOPIA, 2025.
Name of Advisors	1. Dr Teshome Gensa (BSC, Phd in RH). **2.** Dr Meskele Bireda (MD, Internist)
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Certification Sheet

We hereby certify that we have read and evaluated this Thesis titled "level of asthma control and factors associated with poor asthma control among asthmatic patients attending in Gurage zone public hospital, Ethiopia, Central Ethiopia 2025,: An institutional based cross-sectional Study" prepared under our guidance prepared by Dr Akmel Mohamed We recommend that the Thesis shall be submitted as fulfilling the requirements for the award of Certificate of Specialty in Internal Medicine.

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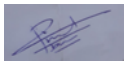
2. Dr.Riyad Ibrahim (MD, Asst.Prof)  13/02/2026

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DECLARATION

By my signature below, I declare and affirm that this specialty thesis entitled “the level of asthma control and factors associated with poor asthma control among asthmatic patients attending in Gurage zone public hospital, Ethiopia, Central Ethiopia 2025” is my own work and I declare that this thesis has not been submitted to any other university anywhere for the award of any academic degree and I have cited and referenced all sources and material used in this document.

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Abbreviation / Acronym	Full Form
ACT	Asthma Control Test
AIRE	Asthma Insights and Reality in Europe
BDR	Bronchodilator Reversibility
CIA	Central Intelligence Agency
COPD	Chronic Obstructive Pulmonary Disease
DALY	Disability-Adjusted Life Year
DPI	Dry Powder Inhaler
EPR-3	Expert Panel Report 3 (NHLBI asthma guidelines)
FPC	Finite Population Correction
GARD	Global Alliance against Chronic Respiratory Diseases
GBD	Global Burden of Disease
GINA	Global Initiative for Asthma
ISSAC	International Study of Asthma and Allergies in Childhood
LABA	Long-Acting Bronchodilator Agonist
ICS	Inhaled Corticosteroid
LAMA	Long-Acting Muscarinic Antagonist
MDI	Metered Dose Inhaler
MEA	Middle East and Africa
NAEPP	National Asthma Education and Prevention Program
NHLBI	National Heart, Lung, and Blood Institute
OCS	Oral Corticosteroid
QoL	Quality of Life
SABA	Short-Acting Beta-2 Agonist
SABINA	SABA use IN Asthma (study)
SPSS	Statistical Package for the Social Sciences
TPE	Therapeutic Patient Education
WHO	World Health Organization

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Abstract

Background: Asthma is a major health challenge globally where majority of the patients have uncontrolled disease status. According to the Global Initiative for Asthma (GINA) guidelines, one of the goals of asthma management is to achieve clinical control. Despite good understanding of therapeutic regimens, there is evidence for suboptimal asthma control in many patients. However, there is limited local evidence on the magnitude of uncontrolled asthma and its associated factors in our setting.

Objectives: The aim of this study is to assess level of poor asthma control and associated factors among asthmatic patients attending public hospitals in Gurage zone, Ethiopia.

Methods: An institutional based cross-sectional study was conducted among clinically diagnosed asthmatic patients who were consecutively enrolled from follow up clinic at public hospital in Gurage zone. Data were collected using a interviewer-administered questionnaire and asthma control was assessed based on the Global Initiative for Asthma (GINA) guidelines. Data were entered into Epi-data 4.6 and analyzed using SPSS version 27. Binary logistic regression was used to examine the association between independent factors and uncontrolled asthma. A variables with adjusted odds ratio (AOR) of 0.05 declared as having significant association.

Result: Among the 283 study participants, the mean age was 53 ± 14 years, and the median duration of asthma was 9 ± 7 years. Out of total participants,74.9% (212/283) had uncontrolled asthma. Uncontrolled asthma was significantly associated with variables including salbutamol use as rescue medication (AOR = 5.18; 95% CI: 2.21–12.18), poor pMDI technique (AOR = 12.35; 95% CI: 3.54–43.06), presence of comorbid disease (AOR = 3.20; 95% CI: 1.41–7.26), longer asthma duration (>6–30 years) (AOR = 11.3; 95% CI: 6.2–20.6), illiteracy (AOR = 2.51; 95% CI: 1.12–5.62)and lack of regular physician follow-up (AOR 11.65 (2.97– 45.79)) were significantly associated with uncontrolled asthma.

Conclusion and recommendation: Nearly three fourth of asthma patient at follow up had uncontrolled asthma. Poor inhaler technique, inadequate follow-up, longer disease duration, comorbid conditions, and lower educational status were factors associated with it. Therefore, promoting regular follow up, strengthening patient centered counseling particularly for patients with comorbidities and low educational status would help control asthma.

Keywords: Asthmatic patients, poor asthma control, Gurage zone, Ethiopia.

1. Introduction

1.1 Background

According to the Global Initiative for Asthma (GINA) 2025, asthma is defined as a heterogeneous disease characterized by chronic airway inflammation. It is identified by a history of respiratory symptoms such as wheeze, shortness of breath, chest tightness, and cough that vary over time and in intensity. Although asthma is associated with airway hyperresponsiveness and airway inflammation, these are not sufficient to make the diagnosis (1).

Globally, asthma affects between 1% and 29% of the population across different countries, as reported in the 2024 GINA update. It poses a considerable public health burden reducing quality of life, limiting productivity, increasing healthcare costs, and elevating the risk of hospitalization and even death (2). The level of asthma control has a significant impact on Disability-Adjusted Life Years (DALYs); when uncontrolled, it increases financial strain and interferes with daily activities, leading to physical, emotional, and social limitations (3).

Asthma control remains the primary goal of long-term management since asthma cannot be cured. Control can be achieved in most patients through a continuous cycle of assessment, treatment, and monitoring**.** Asthma control is defined by the degree of current clinical manifestations and the risk of future exacerbations (4). The GINA Guidelines classify asthma control into three levels: controlled, partly controlled, and uncontrolled. Good control implies the absence of symptoms and activity limitations, minimal airflow restriction, and minimal use of rescue medications(5). According to the Asthma Control Test (ACT), a score of less than 19 indicates poorly controlled asthma (6).

Prioritizing disease control through consistent maintenance therapy particularly with dry powder inhalers (DPIs**)** where appropriate not only reduces symptoms and exacerbation risk but also contributes to environmental sustainability(7).

It’s also crucial to distinguish between asthma severity and asthma control. Control looks at two key areas: current symptoms (impairment) and the risk of future attacks (exacerbations). Intriguingly, even patients who seem to have their daily symptoms well-managed can still face

severe, sudden exacerbations (8). This highlights why asthma care must always balance symptom relief with vigilant risk monitoring.

1.2 STATEMENT OF THE PROBLEM

Asthma is highly prevalent and important public health problem worldwide. It can occur in all age groups, ethnicity and geographic areas. WHO indicates that the prevalence of asthma is increasing worldwide, with estimated 329 million affected people and estimated it will reach 400 million by 2025(9)

In south Jordan asthma control was achieved in 45.2% of the sample. Moreover, older age, severe asthma according to the GINA guidelines, longer duration of asthma, atopy, being on treatment for asthma and history of allergic rhinitis were identified as the main risk factors contributing to poorly controlled asthma(10)

Despite International Guidelines and the availability of medications, control of asthma proves difficult to achieve. A study consisted of 29 countries of Europe, America and Asia showed that asthma control is very poor world-wide. Day time symptoms were reported in up to 74% of asthmatics patients under treatment(11)(12). Another study done in Europe found that the level of uncontrolled asthma was 45%(13). In Canada, one study found that in almost 60% of patients had poorly controlled asthma and it was accounted for 250-300 deaths annually(14).

In Africa, only few studies have assessed level of asthma control. One study conducted in North African countries reported that 71.3% of the patients had uncontrolled asthma(15), whereas in another studies in Cameroon and Nigeria, the proportion of poorly controlled asthma were 42% and 69.3%, respectively(16,17).

The report of the third phase of the International Study of Asthma and Allergies in Childhood (ISAAC) study (2007) indicated asthma prevalence rates of 21.2% in Kenya, 13.0% in Nigeria, and 25.0% in South Africa(18).

Few studies done in Ethiopia reported that the level of uncontrolled asthma was high. One study done in Addis Ababa found that asthma was poorly controlled in 53.3% of the patients(19). whereas, study done in Jimma found that asthma was uncontrolled in 64.5%(20).

Epidemiologic studies suggested that healthcare access and use, smoking status, poor adherence to doctor’s advice, critical errors in inhaler use, oral corticosteroid use, and lack of regular

specialist care are significant factors associated with uncontrolled asthma(21). Another study found that patient-related factors such as poor inhalation technique, non-adherence to treatment and inadequate coping techniques are important contributing factors although other patient related and environmental triggers may play important role(22).

Most of asthma health and economic burden appears to be related to poor asthma control; with the average cost of asthma management was more than six times higher among patients with poorly controlled asthma(23). Poorly controlled asthma increases the burden of asthma symptoms and considerable impact patients' daily activities. One study found that the risk for daily activity limitations was increased by 66% in patients with uncontrolled asthma(24).

It is only relatively recently that Asthma in Ethiopia has started to receive the attention that it deserves. There is lack of high-quality asthma care and lack of health care coverage. Most populations not receive care even for those whom have health insurance. In spite of internationally recognized guidelines for the treatment of asthma; most providers of health services have not yet fully implemented the guidelines in their practices (25). Multiple studies have found that many asthma patients do not follow their prescribed treatments. It is crucial not only for them to take their medication but also for them, their family, and friends to gain a better understanding of asthma's causes and how treatments work(26)(27)(28).

In a nut shell, The World Health Organization (WHO) and other experts have emphasized that asthma is an overlooked contributor to poverty in low- and middle-income countries. It hinders economic and social progress, compromises the health and well-being of those affected, and negatively impacts families and communities. Additionally, asthma is known to cause severe financial strain on healthcare expenses and poses a challenge to achieving universal health coverage(29).

Despite numerous studies on asthma control globally and in various regions of Ethiopia, there is a significant lack of research specifically focused on asthma control and its predictors in the Gurage Zone, Central Ethiopia. Most existing Ethiopian studies have been conducted in other regions, but There is no adequate information regarding the level of asthma control and its associated factors in the Gurage Zone. Unlike studies in Addis Ababa and Wollega, Gurage Zone is mainly rural, with most residents being farmers and having low literacy levels, which may affect asthma control(30)(31). Furthermore, the wide variation in reported rates of poor asthma

control and associated factors across different Ethiopian settings suggests that findings from other regions may not be generalizable to Gurage Zone. Additionally, limited data exist on the appropriateness of asthma management and patient adherence in this area. Therefore, this study was conducted to assess the magnitude of poor asthma control and identifying its predictors among adults attending follow-up at public hospitals in Gurage Zone, providing context-specific evidence to inform local asthma care strategies.

1.3 SIGNIFICANCE OF THE STUDY

Ultimately, this study sought to fill critical knowledge gaps by providing an up-to-date and comprehensive understanding of asthma control, thereby supporting informed public health planning and targeted interventions. The study assessed the magnitude of asthma control status and identified factors associated with poor asthma control among asthmatic patients attending hospitals in the Gurage Zone, Ethiopia. The findings of this study were expected to assist clinicians in improving asthma control and addressing factors related to poorly controlled asthma. Furthermore, the results may help policymakers and health planners in designing strategies to promote asthma control and may serve as baseline data for future research on asthma control.

2 Literature Review

2.1 Asthma control

Asthma control can be broken down into two domains: impairment and risk. Impairment is an assessment of the frequency and intensity of symptoms and functional limitations that a patient is experiencing or has recently experienced. Risk is an estimate of the likelihood of either asthma exacerbations or of progressive loss of pulmonary function over time(32).

Despite the availability of effective therapies there is direct evidence for suboptimal asthma control in many patients worldwide, with long-term management falling far short of the goals set in the GINA guidelines (9). A survey conducted in 11 European countries and involving 8000 asthma patients found that level of GINA-defined asthma control remains low, with 45% of the patients having uncontrolled asthma. Acute exacerbations that required oral steroids were reported by 44.0% of the patients and 23.9% of them had visited the emergency department(33,34).

In the United States, asthma was uncontrolled 51.6% of asthmatic patients (33). Another study in the United States, the CHARIOT study found that greater than 80% of asthma patients were uncontrolled with regard to asthma symptoms (35).

Asthma control study conducted in the Asia-Pacific region countries found that 51.4% of patients had daytime symptoms while, 44.3% reported nocturnal symptoms in prior month. Hospitalization, emergency department admission, or unscheduled visit to health facilities were reported by 43.6% of patients during the previous year (36).

In Africa, there are few focused studies on asthma control. One Study done North Africa reported that 71.3% of patients have uncontrolled asthma (37). In Lesotho, only 32% of the patients had good asthma control (25). Almost half (48%) of the patients had nocturnal symptoms and 30% had experienced daytime symptoms at least twice a week in the past four weeks; 42% reported interference with normal daily activities and 16 out of 34 employed patients had missed work and students (47%) had missed school due to asthma. Emergency department visit were reported by 42% of the patients in the prior six months, whereas, asthma-related hospitalization was reported by 10% of patients in the past year (38).

Asthma control study done in Nigeria found that 82.9% of patients had poorly controlled asthma symptoms, whereas, 38% patients reported emergency department visits in the prior month (39).

Another study done Nigeria found similar pattern of poorly controlled asthma, with 69.3% of the patients reported poorly controlled asthma (40).

In Ethiopia, in Jimma it was reported that 76.1% of the patients had poorly controlled asthma(32) Another study in Hadiya Zone, 56.2% were reported having poorly controlled asthma. 59% were having an asthma exacerbation in prior year, whereas 25% of patients had hospitalization at least minimum of once in their follow up due to asthma related symptoms (32).

2.2 Factors associated with uncontrolled asthma

2.2.1 Socio demographic factors

Socio-demographic factors have been consistently linked to asthma control globally and in Africa. Studies from Khartoum and Kinshasa highlighted that low educational level and female sex were associated with poor asthma control, while having a family history of asthma provided some protective effect. In Ethiopia, evidence from tertiary hospitals and referral centers in Addis Ababa and Jimma indicated that female sex, illiteracy, rural residence, and certain occupations—such as farming were associated with uncontrolled asthma. These findings suggest that socio-demographic characteristics influence patients' ability to understand, access, and adhere to asthma management strategies, highlighting the need for targeted education and support interventions (41) (44) (42) (43).

2.2.2 Behavioral related factors

Behavioral factors, including smoking, exposure to indoor and outdoor pollutants, and adherence to follow-up visits, are major determinants of asthma control. Studies across Africa reported that patients who smoked or were exposed to pollutants and who missed scheduled clinic appointments exhibited poorer asthma control(44). In Ethiopia, research from East Wollega, Jimma, and Addis Ababa confirmed that irregular follow-up and lifestyle exposures such as biomass fuel use for cooking significantly increased the risk of uncontrolled asthma. These findings emphasize that promoting healthy behaviors and ensuring consistent medical follow-up are essential for optimal asthma management (45) (46).

2.2.3 Disease Characteristics

Disease-related factors such as asthma duration, symptom frequency, severity, comorbidities, family history, and prior hospitalizations are strongly associated with asthma control. Evidence from Nigeria and the Democratic Republic of Congo demonstrated that longer disease duration, severe asthma, comorbidities, and early-onset asthma were linked to poor control (47) (48). Similarly, Ethiopian studies reported that longer asthma duration (>30 years), presence of comorbid conditions, previous exacerbations, and frequent emergency visits significantly increased the likelihood of uncontrolled asthma (45). These findings indicate that both the intrinsic characteristics of the disease and patients' clinical history play a central role in achieving adequate asthma control.

2.2.4 Medication-Related Conditions

Medication-related factors, particularly inhaler technique, adherence, type of medications, and access to treatment, are critical determinants of asthma control. Globally, studies have shown that incorrect inhaler use, poor adherence to inhaled corticosteroids, and reliance on oral corticosteroids were associated with poor asthma control. African studies, including those from Nigeria, Khartoum, and Ethiopia, reinforced that improper inhaler technique markedly increases the risk of uncontrolled asthma, while regular controller medication use and proper adherence improve outcomes. In Ethiopia, studies from Jimma and Addis Ababa showed that patients with incorrect inhaler technique, irregular medication use, and inadequate access to prescribed drugs had the highest risk of poor asthma control, highlighting the importance of patient education and continuous monitoring (42) (45).

2.3 Appropriateness of asthma management

The main goal of asthma treatment is to control symptoms, prevent exacerbations, and enable patients to live normal lives. According to the Global Initiative for Asthma (GINA), management should be individualized using a stepwise approach based on symptom severity and frequency. For mild asthma, low-dose ICS–formoterol is the preferred option (Track 1), while taking ICS whenever SABA is used (Track 2) is an alternative(1).

If control is inadequate, treatment should be stepped up by increasing doses or adding therapies such as LAMAs, biologics, or oral corticosteroids. The Global Strategy for Asthma Management and Prevention is widely used as the global standard for evaluating asthma management(1).

From a broader, public health perspective, asthma care also aims to reduce how many people die from asthma, how often they need emergency care, and the wider social and economic costs of poorly controlled asthma like missed work or school and high medical expenses(49).

Asthma care in Europe still isn't where it should be. Back in 2014, a study looked at 8,000 people with asthma and found that nearly half of them didn't have their condition under control. Almost the same number had taken oral steroids for asthma in the past year which usually means they'd had flare-ups or serious symptoms(50).

In the UK, another study found something interesting: people who had their asthma under control using fewer quick-relief inhalers and avoiding flare-ups also had a much smaller carbon footprint. In fact, their environmental impact was about a third of what it was for those with poorly managed asthma. This tells us that helping people manage their asthma better is still a major health goal(51).

There isn't a lot of detailed data on how severe asthma is or how well it's managed across Latin America. But some recent studies have given us a better picture. One of those is the SABINA study, which looked at how people in several Latin American countries use asthma medications, particularly quick-relief inhalers(52).

Between March 2019 and January 2020, the study looked at 1,100 asthma patients from Argentina, Brazil, Chile, Colombia, Costa Rica, and Mexico. The results showed that a large majority about 79% had moderate to severe asthma. On top of that, 31% had asthma that was only partly controlled, while 30% had poor control over their symptoms. Almost half of the patients had at least one asthma attack during the year. These numbers show that asthma is a serious and often poorly controlled condition for many people in Latin America (53).

Asthma in Africa is increasingly common but often underdiagnosed and poorly controlled. Weak healthcare systems, limited trained staff, poor disease awareness, lack of objective monitoring, and the high cost and limited availability of inhaled corticosteroids all contribute to suboptimal

management and outcomes.(54). Furthermore, Asthma management in resource-limited settings is further hindered by the scarcity and high cost of essential devices and medications, such as spacers, which remain largely unaffordable even when available.

In the Middle East and Africa (MEA) region, asthma management faces several persistent challenges. Common issues include overreliance on and overuse of short-acting β-agonists (SABAs), under prescription of inhaled corticosteroids (ICS), poor adherence to treatment regimens, and insufficient insurance coverage. Contributing factors include the widespread availability of SABAs over the counter, unsupervised refilling of outdated prescriptions, reliance on SABAs for immediate symptom relief during exacerbations, and limited awareness of current clinical guidelines among both patients and healthcare providers(55).

2.4 Gaps identified from literature

Globally, despite the availability of effective asthma therapies and clear management guidelines such as those from GINA, asthma control remains suboptimal in a large proportion of patients. Numerous studies from Europe, the United States, and the Asia-Pacific region consistently report high rates of uncontrolled asthma and frequent acute exacerbations, indicating a widespread challenge in achieving optimal disease management. However, there is a significant gap in harmonized, comprehensive data from many low- and middle-income countries, especially across Africa and parts of the Middle East, which limits the ability to fully understand regional variations and tailor interventions accordingly(49).

In Africa, this gap is even more pronounced due to limited healthcare infrastructure, inadequate availability of essential medications such as inhaled corticosteroids, and a shortage of trained healthcare professionals. Many asthma patients face barriers related to cost, access, and lack of awareness about asthma management, which are less documented in the literature. Furthermore, objective assessments like peak expiratory flow measurements and standardized symptom control questionnaires are infrequently used, making it difficult to accurately evaluate asthma control status. In Ethiopia, specifically, studies have reported high proportions of poorly controlled asthma, with rates ranging from over 50% to more than 76%. However, the factors contributing to this poor control, including healthcare delivery challenges, patient adherence, inhaler technique,

and access to medications, remain underexplored. This lack of detailed, context-specific evidence creates a gap in understanding the local barriers to effective asthma management and limits the development of tailored strategies to improve patient outcomes in Ethiopia.

2.5 Conceptual framework

Socio-demographic, clinical characteristics, medication related and patient behavior will be identified as factors associated with uncontrolled asthma.

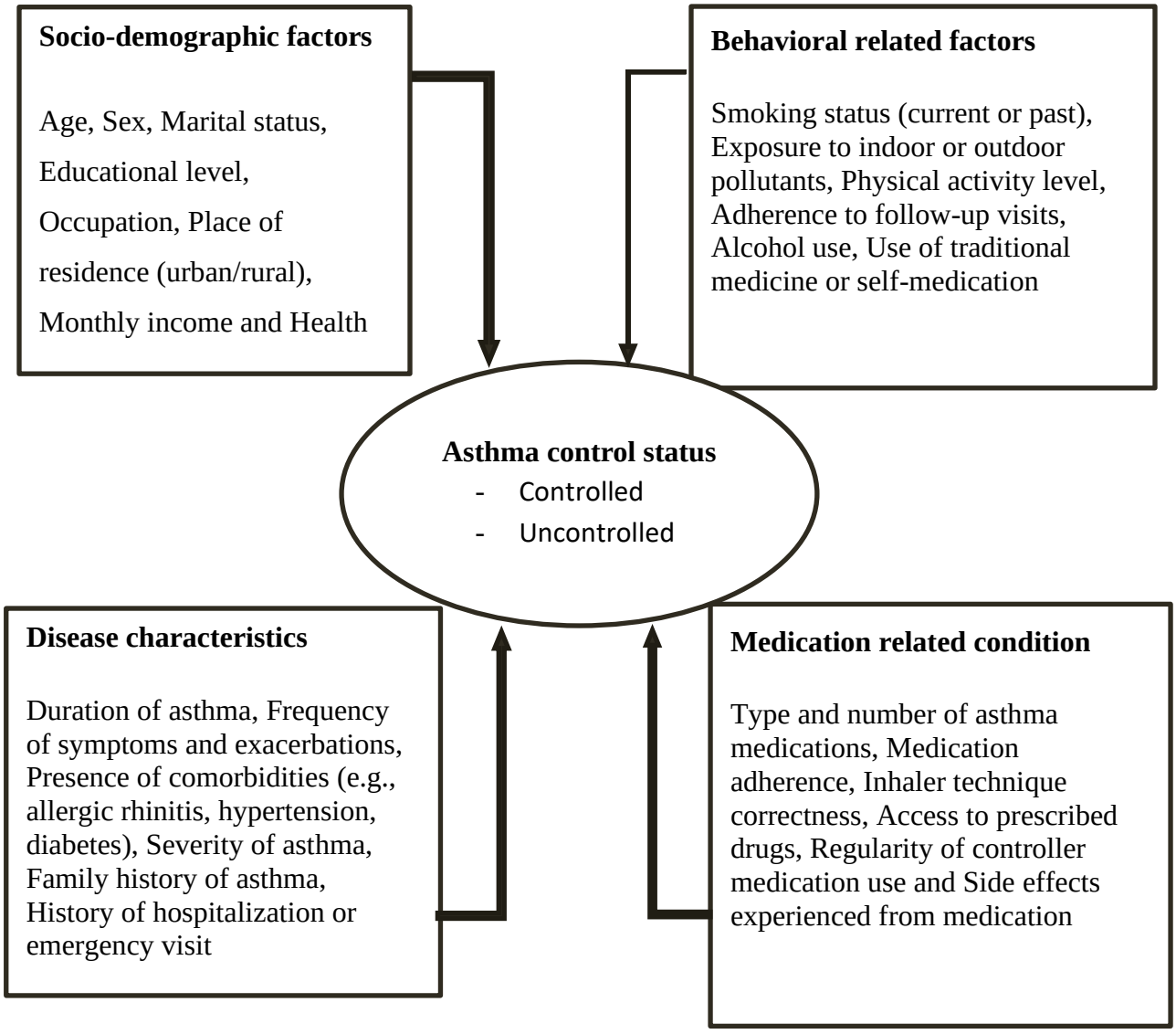

Figure 2: Conceptual framework for factors associated with uncontrolled asthma among asthmatic patients (41) (42) (43) (44) (45) (46) (47) (48) (56).

3 Objectives

3.1 General Objective

- To assess asthma control status and associated factors with poorly controlled asthma among adults with bronchial asthma on follow-up at public hospital in Guraghe zone public hospitals.

3.2 Specific Objectives

- To determine the magnitude of asthma control status among patients aged ⩾18 years attending follow-up in public hospitals of Gurage Zone, Central Ethiopia, between November and December 2025.
- To identify factors associated with poor asthma control among patients aged ≥18 years attending follow-up in the same public hospitals of Gurage Zone during the study period (November–December 2025)

4 Methods and Materials

4.1 Study area and period

The study was conducted in governmental hospitals located in the Gurage Zone Central Ethiopia, The administrative center of the zone is wolkite located 157 km south west of Addis Ababa and 118 km north of Hosanna. It has an elevation ranging from 1,000 to 3,300 meters above sea level. The area has four climatic conditions: 4.1% frost, 27.5% highland, 65.3% temperate, and 3.1% warm. The estimated annual rainfall ranges from 800 to 1,400 mm, and the average annual temperature is approximately 18°C. According Summary and statistical report of the 2007 population and housing census(57). the zone had an estimated total population of 1,280,483 (male = 622,254and female = 658,229). Gurage Zone comprises 15 woredas (10 rural and 5 urban administrations) and a total of 315 kebeles (271 rural and 44 urban), with 261,998 households.

Gurage Zone has a total of seven hospitals (six primary and one tertiary hospital), 53 health centers, 101 private clinics, and 236 health posts, which constitute the primary health care system. These facilities provided a wide range of preventive and curative services, including asthma diagnosis, treatment, and regular follow-up care through outpatient and chronic illness clinics, alongside routine maternal and child health services.

4.2 Study Period

The study was conducted from November 1 to December15, 2025

4.3 Study Design

An institutional based cross-sectional study was conducted.

4.4 Source and Study Populations

All asthmatic patients on follow-up at public hospital in Gurage zone were sources population and those who came for follow up during the study period and fulfill the inclusion criteria were the study population.

4.5 Inclusion and Exclusion criteria

4.5.1 Inclusion criteria

- Adult patients (≥18 years) with a physician-confirmed diagnosis of asthma.
- Patients who have been on follow-up for at least 3 months in Gurage Zone public hospitals.

- Patients attending routine follow-up during the data collection period.
- Patients who are willing and able to provide informed consent.

4.5.2 Exclusion criteria

- Patients presenting with an acute severe asthma attack requiring immediate emergency care.
- Patients who are critically ill or unable to communicate reliably.
- Patients with cognitive impairments or psychiatric conditions that limit their ability to respond to questions.

4.6 Sample size and sampling procedure

4.6.1 Sample size determination

4.6.1.1 Sample size for objective one

The required sample size was determined using the single population proportion formula, assuming a proportion of uncontrolled asthma of 76.1% from a study in JUSH, Jimma, South West Ethiopia, with a 5% margin of error, 95% confidence level, and adding 10% for non-response rate compensation.

Using the formula for cross-sectional studies

- Estimated proportion p=0.76(i.e., 76%)
- Confidence level = 95% → Z=1.96
- Margin of error d=0.05
- Population size N=3194
- Contingency (non-response adjustment): 10%

Step 1: Initial Sample Size (without correction)

n=Z2* p (1−p)/d2 =

n= (1.96)2*0.76*0.24/(0.05)2= 3.8416*0.1824/0.0025=0.70070784/0.0025=280

Step 2: Finite Population Correction (FPC)

nf $= n/(1 + n/N)$ = 280/1+280/3194=280/1.0877 ≈257.4= 257

Step 3: Add 10% Contingency= 257.4+ 25.7= 283.1 ≈ 283.

Final sample for objective one = 283

4.6.1.2 Sample size for objective two

To calculate the sample size required to detect associations between uncontrolled asthma and its independent predictor variables, the two-population proportion formula was applied based on previously identified significant predictors from similar studies(31)

Where:

- (Z_{\alpha/2} = 1.96) for 95% confidence
- (Z_{\beta} = 0.84) for 80% power
- (p_1) = proportion of uncontrolled asthma among exposed group
- (p_2) = proportion of uncontrolled asthma among unexposed group

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 \left[p_1(1-p_1) + p_2(1-p_2)\right]}{(p_1 - p_2)^2}$$

Three key predictors were selected based on their statistical significance and clinical relevance from the current study table. Summary of Sample Size Calculations(58)

Table 1: Strong predictors identified from previous studies for sample size determination.

Predictor Variable	p_1(Exposed)	p_2(Unexposed)	n per group	Total n	+10%Non-response
Duration of asthma (>30 yrs vs <10)	0.704	0.491	79	158	174
Incorrect inhalation technique	0.710	0.445	51	102	113
Exacerbation in last 12 months	0.645	0.451	99	198	218

The largest sample size (n = 283) was considered as the final sample for the study.

4.6.2 Sampling procedure

All Public hospitals in the Gurage Zone, namely Wolkite University Specialized Hospital (WUSH), Gunchire, Atat, Agena, Mehal Amba, Quante, and Hawaryat Primary Hospitals, were included in this study because they provided regular follow-up and treatment services for the majority of asthma patients in the area. These hospitals collectively accommodated almost all asthma patients in the Gurage Zone, making them appropriate and inclusive settings for the study. According to the 2025 GC, report of the selected hospitals, a total of 3,194 adult bronchial asthma patients were on regular follow-up (1,332 at WUSH, 227 at Gunchire, 510 at Atat, 127 at Agena, 397 at Mehal Amba, 526 at Quante, and 75 at Hawaryat Hospital).

The final sample size of 283 participants was proportionally allocated to each hospital according to their respective patient load: 118 from WUSH, 20 from Gunchire, 45 from Atat, 11 from Agena, 35 from Mehal Amba, 45 from Quante, and 7 from Hawaryat Hospital. Given the limited data collection period of one month, it was not feasible to reach the calculated sample size using probability sampling methods. Therefore, a consecutive sampling technique was employed, where all eligible adult asthma patients who attended routine follow-up visits during the data collection period were included until the required sample size was reached. Although consecutive sampling may have introduced some degree of selection bias, it was considered the most practical approach under the time and resource constraints. Moreover, since all asthma patients in the zone were on regular hospital follow-up, the approach was expected to yield a reasonably representative sample of the target population.

4.7 Study Variables

4.7.1 Dependent variables

- Asthma clinical control

4.7.2 Independent variable

- **Socio-demographic factors:** Age, Sex, Marital status, educational level, Occupation, Place of residence (urban/rural), Monthly income and Health insurance status
- **Behavioral related factors:** Smoking status (current or past), Exposure to indoor or outdoor pollutants, Adherence to follow-up visits.

- **Disease characteristics:** Duration of asthma, Frequency of symptoms and exacerbations, Presence of comorbidities (e.g., allergic rhinitis, hypertension, diabetes), Severity of asthma, Family history of asthma, History of hospitalization or emergency visit
- **Medication related condition:** Type and number of asthma medications, Medication adherence, Inhaler technique correctness, Access to prescribed drugs, Regularity of controller medication use and Side effects experienced from medication

4.8. Operational definitions

- **Well controlled Asthma-** Is defined as an Asthma Control Test (ACT) total score of 20–25. This indicates that the patient's asthma is well controlled, meaning symptoms occur infrequently, rescue medication use is limited, there are no night-time awakenings due to asthma, and there is no limitation of normal activity or exercise. In this category, both the patient and healthcare provider consider asthma to be adequately controlled (5).
- **Poorly controlled Asthma-** Refers to an ACT total score of less than 20 (i.e., 5–19). This represents poor symptom control, where patients experience frequent symptoms, require reliever medication often, may have night-time awakenings, and report limitations in daily or physical activities. In this group, the asthma control assessment indicates inadequate or uncontrolled asthma (5).
- **Clinically diagnosed asthma-** is defined as asthma diagnosed symptomatically by physician (general practitioner, resident, internist or emergency and critical care Specialist), with presence of: Q1) variable episodes of asthma symptoms (shortness of breathing, wheezing, chest tightness, cough), Q2) symptoms disappear after taking salbutamol, Q3) seasonal change of symptoms, Q4) worsening with exercise Q5) night or morning attacks Q6) family history, without the use of spirometry. Diagnosis is made with presence of Q1 or /and ≥3 of Q2-Q6 (59,60).
- **Reliever medication-** In this study, reliever medication refers to any short-acting bronchodilator (such as salbutamol inhaler or nebulizer) used by the respondent to relieve acute asthma symptoms or before physical activity.
- **Controller medication-** In this study, controller medication refers to any long-term asthma medication taken daily to prevent symptoms and reduce airway inflammation, such as

inhaled corticosteroids (ICS), ICS–LABA combinations, or leukotriene receptor antagonists.

- **Current smoker:** An adult who has smoked ≥100 cigarettes in their lifetime and who currently smokes cigarettes (daily or some days)(61).
- **Former smoker:** An adult who has smoked ≥100 cigarettes in their lifetime but does not currently smoke cigarettes(61).
- **Never smoker:** An adult who has never smoked or has smoked <100 cigarettes in their lifetime(61).

4.9. Data Collection Process procedures

Asthma control status was assessed using the Asthma Control Test (ACT). The ACT is a well-validated, patient-completed tool consisting of five questions that assess activity limitation, asthma symptoms (shortness of breath and nocturnal symptoms), use of rescue medication, and the patient's overall rating of asthma control over the preceding month. Each item was scored from 1 (worst) to 5 (best), yielding a maximum total score of 25. An ACT score greater than 20 was used to define well-controlled asthma over the prior month.

The structured questionnaire was adapted from the ACT to assess asthma control status and adopted from the Global Initiative for Asthma (GINA) guidelines to collect information on independent variables associated with asthma control. Additional sections were included to capture relevant sociodemographic, health, and medical history data, including age, sex, ethnicity, educational status, smoking status, physician follow-up, asthma education, duration of asthma diagnosis, medication use, history of hospitalization, and comorbidities. The overall questionnaire was structured by compiling ACT items and GINA-based variables, with additional sociodemographic and clinical characteristics included based on commonly reported factors in the literature. The final tool was organized into four sections: identification and sociodemographic characteristics, health-related factors, medical history, and asthma control assessment.

Data collection was conducted in all public hospitals of the Guraghe Zone by 14 trained data collectors (12 general practitioners and 2 internal medicine residents). Eligible participants were approached after their routine outpatient follow-up visits and interviewed in a private setting. All

data collection activities were closely supervised by the principal investigator to ensure data quality and consistency

4.10. Data quality assurance

To ensure data quality, a pre-test was conducted on 5% of the total sample size (approximately 17 participants) at Wolkite health center outside the main study sites to prevent information contamination and avoid inclusion of pre-test participants in the actual study. When conducting the pre-test at an alternative facility was not feasible, strict measures were implemented to prevent overlap by recording pre-test participants separately and screening all potential participants against this list before the final data collection. The pre-test was used to assess the clarity, flow, wording, and completeness of the questionnaire, and necessary modifications were made prior to the main data collection.

All data collectors received one day of intensive training covering the study objectives, ethical considerations, questionnaire content, and proper interviewing techniques. The training included demonstrations and practical sessions on interviewing and record review to ensure uniform understanding. A post-training assessment was conducted to verify data collectors' comprehension and consistency. During data collection, the principal investigator conducted daily on-site supervision and reviewed completed questionnaires for completeness and consistency. Any identified errors, inconsistencies, or missing information were corrected on the same day to maintain data accuracy and reliability.

4.11. Data analysis, processing, and Interpretation

Collected data were first checked for completeness, cleaned, and entered using EpiData 4.6, then exported to SPSS version 27 for analysis. Continuous variables were summarized using mean, median, standard deviation, or interquartile range, while categorical variables were presented as frequencies and percentages. The association between independent variables and poorly controlled asthma was assessed using logistic regression. Bivariate logistic regression was initially conducted to identify candidate variables for multivariable analysis at a p-value ≤ 0.25. Variables meeting this criterion were then entered into multivariable logistic regression to determine independent predictors of poorly controlled asthma. Odds ratios (OR) with 95% confidence intervals (CI) were reported, and statistical significance was set at $p < 0.05$. Findings were presented using tables,

figures, and text, discussed in relation to previous studies, and conclusions and recommendations were drawn based on the results.

4.12. Ethical Considerations

Ethical approval was secured from the Ethical Review Committee of Wolkite University, College of Medicine and Health Sciences, Department of Public Health. Following approval, the Department of Public Health issued official cooperation letters to the relevant authorities. Permission was also granted by the Gurage Zone Health Department and the respective districts. All participants were clearly informed about the purpose and procedures of the study, the significance of their participation, their right to withdraw at any time, and the assurance that their privacy and confidentiality would be maintained. No personal identifiers were recorded, and all information was handled confidentially.

4.13 Dissemination of Results

The final findings of this study will be initially submitted and communicated to the Department of Internal Medicine, College of Medicine and Health Sciences, Wolkite University, both before and after the final thesis defense. The results will also be disseminated to the respective health offices, Wollkite University comprehensive Specialized Hospital (WUSH), and other relevant stakeholders at various managerial levels. Further efforts will be made to publish the findings in national and international scientific journals to reach a broader audience.

5. Result

5.1 Socio-demographic characteristics

A total of 283 adult asthma patients participated in the study giving 100% response rate. Slightly more than half of the respondents were male (52.7%), while females accounted for 47.3%. The study population was predominantly older, with nearly three-quarters of participants aged above 40 years (71.7%). Most respondents were married (77.7%), and a substantial proportion had no formal education (50.9%), followed by those with primary education (41.3%), whereas only a small minority attained secondary or higher education. In terms of occupation, farming was the most common livelihood (67.5%), with smaller proportions engaged in government employment, private business, or other activities(Table 2).

TABLE 2: Socio-demographic characteristics of study in Guraghe Zone, Central Ethiopia (N = 283), Nov to Dec 2025

Variable	Category	Frequency	Percent
Sex	Male	149	52.7
	Female	134	47.3
Age group (years)	18–≤40	80	28.3
	>40	203	71.7
Place of residence	Urban	100	35.3
	Rural	183	64.7
Ethnicity	Gurage	234	82.7
	Oromia	19	6.7
	Amhara	30	10.6
Religion	Muslim	128	45.2
	Orthodox	103	36.4
	Protestant	31	11.0
	Catholic	21	7.4
Marital status	Single	23	8.1
	Married	220	77.7
	Divorced	15	5.3
	Widowed	25	8.8
Educational status	Illiterate	144	50.9
	Primary	117	41.3
	Secondary	16	5.7

	Higher education	6	2.1
Occupation	Farmer	191	67.5
	Housewife	17	6.0
	Government employed	35	12.4
	Non-government employed	25	8.8
	Student	4	1.4
	Private business	11	3.9
Monthly income (ETB)	1000–2000	165	58.3
	>2000	118	41.7
Cooking area	Main house	169	59.7
	Outside the house	114	40.3

5.2 Asthma related history and other co-morbidities of the study participants.

With respect to disease and asthma related characteristics, more than half of the participants had been living with asthma for over six years (58.3%), and 41.0% of participants had at least one comorbid condition, particularly hypertension and diabetes mellitus, while 59.0% had no documented comorbidities. Over one-third of patients had been hospitalized due to asthma exacerbations in the preceding 12 months, and nearly half reported unscheduled healthcare visits, indicating a substantial burden of disease. 81% (185/228) of participants demonstrated poor inhaler technique.

Table 3: Asthma Management Practices among Asthmatic Patients Attending Public Hospitals in Gurage Zone, Central Ethiopia, (N = 283) Nov to Dec 2025

Variable	Category	Frequency	Percent
Duration of asthma (years)	≤5	118	41.7
	>5	165	58.3
Comorbid diseases	Hypertension	43	15.2
	Stroke	26	9.2
	Cor pulmonale / COPD	22	7.8
	Diabetes mellitus	25	8.8
	No comorbidity	167	59.0
Concurrent medications	Amlodipine	46	16.3
	Aspirin / ATV / Enalapril	31	11.0
	Lasix / Spironolactone	19	6.7
	Metformin / NPH	24	8.5
	None	163	57.6
Hospitalized in past 12 months	Yes	100	35.3
	No	183	64.7
Unscheduled health visit (12 months)	Yes	139	49.1
	No	144	50.9
PMDI technique	Poor	228	80.6
	Good	55	19.4
Rescue medication used	Salbutamol puff	205	72.4
	None	78	27.6
Regular physician follow-up	Yes	57	20.1
	No	226	79.9
Asthma prevented usual activities (past 4 weeks)	All the time	72	25.4
	Most of the time	65	23.0
	Some of the time	74	26.1
	A little of the time	42	14.8
	None of the time	30	10.6

Shortness of breath (past 4 weeks)	More than once a day	64	22.6
	Once a day	65	23.0
	3–6 times a week	82	29.0
	1–2 times a week	39	13.8
	Not at all	33	11.7
Night-time awakening due to asthma (past 4 weeks)	≥4 nights per week	71	25.1
	1–2 nights per week	70	24.7
	2–3 nights per week	70	24.7
	Once or less per week	40	14.1
	Not at all	32	11.3
Rescue inhaler use (past 4 weeks)	≥3 times per day	79	27.9
	1–2 times per day	65	23.0
	2–3 times per week	67	23.7
	Once or less per week	34	12.0
	Not at all	38	13.4
Self-rated asthma control (past 4 weeks)	Not controlled	79	27.9
	Poorly controlled	67	23.7
	Somewhat controlled	65	23.0
	Well controlled	43	15.2
	Completely controlled	29	10.2

Footnote: PMDI = Pressurized Metered Dose Inhaler; ACT = Asthma Control Test.

5.4: Asthma Control Status Among study participants.

Out of 283 adult asthma patients, 74.9% had uncontrolled asthma (95% CI: 69.5%–80.0%)**,** while 25.1% had controlled asthma **(**95% CI: 20.0%–30.5%)

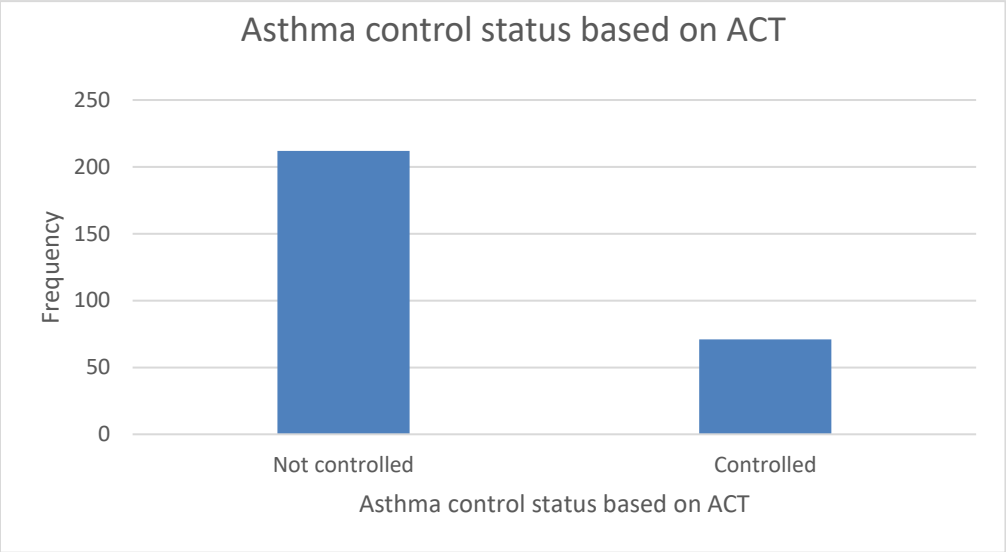

Figure 2: Asthma control status among patient age>18 with bronchial asthma on follow-up in Guraghe Zone, Central Ethiopia, 2025 (N = 283)

5.4 Other factors associated with asthma control status.

The majority of participants were covered by community-based health insurance, accounting for 90.8%, while only 9.2% reported no insurance coverage. Regarding nutritional status, most patients (70.0%) had a normal body mass index (18–24.9 kg/m²), whereas 14.1% were underweight and 15.9% were overweight. Concerning smoking status, the vast majority of respondents were non-smokers (88.3%), with a small proportion being past smokers (8.1%) and current smokers (3.5%).

Table 4: Descriptive Distribution of other factors associated with asthma control status among adults with bronchial asthma on follow-up at public hospitals in Guraghe Zone, Central Ethiopia, Nov to Dec 2025

Variable	Category	Frequency	Percent
Community-based health insurance	Yes	257	90.8
	No	26	9.2
Body mass index (kg/m²)	<18	40	14.1
	18–24.9	198	70.0
	25–29.9	45	15.9
Smoking status	Current smoker	10	3.5
	Former smoker	23	8.1
	Never smoker	250	88.3

5.5: Factors associated with asthma control status among study participants by bivariate analysis.

In the bivariate analysis, several factors showed an association with asthma control at a p-value threshold of <0.25, including age of the patient, type of rescue medication used, PMDI inhaler technique, presence of comorbid diseases, duration of asthma, educational status, smoking status, income level, and regular physician follow-up. These variables were therefore considered for inclusion in the multivariable logistic regression model.

Table 5: Factors associated with poor asthma control by bivariate analysis among adults with bronchial asthma on follow-up at public hospitals in Guraghe Zone, Central Ethiopia, Nov to Dec 2025

S.No	Variable Category	COR (Exp(B))	95% CI (Lower–Upper)	p-value
1	Educational status of the patient	0.460	0.265 – 0.801	0.006*
2	Rescue medication used	11.434	6.138 – 21.299	<0.001*
3	Duration of asthma	0.111	0.058 – 0.210	<0.001*
4	Pressurized metered dose inhaler use	4.462	2.390 – 8.328	<0.001*
5	Co-morbid diseases	0.637	0.362 – 1.123	0.119
6	Income of the patient	1.400	0.815 – 2.405	0.222
7	Regular physician follow-up	2.016	0.934 – 4.353	0.074
8	Age of patient	0.302	0.171 – 0.533	<0.001*
9	Smoking status of the patient	1.197	0.629 – 2.278	0.184

5.6 Factors associated with asthma control status among study participants by multivariate analysis.

After adjustment for potential confounders, type of rescue medication, PMDI inhaler technique, presence of comorbid disease, duration of asthma, educational status, and regular physician follow-up remained independently associated with asthma control. Patients using non-salbutamol rescue medications had significantly higher odds for controlled asthma compared with those using salbutamol alone (AOR = 5.18; 95% CI: 2.21–12.18). Similarly, patients who demonstrated good PMDI inhaler technique were over twelve times more higher odds to achieve asthma control than those with poor technique (AOR = 12.35; 95% CI: 3.54–43.06).

Patients without comorbidities had nearly three times higher odds to have controlled asthma compared to their counter parts(AOR = 3.20; 95% CI: 1.41–7.26).

Patients with a longer duration of asthma (>5 years) had 89% lower odds of achieving asthma control compared to those with a shorter duration (≤5 years) **(**AOR = 0.11; 95% CI: 0.06–0.21

Educational status was another important determinant; educated patients had more than twice the likelihood of controlled asthma compared with illiterate patients (AOR = 2.51; 95% CI: 1.12–5.62).

Importantly, regular physician follow-up emerged as a strong independent predictor of asthma control. Patients who reported regular follow-up visits were nearly twelve times more likely to have controlled asthma compared with those without regular follow-up (AOR = 11.65; 95% CI: 2.97–45.79). This finding underscores the critical role of continuous clinical monitoring, treatment adjustment, and patient education in achieving optimal asthma control.

Table 6: Factors associated with poor asthma control by multivariate analysis among adults with bronchial asthma on follow-up at public hospitals in Guraghe Zone, Central Ethiopia, Nov to Dec 2025

Variable	Category	Asthma control status		COR (95% CI)	p-value	AOR (95% CI)	p-value
		Poorly controlled n (%)	Controlled n (%)				
Rescue medication used	Not Salbutamol user	31 (39.7)	47 (60.3)	1	–	1	–
	Salbutamol	181 (88.3)	24 (11.7)	11.43(6.13–21.29)	<0.001	5.184 (2.207–12.180)	<0.001
PMDI use	Good inhaler	27 (49.1)	28 (50.9)	1	–	1	–
	Poor inhaler	185 (81.1)	43 (18.9)	4.462(2.39–8.32)	<0.001	12.354 (3.544-43.06)	<0.001
Comorbid disease	No	121 (71.6)	28 (50.9)	1	–	1	–
	Yes	91 (79.8)	28 (50.9)	0.63(0.362–1.1.2)	0.119	3.2 (1.41–7.262)	0.005
Duration of asthma	1–≤5 years	62 (52.5)	56 (47.5)	1	–	1	–
	>5 years	150 (90.9)	15 (9.1)	11.30(6.20–20.60)	<0.001	0.47 (0.11–0.195)	<0.001
Educational status	Educated	94 (67.6)	45 (32.4)	1	–	1	–
	Illiterate	118 (81.9)	26 (18.1)	0.46(0.265-0.801)	0.006	2.51 (1.124–5.618)	0.025
Regular physician follow-up	Yes	48 (84.2)	9 (15.8)	1	–	1	–
	No	164 (72.6)	71 (25.1)	2.016(0.93–4.35)	0.074	11.65 (2.97–45.79)	<0.001

5 Discussion

The principal finding of this study revealed that asthma control at wolkite university specialized hospital (WUSH) is poor. Based on the ACT algorithm, 74.9% of respondents were classified as having uncontrolled asthma, while only 25.1% had well-controlled asthma. Poor asthma control was significantly associated with use of Salbutamol as a rescue medication, poor PMDI inhaler technique, presence of comorbid disease, illiteracy, longer duration of asthma, and lack of regular physician follow-up, with poor inhaler technique and absence of regular follow-up showing the strongest associations.

The present study showed that 74.9% of adult asthma patients had uncontrolled asthma, which is higher than the 51.6% of patients with good self-care practice reported in East Wollega Zone. This variation may be explained by differences in socio-demographic and clinical characteristics, as 58.4% of participants in the Wollega study were urban residents compared to 35.3% in our study, and farmers accounted for 29.3% in Wollega versus 67.5% in our study, as well as differences in sample size (423 in Wollega vs. 283 in the present study) and study setting. The finding is comparable with other Ethiopian studies reporting 64%, 71.1%, and 78% prevalence of poor or uncontrolled asthma, indicating that suboptimal asthma control remains a major challenge in the country (13) (32) (45) (46) (62) (63)(64)

A poor inhaler technique remained independently associated with poor asthma control (AOR = 5.184; 95% CI: 2.207–12.180), demonstrating a very strong and clinically significant effect. These findings are consistent with a study conducted at Tikur Anbessa Specialized Hospital in Addis Ababa, where 34.6% of asthmatic patients demonstrated improper inhaler technique and only 24.2% achieved well-controlled asthma (45). Similarly, a study from Jimma Medical Center showed a markedly increased risk of suboptimal asthma control among patients using incorrect technique (AOR = 16.23, p = 0.022), and a study from Sudan reported that inhaler technique training significantly reduced poor asthma control (OR = 0.37; 95% CI: 0.17–0.78)(41) (41). Improper pMDI use, including poor inhalation coordination, low inspiratory flow, and failure to hold the breath, reduces drug deposition in the lower airways, leading to inadequate absorption and poor asthma control. These deficiencies contribute to persistent airway inflammation and

poorer clinical outcomes, underscoring the importance of assessing inhaler technique before treatment adjustment(65).

In the study salbutamol use was also significantly associated with poor asthma control. The report corroborates with study conducted in Jimma that showed frequent SABA use was linked to poor asthma control (AOR = 5.18; 95% CI: 2.21–12.18, p = 0.001)(66). Similarly, in Addis Ababa also supported the finding. (AOR = 2.30; 95% CI: 2.01–2.76) (43).

Comorbidities were significantly associated with poor asthma control in the present study (AOR = 3.20; 95% CI: 1.41–7.26; p = 0.005). This finding is consistent with a systematic review conducted in Ethiopia and with studies from Ethiopian tertiary hospitals, as well as the Jimma University chest clinic study (p = 0.007), all of which identified comorbid conditions as significant contributors to suboptimal asthma control.(67) (63) (68). A notable finding is that 11.8% of patients with uncontrolled asthma were taking aspirin, which will worsen symptoms and amplify the impact of comorbidities on asthma control, a finding supported by the *Aspirin and Asthma* study(69).

In this study, asthma duration >5 years was associated with lower odds of the outcome compared with 1–5 years **(**AOR = 0.47; 95% CI: 0.11–0.195; p < 0.001). Similarly, the Jimma study found a significant association for asthma duration >5 years **(**AOR = 7.58; 95% CI: 1.51–38.05; p = 0.014**)**, confirming its role as an important predictor(70).

In this study, illiterate patients had significantly higher odds of uncontrolled asthma compared with educated individuals (AOR = 2.51 95% CI: 1.124–5.618). This finding is comparable with a study conducted in the Republic of Congo, which also reported a strong association between low educational level and poor asthma outcomes (AOR = 3.26; 95% CI: 1.54–6.67) (47).

Regular physician follow-up was significantly associated with better asthma control. Patients without regular follow-up had a higher proportion of uncontrolled asthma (25.1%) compared with those with regular follow-up (15.8%), with lack of follow-up strongly associated with poor asthma control (AOR =11.65, 95% CI: 2.97–45.79, p < 0.001). This is consistent with a study from Jimma, where 76.1% of patients had poor asthma control and 31.2% reported unscheduled visits (66). Similarly, a real-life African study reported that 36% missed at least one visit, with non-attendance

rising from 48.4% at one month to 79.5% at twelve months, and unacceptable asthma control ranging from 17.2% to 24.4% during follow-up (44). These findings collectively underscore the critical role of regular follow-up in maintaining optimal asthma control.

7 Limitations and strength of the study

Although the study included all patients from all public hospitals in Gurage zone which give better representativeness, some of the following limitations should be take into consideration during interpretation of the findings. First, data collection was conducted during November and December, a period in Ethiopia when asthma exacerbations are more frequent due to cold and rainy weather, which may have contributed to the high level of poor asthma control observed. Second, asthma diagnosis was based on clinical assessment rather than spirometric confirmation, as spirometry was not available in the study area. This may have resulted in misclassification or inclusion of patients without definitive asthma. In addition, most patients did not receive standard therapy, likely due to limited availability of medications, which may have negatively influenced asthma control outcomes.

Furthermore, treatment adherence, physician prescribing of guideline-directed medical therapy (GDMT), and assessment of patients' asthma education were not routinely evaluated, which could have influenced the observed rates of uncontrolled asthma. The cross-sectional design of the study also limits the ability to establish causal relationships between the identified factors and asthma control. In addition, the use of consecutive sampling may have introduced selection bias, potentially affecting the generalizability of the findings.

8 Conclusion

Nearly three-fourth of adult patients with bronchial asthma attending public hospitals in the Guraghe Zone had poorly controlled asthma, indicating that asthma control remains a major public health challenge in the study area.

Poor PMDI inhaler technique, use of salbutamol-only rescue medication, presence of comorbid diseases, longer duration of asthma, low educational status, and lack of regular physician follow-up were significantly associated with poorly controlled asthma.

9 Recommendations

The finding implies that asthma management need attention for concerned bodies. Interventions focusing on regular physician follow-up, proper inhaler technique training, management of comorbid conditions, and the government should advocate on general education to improve asthma control in the population..

Health-care providers should incorporate routine inhaler technique evaluation and patient counseling into each follow-up visit. Moreover, system-level efforts focusing on treatment adherence, early detection of comorbidities, and continuous monitoring are essential. Further longitudinal studies using objective diagnostic tools are warranted in similar resource-limited settings.

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List of Annex

Annex 1: Participant information sheet and informed consent form

Good morning/afternoon dear participant! My name is _____. I am working as a data collector for the study being conducted in this hospital on asthma control status and asssociated factors with poorly controlled, who is studying for specialty degree at Wolkite University, college of Medicine and Health sciences. I kindly request you to lend me your attention to explain about the study and being you selected as the study participant.

The purpose of this study is to assess asthma control status and identify factors associated with poorly controlled asthma among adults with bronchial asthma attending follow-up clinics at public hospitals in the Guraghe Zone. The findings of this study will help health offices and health care providers to design and implement locally appropriate strategies to improve asthma management and follow-up care. The interview will take approximately 30–40 minutes to complete.

All information you provide will be kept strictly confidential, and you are not required to mention your name. Your participation in this study is entirely voluntary, and you have the right to refuse participation or to skip any question at any time without any consequences. Participation or non participation will not affect your access to health services in any way. If you have any questions or would like to know the results of this study, you may contact the principal investigator using the address provided.

Principal investigator: Dr Akmel Mohamed(MD, final year IM resident)

✆ +251-911-89-72-45

akiracool0911@gmail.com

Consent Form English Version

I have read all the process and the objective of the study and I have understood about the purpose, advantage, and disadvantage of this study titled asthma control status and associated factors with poorly controlled asthma in Gurage zone. I also understood that the research imposes no risk and no composition would be provided to me. I have been told that if I fill discomfort to respond to any of the question, I fill free to drop it any time I wish to do so. I have understood the information given and the participation is completely voluntary based.

I have been told that my answers to the questions will not be given to anyone and not expect to write my name. Now I am giving my consent to participate in the study voluntarily.

Could I have your permission to continue?

1. Yes_____2. No_____, Stop and thank the respondent.

Data collector: Name_____ Signature _____ Date_____

Annex 2: English Version of Interviewer Administered Questionnaire

Questionnaire No: _____

Medical record (card) number _____

Part 1 – Identification and socio demographic characteristics of participants

1. Age _____ years
2. Gender A. Male B. Female
3. Ethnicity A. Amhara B. Oromo C. Gurage D. other (Specify)
4. Religion A. Muslim B. Orthodox C. Protestant D. other (Specify)
5. Marital status A. Single B. Married C. Divorced D. Widowed
6. Educational status A. Illiterate B. Primary C. Secondary D. Higher
7. Occupation A. Farmer B. House wife C. Government employed
   D. Non-government employed D. Student E. Private business G. Other (Specify)
8. Place of residence A. Urban B. Rural
9. Presence of health care insurance(CBHI) A. yes B. no
10. Monthly income A. <2000 EB B. >= 2000 EB

Part 2 – Health characteristics of the study participant

1. Height _____ Weight _____ Body mass index (BMI) _____
2. Smoking status of the patient A. Current smoker B. Past smoker C. Non-smoker
3. Did you have regular physician follow up for your asthma A. Yes B. No
4. Did you have received education about asthma anytime A. Yes B. No
5. If yes to question number 4 from whom you received? A. Physician B. Pharmacist
   C. Knew about asthma diseases independently D. Other (Specify)

Part 3 – Medical history

1. Duration asthma diagnosis _____
2. Types of rescue medication used by the patient during symptom/s attack.
   A. SABA (e.g. Salbutamol puff) B. systemic corticosteroid (e.g. oral prednisolone)
   C. Theophedrine D. Not any medication E. Other (Specify)

3. Types of Controller anti-asthmatic drugs used by the patient for past 3 months
   A. Ics (inhaled corticosteroid) alone
      1. Beclomethasone 2. Symbicort 3. Seretide 4 Other
   B. Ics with LABA (long acting β2 agonist) e.g beclomethasone + formoterol puff
   C. Ocs (oral corticosteroid) e.g prednisolone
   D. Oral theophylline e.g theophedrine
   E. Not any medication
   F. Other (Specify)
4. For Q4 if answer is not on any medication, why? A. Un availability of the drug
   B. Higher price of the medication C. Fear of side effect
   D. Fells already improved/cured E. Other
5. Comorbid illness (if present, specify) _____
6. Concurrent medication prescribed? If present specify
7. During the past 12 months, have you been hospitalized due to asthma symptoms? A. Yes B. No
8. During the past 12 months did you have an unscheduled visit to health due to asthma symptoms? A. Yes B. No

Part 4 - Data collection format for asthma control

4.1 The following test is asthma control test to assess asthma control. Please circle the appropriate score for each question.

1. During the past 4 weeks, how often did your asthma prevent you from getting as much done at work, school or home? A. All the tome B. Most of the time
   C. Some of the time D. A little of the time D. None of the time
2. During the past 4 weeks, how often have you had shortness of breath?
   A. More than once a day B. Once a day C. 3-6 times a week
   D. 1-2 times a week E not at all
3. During the past 4 weeks, how often did you asthma (wheezing, coughing and shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?
   A. 4 or more nights a week B. 1 or 2 nights a week C. 2 or 3 times a week D. Once or less a week E. Not at all

4. During the past 4 weeks, how often have you used a rescue inhaler (such as salbutamol)?

   A. 3 or more times a day B. 1 or 2 times a day C. 2 or 3 times a week D. Once or less a week E. Not at all

5. How would you rate your asthma control during the past 4 weeks?

   A. Not controlled B. Poorly controlled c. Somewhat controlled D. Well controlled E. Completely controlled

Part 5: inhaler technique assessment

1. Inhalation protocol pressurized metered-dose inhaler (please tick on box for each point listed)

- ☐ Shaking MDI and removing cap
- ☐ Breathing out slowly and fully
- ☐ Holding MDI upright
- ☐ Place MDI in mouth or 1-2 inches away from mouth
- ☐ Actuate the MDI once
- ☐ Begin to breathe in the same amount of actuation and breathe in slowly
- ☐ Hold breath for 10 seconds
- ☐ Take inhaler out of mouth and maintain mouth closing
- ☐ Wait for at least 30 seconds before next actuation
- ☐ Rinse the mouth after the use of a steroid inhale

Annex 3: Amharic Version of Information Sheet and Consent Form

የመረጃ ቅጽ

ሰላምታ፡-ጤና ይስጥልኝ!! እኔ_____ እባላለሁ፡፡ይህ ጥናት የሚካሄደው በ ዶ/ር አክመል መሀመድ በተባሉት የወልቂጤ ዩኒቨርሲቲ ህክምናና ጤና ሳይንስ ኮሌጅ ተማሪ ሲሆን በዩኒቨርሲቲው ሙሉ ፈቃድ ታግዘው የሁለተኛ ዲግሪያቸው መመረቂያ ጽሁፍ በዞን ባሉ ሆስፒታሎች የአስም ህመም ቁጥጥር እና ለአስም ህመም አለመቆጣጠር ምክንያቶችን ጥናት ያደርጋል። ፡፡ከጥናቱ የሚገኘው ውጤት/ ግኝት የአስም ህመም ቁጥጥር ያለበትን ሁኔታ እና ለአስም ህመም አለመቆጣጠር ምክንያቶችን የሚነግር ሲሆን በተጨማሪም የጥናቱ ባለቤት በዩኒቨርሲቲው በውስጥ ደዌ ስፔሻሊቲ ትምህርት ክፍል የሁለተኛ ዲግሪየቸውን ለማግኘት እንደ ማሟያ ፅሑፍ በመሆን ይረዳል፡፡

ይህን መጠይቅ ለመሙላት ከ30 እስከ 40 ደቂቃ የሚወስድ ሲሆን በዚህ ቃለ መጠይቅ ፈቃደኛ ካልሆኑ ያለመሳተፍ መብትዎ የተጠበቀ ነው፡፡እርስዎ በዚህ ጥናት ተሳታፊ በመሆንዎ በቀጥታ ሊያገኙ የሚችሉት ነገር ላይኖር ይችሊል፤ነገር ግን የእርስዎ ተሳትፎ በአገልግሎቱ አጠቃቀምና ምክንያት ዙሪያ ያሉችግሮች ወይም ክፍተቶች ለማሳየት እና ትክክለኛ የመፍትሔ አቅጣጫ ለመጠቆም እጅግ አስፈላጊ ነው፡፡ጥናቱ ውጤታማ ሊሆን የሚችለው እርሶ በሚሰጡት ትክክለኛ መልስ ላይ የተመረኮዘ በመሆኑ፤ጥያቄዎቹን በጥንቃቄ እንዲመልሱልን ፍቃደኝነትዎን በትህትና እንጠይቃለን፡፡ በተጨማሪም የሚሰጡት መረጃ ከተባለለት ጉዳይ ውጪ እንደማይውል እና ሚስጥራዊነቱ የተጠበቀ እንደሚሆን አረጋግጣለሁ፡፡በቃለ መጠይቅ ወቅት ለእርስዎ ግልጽ ያልሆነ ነገር ካለ መጠየቅ ይችላሉ፡፡ ለመመለስ ፈቃደኛ ያልሆኑበት ጥያቄ ካለም ማለፍ ይችላሉ፡፡በየትኛዉም ምክንያት በመጠይቁ መሃል ማቋረጥ ቢፈልጉ ጥያቄዉን የማቋረጥ መብት አለዎት፡፡

ተጨማሪ ጥያቄ ካለዎትና እንዲሁም በቀጣይ የተሰበሰበው መረጃ ውጤት ለማወቅ ከፈለጉ ከዚህ በታች በተጠቀሰው የዋናው የጥናቱ ባለቤት ስልክ ቁጥርና አድራሻ ተጠቅመው ማግኘት ይችላሉ፡፡

እርሶም በዚህ ጥናት በመሳተፎ ከልብ አመሰግናለሁ!!!!!!

ዶ/ር አክመል መሀመድ

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የስምምነት ቅጽ

ከላይ የተፃፈውን የመረጃ ቅፅ አንብቤ የጥናቱን አላማና ጥቅም በግልጽ ተረዴቻለሁ፡፡ በዚህም መሰረት ያለጥናት ቡድኑ አባላት ተፅእኖ በሙሉ ፈቃደኝነት በዚሁ ጥናት በመሳተፍ እድሜቸው ከ አንድ አመት በታች ህፃን ያላቸው እናቶች ህጻናትን ጸሃይ ስለማሞቅ እውቀት አመለካከትና ክህሎት በሚደረገው ጥናት ላይ የሚጠበቅብኝን አስተዋፅአ ለማበርከት መወሰኔን በፊርማዬ አረጋግጣለሁ፡፡

የተሳታፊው ቁጥር _____ፊርማ_____ቀን_____

የመረጃ ሰብሳቢ ሥም _____ ፊርማ _____

መረጃ የተሰበሰበበት ቀን_____ የተጀመረበት ሠዓት _____ ያለቀበት ሰዓት _____

የተቆጣጣሪ ሥም _____ፊርማ_____ ቀን_____

ማጠቃለያ:

ለተሳትፎዎና ለነበሮት ቆይታ በጣም አመሰግናለሁ፡፡ የነበረን ቆይታ በጣም ደስ የሚል ነበር የህጻናት ጤና ለማስጠበቅ በቂ መረጃ ተለዋውጠናል በድጋሚ አመሰግናለሁ፡፡.

Annex 4: Amharic Version of Interviewer Administered Questionnaire

የጥናቱ መጠይቅ

የመጠይቅ ቁጥር፡ _____

የሕክምና መዝገብ (ካርድ) ቁጥር፡ _____

ክፍል 1 – የተሳታፊዎች መለያ እና ማህበራዊ-ሕይወት መረጃ

1. ዕድሜ _____ ዓመት
2. ፆታ፡ ሀ. ወንድ ለ. ሴት
3. ዘር፡ ሀ. አማራ ለ. ኦሮሞ ሐ. ጉራጌ መ. ሌላ (ይግለጹ) _____
4. ሃይማኖት፡ ሀ. ሙስሊም ለ. ኦርቶዶክስ
   ሐ. ፕሮቴስታንት መ. ሌላ (ይግለጹ) _____
5. የትዳር ሁኔታ፡ ሀ. ያላገባ ለ. ያገባ ሐ. የተፋታ መ. የትዳር አጋር የሞተበት
6. የትምህርት ደረጃ፡ ሀ. ያልተማረ ለ. መጀመሪያ ደረጃ
   ሐ. ሁለተኛ ደረጃ መ. ከፍተኛ ደረጃ
7. ሥራ፡ ሀ. ገበሬ ለ. የቤት እመቤት ሐ. የመንግሥት ሰራተኛ
   መ. የግል ድርጅት ሰራተኛ ሰ. ተማሪ ረ. የግል ንግድ ሰ. ሌላ (ይግለጹ) _____
8. የመኖሪያ ቦታ፡ ሀ. ከተማ ለ. ገጠር
9. የጤና መድህን ተጠቃሚ ኖት? ሀ አው ለ አይ
10. የወር ገቢዎት በአማካይ ምን ያክል ነው? _____

ክፍል 2 – የተሳታፊዎች የጤና ባህሪ

1. ቁመት _____ ክብደት _____ አማካይ ክብደት (BMI_____

2. ሲጋራ ያጨሳሉ፡ ሀ. አው ለ. ድሮ አጨስ ነበር ነገር ግን አቁምያለው ሐ. አላጨስም

3. በቀጠሮዎት መሠረት የህክምና ክትትልዎን በሃኪም ያደርጋሉ? ሀ. አዎ ለ. አይ

4. ስለ አስም በሽታ ትምህርት ወስደው ያውቃሉ? ሀ. አዎ ለ. አይ

5. ለተራ ቁጥር 4 መልሰዎ አዎ ከሆነ ከማን ትምህርቱ ተሰጦት? ሀ. በሐኪም ለ. በመድሃኒት
   ሻጭ ሐ. በራስዎ ስለ አስማ አጥንተው መ. ሌላ (ይግለጹ) _____

ክፍል 3 – የሕክምና ታሪክ

1. አስም በሽታው ከታወቅ ምን ያክል ጊዜ ሆነው _____

2. የአስም መቀስቀስ ስሜት በሚሰሞት ወቅት ምን ያደርጋሉ?፡ ሀ. ሰማያዊ መልክ ያለውን የሚነፋውን መድሃኒት እወስዳለው (ሳልቡታሞል አየር ለ. ፕሬድኒሶሎን ክኒን እውጣለው ሐ. ቲዮፊዲሪን ክኒን እውጣለው መ. ምን አልወስድም ሠ. ሌላ (ይግለጹ) _____

3. ላለፉት 3 ወራት አስሞትን ለመቆጣጠር ምን አይነት መድሃኒቶችን ወሰዱ?፡ ሀ. ሽሮ መልክ ያለው ሚነፋውን መድሃኒት (ቤክሎሜታሶን) ለ. ነጭ በቀይ መልክ ሆኖ ሚመጠጠው(ሲሚቢኮርት) ሐ.ፕሪድኒሰሎን እውጣለው መ. ቲዮፊዲሪን እውጣለው ሠ. ምንም አልወስድም
ረ. ሌላ (ይግለጹ)_____

4. በተራ ቁጥር 4 አልጠቀምም ብለው ከሆነ ለምን? ሀ. መድሃኒቱ ስለሌለ ለ. ዋጋው ውድ ስለሆነ ሐ. የጎንዮሽ ጉዳቱን ፍርሃት መ. ወድያው የመሻሻል ስሜት ስለሚሰማኝ ሠ. ሌላ (ይግለጹ) _____

5. ተጓዳኝ ሕመም አለ? (ካለ ይግለፁ) _____

6. ከአስም መድሃኒት ውጪ የሚወስዱ መድሃኒት ካለ ይግለጹ_____

7. ባለፉት 12 ወር ውስጥ በአስም ምልክት ምክንያት ሆስፒታል ተኝተው ያውቃሉ ሀ. አዎ ለ. አይ

8. ባለፈት 12 ወር ውስጥ በአስም ምልክት ምክንያት ያልታቀድ ሆስፒታል ክትትል

9. አድርገው ያውቃሉ? ሀ. አዎ ለ. አይ

ክፍል 4 – የአስም ህመም መቆጣጠር መጠየቂያ ክፍል
የሚከተሉት ጥያቄዎች የአስም መቆጣጠሪያ መለኪያ ጥያቄዎች ናቸው፤ እባክዎ ለእያንዳንዱ ጥያቄ ትክክለኛው መልስ በማከበብ ይምረጡ።

1. የአስም ህመም ላለፉት 4 ሳምንታት በስራ፣ በትምህርት ወይም በቤት ውስጥ ምን የክል ጊዜ ጫና አመጣቦት? ***ሀ.*** ሁሉም ጊዜ ለ. አብዛኛውን ጊዜ ሐ. አንዳንድ ጊዜ መ. ትንሽ ጊዜ ሠ. ምንም ጊዜ

2. ላለፉት 4 ሳምንት ምን የክል ጊዜ ትንፋሽ ማጠር ተሰምቶታል? ሀ. ከአንድ ቀን በላይ ለ. በቀን ከንዴ ሐ. በሳምንት ከ3–6 ጊዜ መ. በሳምንት ከ1–2 ጊዜ ሠ. ተሰምቶኝ አያውቅም

3. ላለፉት 4 ሳምንታት በአስሙ(በማሳል፣ ትንፋሽ በማጠር፣ በደረት ውጋት፣ በፉጨት በመተንፈስ) ምክንያት ከንቅልፎ ተነስተው ያውቃሉ? ሀ. በሳምንት 4 ምሽት ወይም ከዚያ በላይ ለ. በሳምንት 1–2 ምሽት ሐ. በሳምንት 2–3 ምሽት መ. በሳምንት 1 ምሽት ወይም ከዚያ በታች
ሠ. በምሽት በአስም ምክንያት አልነሳም

4. ባለፈው 4 ሳምንት የአስም ምልክት መቀነሻ ሚነፋውን መድሃኒት (ሳልቡታሞል) ምን ያክል ጊዜ ተጠቀሙት? ሀ. በቀኑ 3 ጊዜ ወይም ከዚያ በላይ ለ. በቀኑ 1–2 ጊዜ ሐ. በሳምንት 2–3 ጊዜ መ.. በሳምንት 1ጊዜ ወይም ከዚያ በታች ሠ. አልተጠቀምኩም

5. ባለፈው 4 ሳምንት የአስም ቁጥጥርዋት እንዴት ነበር? ሀ. አልተቆጣጠርኩትም ለ. ጥሩ በማይባል ደረጃ ተቆጣጥሬዋለው ሐ በከፊሉ ተቆጣጥሬዋለው መ.ጥሩ ተቆጣጥሬዋለው ሐ. ሙሉ በሙሉ ተቆጣጥሬዋለው

<u>ክፍል 5</u> ቀጣይ የሚገኙት ጥያቄዎች የሚነፋውን የአስም መድሃኒት አጠቃቀም አግባብነት የሚመዝኑ ስለሆኑ አባኮትን ትክክለኛ መልሶች ላይ ምልክት በማድረግ መልስ ይስጡ።

1. የሚነፋውን የአስም መድሃኒት በመነቅነቅ እና ማፈኛ ክዳኑን ማስወገ☐

2. በቀስታ ሙሉ በሙሉ አየር ማስወጣት: ☐

3. የሚነፋውን መድሃኒት ቀጥ አድርጎ መያዝ☐

4. የሚነፋውን መድሃኒት ከአፉ አቅራቢያ ከ1–2 ጣት ርቀት ማቅረ☐

5. የሚነፋውን መድሃኒት መንፍያ አንደ ጊዜ መጫ☐

6. መንፍያውን ከተጫኑ በሁዋላ በተነፋው መጣን ወደውስጥ አየር ከሳቡ በሁዋላ ቀስ ብሎ ወደ ውስጥ አየር መ☐ብ:

7. ለ10 ሰከንድ ትንፋሾትን አየር መያዝ:☐

8. የሚነፋውን መድሃኒት ከአፍ ማውጣት እና አፎትን መዝ☐

9. ቀጣይ የሚነፋውን ከመውሰዶት በፊት ለ 30 ሰከንድ መጠ☐

10. Steroid ያለው የአስም ሚነፋ መድሃኒት ከወሰዱ በሁዋላ አፍን መታ☐