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þÿ L e v e l O f A s t h m a C o n t r o l A n d Associated Factors In Adults Attending Government Hospitals,Bahir Dar,Ethiopia,2023

Sintayehu, Bekalu

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COLLEGE OF MEDICINE AND HEALTH SCIENCE

SCHOOL OF MEDICINE DEPARTMENT OF INTERNAL MEDICINE

LEVEL OF ASTHMA CONTROL AND IT'S ASSOCIATED FACTORS IN ADULTS ATTENDING GOVERNMENT HOSPITALS,BAHIR DAR,ETHIOPIA,2023

BY:

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FEBRUARY, 2024

BAHIR DAR, ETHIOPIA

BAHIR DAR UNIVERSITY
COLLEGE OF MEDICINE AND HEALTH SCIENCE
SCHOOL OF MEDICINE DEPARTMENT OF INTERNAL MEDICINE

LEVEL OF ASTHMA CONTROL AND IT'S ASSOCIATED FACTORS IN ADULTS ATTENDING GOVERNMENT HOSPITALS,BAHIR DAR, NORTHWEST ETHIOPIA.

A RESEARCH THESIS SUBMITTED TO DEPARTMENT OF INTERNAL MEDICINE, SCHOOL OF MEDICINE, COLLEGE OF MEDICINE AND HEALTH SCIENCE, BAHIR DAR UNIVERSITY, IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR SPECIALTY IN INTERNAL MEDICINE

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FEBRUARY, 2024

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DECLARATION

This is to certify that the research thesis entitled “level of asthma control and its' associated factors in adults attending government hospitals, Bahir Dar, Northwest Ethiopia, 2023. ” submitted to Department of internal medicine, School of medicine, College of medicine and health science, Bahir Dar University, in the partial fulfillment of the requirements for specialty in internal medicine is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates. The assistance and help I received during the course of this investigation have been duly acknowledged.

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Bahir Dar, Ethiopia

APPROVAL OF THESIS FOR DEFENSE

I hereby certify that I have supervised, read, and evaluated this research thesis titled "level of asthma control and its associated factors in adults attending government hospitals, Bahir Dar, Northwest Ethiopia, 2023"By Bekalu Sintayehu (Internal Medicine Resident) prepared under my guidance. I recommend the research thesis to be submitted for oral defense.

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Board of Examiners

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LISTS OF ACRONYMS AND ABBREVIATIONS

BMI……Body Mass Index

DAYS…. Disability Adjusted Life Years

FEV1…... Forced Expiratory Volume in 1 Second

GINA……Global Initiative for Asthma

GERD……Gastroesophageal Reflux Disease

HTN.....Hypertension

DM.....Diabetes Mellitus

CKD.....chronic kidney disease

PHTN.....Pulmonary Hypertension

DVHD.....Degenerative Valvular Heart Disease

RHD.....Rheumatic Heart Disease

RVI.....Retro-Viral Infection

IHD.....Ischemic Heart Disease

MARS-A….Medication Adherence Report Scale for Asthma

InTeQ------ Inhaler Technique Questionnaire

HRQoL…. Health Related Quality of Life

LMIC…… Low and Middle Income Countries

OSA……Obstructive Sleep Apnea

REACT……Real World Evaluation of Asthma Control and Treatment

TGSH……...Tbebe Ghion Specialized Hospital

WHO……...World Health Organization

ABSTRACT

Introduction:

Poor control of asthma negatively affects patients, their caregivers, and the country as a whole. Determining the status of asthma control and identifying associated risk factors for poor control is a key strategy to decrease the negative health impacts and financial burden of the disease.

Objective: To assess level of Asthma control and associated factors in patients attending chest clinic at government Hospitals, Bahir Dar, Ethiopia.

Methods: Institutional based cross sectional study design was conducted from September-November 2023. Data was collected from 373 consecutive chest clinic attending physician diagnosed asthmatic patients at government hospitals using the pre-developed data collection checklist.

Results: a total of 373 patients were included in this study. Of these 204(54.7%) were females with mean age of 43.77±15.79yrs and median duration of asthma was 12±13.7yrs.161(43.2%) of participants had poorly controlled asthma. being adherent to controller medication (AOR 4.36, 95% CI 2.09-9.09, P=<0.001), health insurance based access to health care (AOR 1.85, 95% CI 1.05-3.26, P=0.031), having no ER admission in the last year (AOR 3.77, 95% CI 1.51-9.41, P=0.004), correct inhaler technique (AOR 4.31,95% CI 2.37-7.84,P=<0.001), less than one reliever canister use in the previous 1 month(AOR 5.09,95% CI 3.01-8.62,P=<0.001),non- fuel use for cooking(AOR 3.25,95% CI 1.36-7.74,P=0.008), were variables that increase asthma control. However use of SABA alone (AOR 0.07, 95% CI 0.03-0.18, P=<0.001), was significantly associated with decreased asthma control level.

Conclusion: Our study revealed that a significant number of individuals presented with suboptimal asthma control. Therefore, healthcare providers should work to improve patients' awareness of their medications adherence and avoid SABA alone use for decreasing the progression of the disease, and better level of asthma control.

Key words: Asthma, Asthma control, associated factor

1. INTRODUCTION

1.1. Background of the study

Asthma is a heterogeneous disease characterized by chronic airway inflammation. It is defined by a history of respiratory symptoms, such as wheeze, shortness of breath, chest tightness and cough that vary over time and in intensity together with variable expiratory flow limitation(1). It affects people from all ages and ethnicities worldwide(1). Globally, Bronchial asthma affects 315 million people contributing with more than 23 million of Disability-Adjusted Life Years (DALYs)(2).

Asthma prevalence has been increasing in many countries, in parallel with the development of urbanization and the adoption of modern lifestyles. By 2025 the number of asthmatic people is estimated to increase by 100 million people worldwide(3).

Despite the existence of treatment guidelines, many individuals with asthma remain undertreated and poorly controlled, resulting in a significant burden, not only in terms of quality of life, but also in terms of health costs. Health cost associated with asthma could be direct costs, like treatments and hospitalizations, as well as indirect costs, due to work absences and premature death(4)(5).

Identifying predictors for poor asthma control may greatly modify adverse effects and potentially lessen the financial burden of the disease. Many studies have been published on level of asthma control throughout the world, showing control to be suboptimal(6)(7). In Ethiopia there are studies showing asthma control is poor, ranging from 43.8 to 76.1% in hospital chest clinics(8)(9)(10).

This study was designed to assess the level of asthma control and risk factors for poor asthma control in the chest clinic of Government Hospitals, Bahir Dar, Ethiopia.

1.2. Statement of the problem

Asthma is continuing to be a major cause of morbidity and mortality worldwide. Globally World Health Organization (WHO) estimated that there were more than 339 million people with Asthma in 2018. Of these, 417,918 died within the same year, and most of the deaths were in Low and middle-income countries (LMICs). Notably, the real-world evaluation of asthma control and treatment (REACT) study conducted among US patients with moderate to severe asthma receiving standard asthma medications showed that asthma control was not achieved in 55% of the patients(11).

With a high prevalence of asthma (8.7%) in Ethiopia, there are few discrete studies investigating the level of asthma control and its associated factors. In a study conducted at the capital of Ethiopia, 75.8% of asthmatic patients had uncontrolled asthma. The use of biomass fuel for cooking, longer duration of asthma, incorrect inhalation technique, and asthma exacerbation in the last 12 months were linked with poor control of asthma(12).

Similarly, Zewdie at el reported the prevalence of poorly controlled asthma to be as high as 50%. In this study, poor knowledge about asthma, a negative attitude about asthma, moderate asthma, and non-adherence to inhaled corticosteroids were associated with poorly controlled asthma(13).

Asthma has a significant impact on the lives of people, it can cause multifaceted problems that negatively affect patients, their caregivers, and the country as a whole. Individuals with uncontrolled asthma had up to 4.6-fold greater frequency of hospitalizations, 1.8-fold higher number of emergency department visits, and lower productivity, as they were more likely to be unemployed, more days absent from work and more activity limitations(14).

Despite the fact that poorly controlled asthma have a number of effects on the life of people, there have been few studies that address the scope of the problem and the risk factors associated with it. As far as my knowledge concerned, there is no study that addresses the magnitude of level of asthma control and its' associated factors in the area. As a result, the purpose of this study will be to assess the level of Asthma control and associated factors on patients attending chest clinic at Government Hospitals, Bahir Dar, Ethiopia, 2023

1.3. Significance of the study

This study will identify the level of asthma control and its associated factors, so the findings will help primarily the community by playing a crucial role in advancing knowledge of health professionals and understanding about the factors that affect the level of asthma control. It will help to improve the quality of life by early detecting risk factors and effective intervention.

It will also aid in the planning and organizing of health education strategies that will enhance patient skills to enable them to achieve the desired level of asthma control in order to reduce/prevent emergency visits or hospital admissions.

Due to the unavailability of such studies in the study setting, this study provides valuable information to health professionals, researchers, and other stakeholders. By using this study, concerned bodies plan for interventions, and the researchers may use the findings of this study as a reference for future studies.

2. LITERATURE REVIEW

2.1. Bronchial asthma definition and severity

Previous Global Initiative for Asthma (GINA) guidelines were based on disease severity and classified asthma into four categories: mild intermittent, mild persistent, moderate persistent and severe persistent(15,16).but, many studies have shown that control of asthma is achievable in most patients regardless of the level of severity; for this reason, now a days, asthma guidelines have distinguished asthma severity from asthma control(17).

2.2. Moving from asthma severity to control

Asthma severity is an inherent characteristic of the patient and it is defined by the frequency and severity of symptoms as well as the level of treatment that is required to control the symptoms or, in very severe asthma, by no responsiveness to treatment. Thus, asthma severity reflects simultaneously the activity of the underlying disease and the required level of treatment, and it may vary over time and in different asthma phenotypes(16).

Conversely, asthma control refers to the extent to which the manifestations of asthma have been reduced or eradicated by treatment(18).Asthma control encompasses both the patient's symptoms and limitations (daytime symptoms, nocturnal symptoms, activity limitations and use of rescue medications) and the future risk of adverse asthma outcomes (including future exacerbations, development of fixed airflow obstruction and treatment-related adverse events(18).

2.3. Asthma control

According to the current guidelines, asthma is defined as “controlled “if the patient reports symptoms and use of reliever medication less than twice a week, has no nocturnal symptoms, no activity limitation and has no important risk factors such as history of intubation, low forced expiratory volume in 1 s (FEV1) or exacerbations in the last year.

It is defined as “partly controlled “when daily symptoms and use of reliever medication are present more than twice a week and/or the patient experiences nocturnal symptoms and activity limitations, and as “uncontrolled “if three or more of the aforementioned conditions are present(18).

It is only recently that overall asthma control has been defined not only as the control of symptoms and functional limitations that the patient experiences as a result of asthma, but also as the minimization of future risk of asthma exacerbations, prevention of lung function decline and prevention of medication side-effects(18).

2.4. Association of control with clinically important parameters

Asthma has an important impact in everyday life, not only because the patients may be significantly burdened by the symptoms of the disease (such as dyspnea, cough and wheezing) but also because it leads to limitations in physical activities, sleep disturbance and negative effects in their work and social life, leading to anxiety and depression(19,20).

Asthma control significantly affects the use of healthcare resources and the patients’ quality of life, as assessed with the use of standardized health-related quality of life (HRQoL) questionnaires. Poor asthma control is also related to symptoms of Depression, especially in patients with severe asthma, and it is believed that the presence of depression in these patients might have a negative impact on treatment adherence and HRQoL, leading to an ongoing vicious circle(19,21).

2.5. Risk factors for poor asthma control

Causes of poor asthma control are multifactorial and are related either to the disease itself, to the physician or to the patient. Factors related to the physician include asthma misdiagnosis, poor knowledge of current guidelines or difficulty in changing practicing routines, implementation of self-management plans in only a minority of patients and a poor doctor–patient relationship(22).

The correct diagnosis is the first important step for the treatment of asthma, as missing the diagnosis will result in no treatment and no disease control and the differential diagnosis includes many other disease entities. Patients with other respiratory diseases misdiagnosed as asthma are unlikely to respond to asthma medication and, moreover, if treated in a control-based way, the lack of response will lead to progressively increased doses of medication, which will possibly result in notable side-effects without any benefit. Once diagnosis is established, assessment of severity and control is the cornerstone of asthma treatment because the doses of medication should be adequate to achieve control of the disease but should not be excessive, causing unwanted short- or long-term side-effects.

A good doctor–patient partnership is one of the most important factors resulting in good asthma control. Patients should be encouraged to express their needs and ask for information on their disease, and should be continuously educated on how to provide information about their levels of asthma control(23).

Factors that are related to the patients include socioeconomic factors, adherence to medication, correct use of inhalers and patient expectations for disease improvement(22).

Patients often have inadequate knowledge about their asthma, are not able to recognize their symptoms, do not take their medication correctly or try to reduce or stop treatment, and cannot identify signs of disease deterioration or monitor simple clinical parameters(24).

Incorrect use of inhalation devices is also very common and is associated with poor asthma control and adverse disease outcomes such as hospital admissions, visits to the emergency departments and courses of systemic corticosteroids(25).

Unfortunately, studies have shown that most healthcare professionals are not able to demonstrate correct inhaler technique and this results in further poor control of asthma(26).

Exposure to triggers, such as allergens, smoke, environmental and work-related irritants, as well as a sedentary lifestyle and poor diet, may be related to poor asthma control(27).

Avoidance of triggers is essential where possible, and this includes advice about allergen avoidance (house dust mites, pets, molds) and change of work environment, if necessary, while smoking cessation should be advocated at each visit.

Comorbidities, usually present in patients with asthma, are also a reason for poor disease control. The most common comorbidities that complicate asthma control are allergic rhinitis, gastro-esophageal reflux disease (GERD), obstructive sleep apnea and psychopathological comorbidities(28–31).

Allergic rhinitis often coexists with asthma and probably over 80% of patients with allergic asthma have concomitant rhinitis(28).

Asthma patients with severe rhinitis and rhino-sinusitis seem to be four to five times more likely to have poorly controlled asthma compared with patients without rhinitis, while treatment of allergic rhinitis results in favorable outcomes regarding asthma control(32).

Numerous studies have shown that the respiratory lining is affected all along its length and rhinitis and asthma are expressions of the same disease spectrum(33,34).

Around 80% of asthmatic patients reported symptoms of GERD, while the use of pH monitoring identified GERD in 38%(35).GERD is both a cause of poor asthma control and a risk factor for asthma exacerbations, although there is evidence that only symptomatic GERD influences asthma control(33,35). So, treatment with proton pump inhibitors is not expected to improve poorly controlled asthma unless a patient suffers from symptomatic GERD(36).

Obstructive sleep apnea is another comorbidity that can be present in asthmatic patients and is related to increased asthma symptoms and poor asthma control(30).sleep apnea management with continuous positive airway pressure results in improvement of asthma control(37).

In a pivotal study from the Netherlands, factors significantly associated with frequent exacerbations included severe nasal sinus disease (adjusted odds ratio (OR) 3.7), gastro-esophageal reflux (OR 4.9), recurrent respiratory infections (OR 6.9) and obstructive sleep apnea (OR 3.4).however, severe chronic sinus disease and psychological dysfunctioning were the only independently associated factors (adjusted OR 5.5 and 11.7, respectively)(29).

3. CONCEPTUAL FRAMEWORK

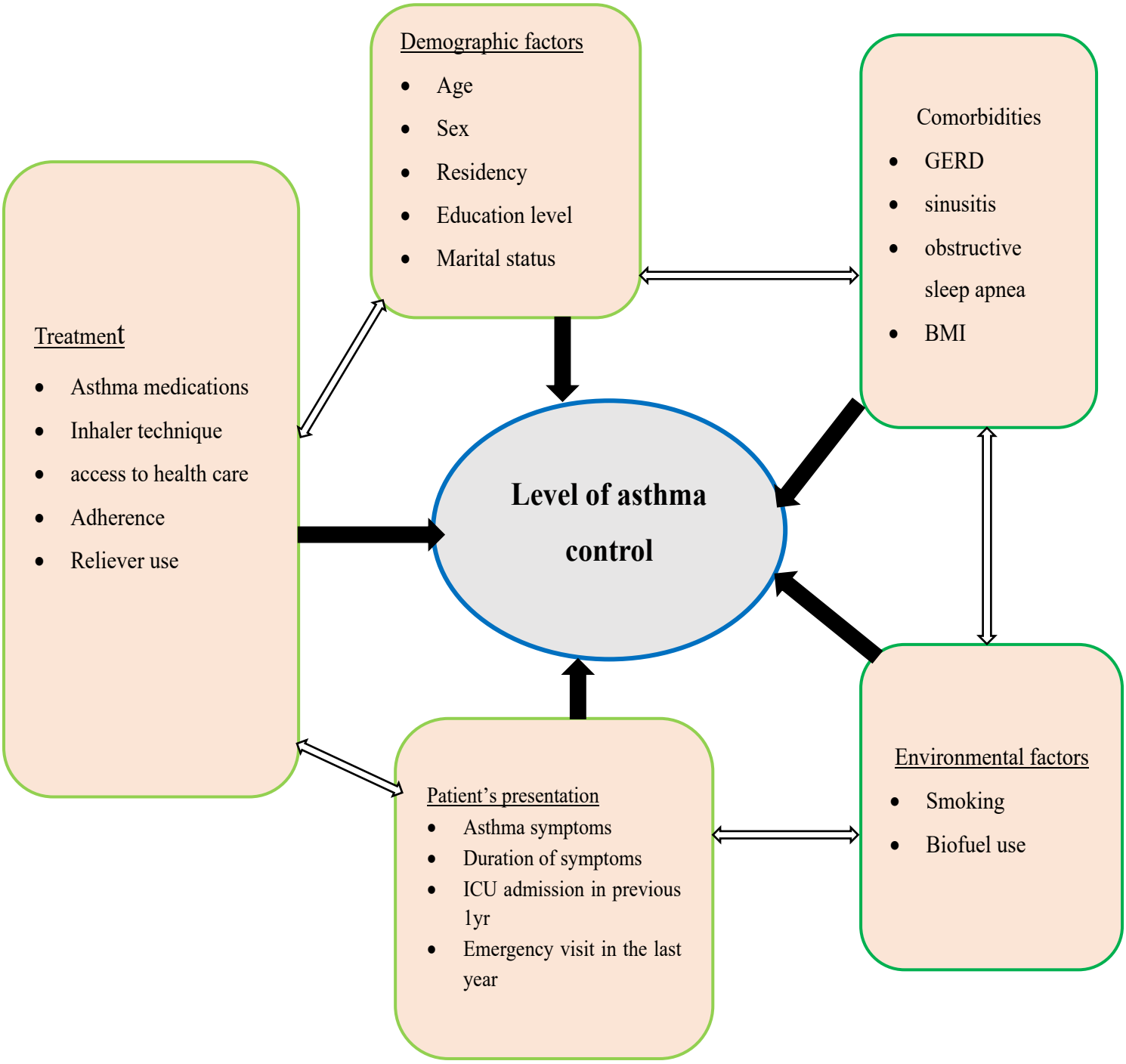


Figure 1: Conceptual frame work of the study for level of Asthma control and associated factors on patients attending Government Hospitals, Bahir Dar, Ethiopia, 2023.

4. OBJECTIVES

4.1. General objective

To assess the level of asthma control and its associated factors for patients attending chest clinic at government hospitals, Bahir Dar, Ethiopia, 2023.

4.2. Specific objective

To determine the level of asthma control for patients attending chest clinic

To identify factors associated with level of asthma control for patients attending chest clinic.

5. METHODS

5.1. Study design

Institutional-based cross-sectional study was conducted.

5.2. Study area and period

The study was conducted at Government hospitals, Bahir Dar from September- November, 2023.

Bahir Dar, the capital city of Amhara region, is situated on the southern shore of Lake Tana.

Bahir Dar city (one of the ten most beautiful cities in Africa and one of the twelve UNESCO Learning Cities Awardee of 2015). The city is located approximately 578 km (360 miles) north-northwest of Addis Ababa, and an elevation of 1,840 meters (6,036 foot) above sea level. Three public hospitals, namely Tibebe Ghion Specialized Hospital (TGSH), Felege Hiwot Referal Hospital and Addis Alem Primary Hospital (APH) existed in Bahir Dar city giving services for the people. Tibebe Ghion specialized hospital is located about 10km south from the city center and about 7 km from the new bus station ('Addisu Meneharia') on the way to Adet district and about 23 km from the Blue Nile Falls [locally called 'Tisabay' (Smoke of Fire)]. It is a tertiary university teaching hospital with 450 bed capacity out of which 72 are occupied by medical adult patients. The hospital receives patients who are referred from across the Amhara region and gives outpatient and inpatient services in all major departments. Felege Hiwot Referal Hospital started giving service in 1955. The other hospital where study will be conducted is Addis Ale m Primary Hospital which is a primary hospital and started to give service since 2007.

Currently, these three hospitals have inpatient beds and outpatient clinics which are expected to serve an estimated 5-7 million people**.** There are subspecialists, internists, residents, general practitioners and interns under internal medicine department. The study was done among bronchial asthma patients who were having follow up at chest clinic in Bahir Dar Public Hospitals from September-November, 2023.

5.3. Source population

All asthma patients attending chest clinic at Government Hospitals in Bahir Dar were the source population.

5.4. Study population

All asthma patients attending chest clinic at Government Hospitals in Bahir Dar during the study period.

5.5. Eligibility criteria

5.5.1. Inclusion criteria

All asthmatic patients who attend chest clinic were included in the study.

Patients who are at least 18 years old, asthma medications use for at least the previous 6 months, and attending chest clinic at Government hospitals in Bahir Dar during the study period were included.

5.5.2. Exclusion criteria

Patients with incomplete chart, patients with active lung Infections and physician diagnosed bronchiectasis or COPD were excluded.

5.6. Study variables

5.6.1. Dependent variable

Level of asthma control (based on GINA asthma symptom control assessment tool)

- Well controlled
- Partly controlled
- Poorly controlled

5.6.2. Independent variables

Demographic factors: Age, sex**,** BMI, marital status, occupation, monthly income

Comorbidities: GERD. Sinusitis, obesity**,** OSA, DM, HTN, CKD, others

Environmental factors: smoking**,** biomass fuel use

Patient presentation: Duration of asthma, asthma symptoms, emergency visits for asthma exacerbation, history of ICU admission/intubation in the past one year.

Treatment: Medications given for asthma**,** Inhaler technique, number reliever canisters used, adherence to controller, frequency of follow up.

5.7. Operational definitions and Terms

B. asthma: defined by history of respiratory symptoms, such as wheeze, shortness of breath, chest tightness and cough, that vary over time and in intensity together with variable airflow limitation.

Asthma exacerbation: defined as the self-report of worsening respiratory symptoms for greater than 48 h in the past 12 months.

Well controlled: defined by the absence of daytime symptoms (no more than twice a week), the absence of nighttime symptoms, no limitations in activities, and limited need for rescue medication (not more than twice a week)(38) .

Partly controlled asthma: when daytime symptoms or rescue medication use was present more than twice per week, and night waking or activity limitation were present in any week(38).

Uncontrolled asthma: defined as the presence of any three or more of these individual features within any week(38).

Adherent to medication: A patient who scored ≥4.5 for the mean MARS-A was adherent to the controller medication(39).

Non-adherent to medication: A patient who scored < 4.5 for the mean MARS-A was non-adherent to the controller medication(39).

Correct Inhalational technique: InTeQ global score 3-5(40,41).

Incorrect inhalational technique: InTeQ global score 1-2(40,41).

Biomass: solid fuels that are derived from plants and animals and that are intentionally burned by humans for household energy. The solid fuels primarily include wood, agricultural residue, animal waste (dung), charcoal, leaves and grass(42).

GERD: self-report of heartburn requiring medication.

Allergic rhino sinusitis: defined as the self-report of recurrent episodes of running nose and sneezing unrelated to cold symptoms.

OSA: self-report night time snoring and day time excessive sleepiness despite night time adequate sleeping.

Smoker: anyone who smokes 100 cigarettes in his/her life time OR who smoked in the previous 28days.

5.8. Sample size determination

The sample size was calculated using single population proportion formula(43). Considering 53.3% as proportion (p) of poorly controlled asthma(12), with 95% confidence interval and 5% marginal error (d), the sample size is calculated to be 383.

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

Where n= sample size

Zα/2=standard normal distribution corresponding 95% significance= 1.96

P = estimated proportion of poorly controlled asthma = 53.3% in a study at Addis Ababa

d = desired precision =5%

n = (1.96)2 (0.533) (0.467)/ (0.05)^2

n = 383

Adding 5% of non-responder rate, n=402.

Table 1: The Sample size calculation by using significant factors

Variables	CI	AOR	Ratio (unexposed/exposed	Power	% of outcome In un exposed	% of outcome In exposed	Sample size
Duration of asthma ≥ 30yrs (28)	95 %	3	5.7	80%	50	75	245
Incorrect inhalation technique (28)	95 %	3.1	1.9	80%	44	71	119

Therefore, the sample size calculated by using single population formula was larger than the sample size calculated for secondary objective. So, that the final sample size of the study was 402.

5.9. Sampling procedure

All asthmatic patients who attend chest clinic during the study period were included in the study. Consecutive sampling was used to get 373 patients; 200 participants from Felege Hiwot Hospital, 102 participants from TGSH and 71 participants from Adisalem Primary Hospital. All asthmatic patients who came for follow-up were interviewed on the day they came.

5.10. Data Collection Procedures

Data was collected using a pretested data collection format from the patient. The questionnaires contain six sections including demographic factors, environmental factors, patient presentation, comorbidities, treatment given including adherence to controller and inhalational technique and GINA asthma symptom control assessment tool.

5.11. Data Quality Assurance

The data was collected by 2 trained health professionals (trained nurses) and supervised by 1 internal medicine resident. Training was given how to collect the data. Pretest was conducted in 5% of the sample before actual data collection to check consistency and ambiguity of the tool.

5.12. Data processing and analysis

The collected data was cleaned and checked for quality prior to data entry, then data was exported to SPSS version 27 statistical software for analysis. The descriptive analysis was done by simple frequencies and proportions, and the results were presented by tables, bar graphs. Both bivariate and multivariable analysis were used to assess the association between each independent variables and the outcome variable by using ordinal logistic regression. Variables with a 95% confidence interval and P-value< 0.25 during the bivariate analysis were included in the multivariable logistic regression analysis. In the final multivariable regression model factors were considered significantly associated if p value is less than 0.05.

6. ETHICAL CONSIDERATIONS

Ethical clearance was obtained from Bahir Dar University Ethics Review Committee. A support letter was sent to Tibebe Ghion Specialized Hospital, Felege-Hiwot referral hospital and Adisalem primary hospital. Names were not used in collecting the data from the medical files. Confidentiality was maintained by keeping the data collection forms locked in a secure cabinet and the electronic data file was kept securely in a password protected computer. Data obtained in the course of study was only handle by the research team.

7. DISSEMINATION OF RESULTS

The finding of this study will be disseminated through publications, presentations on scientific meetings and conferences. The finding of the study will be forwarded to Bahirdar University, Tibebe Ghion Specialized Hospital, and Amhara National Health Bureaus.

8. RESULTS

8.1 Sociodemographic characteristics

In this study a total of 373 patients with physician diagnosis of asthma who had follow up at government hospitals, Bahir Dar were recruited. Of these, 204 (54.7%) were females. The mean age was 43.± 15.79 years. Majority, 134 (35.9%) were aged between 18 and 34 years. Regarding residence area, 260 (69.7%) of the participants were living in urban area. About, 52 (13.9%) participants didn't attend formal education (Table 2).

Table 2: sociodemographic characteristics of the study participants in public hospitals at Bahir Dar, 2023, (N=373).

Variables	**Category**	**Frequency**	**Percentage**
Sex	Female	204	54.7
	Male	169	45.3
Age	18-34	134	35.9
	35-54	132	35.4
	≥55	107	28.7
Marital status	Single	75	20.1
	Married	270	72.4
	Divorced	8	2.1
	Widowed	20	5.4
Education status	uneducated	52	13.9
	Primary school	73	19.6
	Secondary school	99	26.5
	College and higher	149	39.9
Residence	Urban	260	69.7
	Rural	113	30.3
Occupation	Farmer	43	11.5
	Student	18	4.8
	Merchant	59	15.8
	Housewife	127	34
	Government employee	111	29.8
Monthly income median ±SD(ETB)		5000±5134.97	

8.2. Asthma Related Information

Of 373 participants, 136(36.5%) were underweight and 25(6.7%) were obese whereas majority (45.8%) had normal weight.50 (13.4%) participants were biomass users for cooking. Eight participants had ICU admission for asthma exacerbation in the last one year (Table 3).

Table 3: Asthma related information of the study participants in public hospitals at Bahir Dar, 2023, (N=373)

Variables	Category	Frequency	Percentage
Duration of asthma (median duration), years		12±13.7	
Ever smoking status	yes	10	2.7
	no	363	97.3
Biomass fuel use	yes	50	13.4
	no	323	86.6
BMI	underweight	136	36.5
	normal	171	45.8
	overweight	41	11
	obesity	25	6.7
GERD	yes	20	5.4
	No	353	94.6
Allergic rhinitis	yes	26	7
	no	347	93
OSA	Yes	10	2.7
	No	363	97.3
Emergency visit in the last 1 year	Yes	39	10.5
	No	334	89.5
Inhalation technique	correct	275	73.7
	incorrect	98	26.3
Asthma symptoms	cough	251	93.3
	Shortness of breath	132	49.1
	Chest tightness	77	28.6
	wheezing	112	41.6
Comorbidity	HTN	27	45.8
	DM	13	22
	Heart failure	4	6.8
	CKD	2	3.4
	Others	19	32.2
List of medication patient receiving	SABA alone	116	31.1
	SABA-ICS	218	58.4
	LABA-ICS	39	10.5
level of asthma control	Well controlled	127	34
	Partly controlled	85	22.8
	Poorly controlled	161	43.2

Day time asthma symptoms >twice /week	Yes	229	61.4
	No	144	38.6
Night time awakening	Yes	106	28.4
	No	267	71.6
SABA use> twice /week	Yes	240	64.3
	No	133	35.7
Activity limitation due to asthma	Yes	146	39.1
	No	227	60.9
Access to health care	health insurance	257	68.9
	out of pocket	116	31.1
ICS adherence	Adherent	301	80.7
	Non-adherent	72	19.3
Number of reliever canister used in the past one month	less than one	168	45
	one and above	205	55
Emergency visit in the last one year	yes	39	10.5
	no	334	59.3
ICU admission for asthma in the last one year	yes	8	2.1
	no	365	97.9
frequency of follow up in the last one year	less than one month	11	2.9
	every one month	247	66.2
	every two months	71	19
	more than 2 months	44	11.8

Others: subclinical hypothyroidism, PHTN, DVHD, RHD, osteoporosis, RVI, Parkinson disease, IHD, stroke

8.3 Level of asthma control

In this study 161(43.2%) of participants had poorly controlled asthma; 85(22.8%) participants had partly controlled asthma; whereas 127(34%) participants had well controlled asthma. The proportion of poorly controlled asthma is higher in females 91/161(44.6%) than males but the difference was not significant (p=0.77).

One hundred and six (28.4%) participants had night time awakening; 146(39.1%) had activity limitation; and 229(61.4%) had day time asthma symptoms more than twice per week. Thirty nine (10.5%) individuals had emergency department visit in the last one year (Table 3).

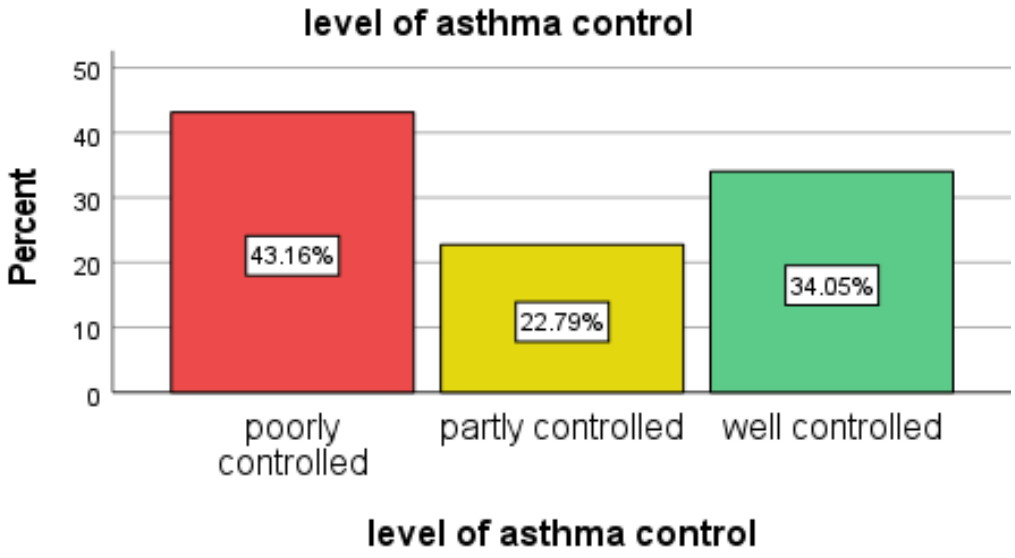


Figure 2: level of asthma control among asthmatic patients in public hospitals at Bahir Dar, 2023.

Table 4: Level of asthma control in relation to baseline characteristics.

Sociodemographic characteristics	Level of asthma control				
	Poorly controlled n(%)	Partly controlled n(%)	Well controlled n(%)	Pearson chi-square	P value
Gender				0.518	0.77
Male	70(41.4)	41(24.3)	58(34.3)		
Female	91(44.6)	44(21.6)	69(33.8)		
Age				12.3	0.15
18-34	50(37.3)	31(23.1)	53(39.6)		
35-54	50(37.9)	34(25.8)	48(36.4)		
≥55	61(57)	20(18.7)	26(24.3)		
Residence				1.43	0.48
Urban	116(44.6)	55(21.2)	89(34.2)		
Rural	45(39.8)	30(26.5)	38(33.6)		
Educational status				5.45	0.48
Uneducated	30(57.7)	8(15.4)	14(26.9)		
Primary school	30(41.4)	18(24.7)	25(34.2)		
Secondary school	41(41.4)	24(24.2)	34(34.3)		
College & above	60(40.3)	35(23.5)	54(36.2)		
Occupation				4.33	0.93
Farmer	17(39.5)	13(30.2)	13(30.2)		
Government employee	48(43.2)	24(21.6)	39(35.1)		
Housewife	52(40.9)	28(22)	47(37.0)		
Merchant	29(49.2)	12(20.3)	18(30.5)		
Student	9(50.0)	3(16.7)	6(33.3)		
Unemployed	6(40)	5(33.3)	4(26.7)		

Marital status					12.21	0.057
	Divorced	6(75.0)	2(25.0)	0(0.00)		
	Married	113(41.9)	60(22.2)	97(35.9)		
	Single	28(37.3)	20(26.7)	27(36.0)		
	Widowed	14(70)	3(15)	3(15)		
BMI					14.8	0.022
	Underweight	63(46.3)	23(16.9)	50(36.8)		
	Normal	69(40.4)	41(24.0)	61(35.7)		
	Overweight	15(36.6)	11(26.8)	15(36.6)		
	Obese	14(56.0)	10(40.0)	1(4.0)		

8.4 Factors associated with level of asthma control

being adherent to controller medication (AOR 4.36, 95% CI 2.09-9.09, P=<0.001), health insurance based access to health care (AOR 1.85, 95% CI 1.05-3.26, P=0.031), having no ER admission in the last year (AOR 3.77, 95% CI 1.51-9.41, P=0.004), correct inhaler technique (AOR 4.31,95% CI 2.37-7.84,P=<0.001), less than one reliever canister use in the previous 1 month(AOR 5.09,95% CI 3.01-8.62,P=<0.001),non- fuel use for cooking(AOR 3.25,95% CI 1.36-7.74,P=0.008), were variables that increase asthma control. However use of SABA alone (AOR 0.07, 95% CI 0.03-0.18, P=<0.001), was significantly associated with decreased asthma control level (Table 5).

Table 5: Independent predictors of asthma control among asthmatic patients at government hospitals, Bahir Dar, Ethiopia, bi-variable and multivariate analysis (N=373)

Variable	*COR(95%CI)*	*P-value*	*AOR(95%CI)*	*p-value*
Age				
18-34	2.17(1.33-3.54)	0.002	1.49(0.59-3.72)	0.39
35-54	2.01(1.23-3.27)	0.005	1.28(0.61-2.69)	0.50
≥55	1		1	
Educational status				
College & higher	1.85(1.00-3.43)	0.048	0.52(0.20-1.35)	0.18
Primary school	1.75(0.88-3.47)	0.108	1.00(0.40-2.49)	0.98
Secondary school	1.74(0.91-3.33)	0.094	0.47(0.18-1.26)	0.13
Uneducated	1		1	
Marital status				
single	1.10(0.69-1.76)	0.679	0.84(0.39-1.83)	0.67
others	0.27(0.11-0.62)	0.002	0.30(0.09-0.97)	0.044
married	1		1	
BMI(kg/m^2)				
<18.5	2.18(0.98-4.83)	0.054	1.35(0.49-3.69)	0.55
18.5-24.9	2.45(1.12-5.34)	0.024	1.55(0.57-4.19)	0.38
25.0-29.9	2.70(1.08-6.77)	0.034	2.16(0.67-6.97)	0.19
≥30	1		1	

GERD				
No	2.06(0.80-5.31)	0.13	1.75(0.57-5.32)	0.32
Yes	1		1	
Allergic rhinitis				
No	1.95(0.87-4.37)	0.10	2.63(0.95-7.25)	0.06
Yes	1		1	
Asthma duration(in yrs)				
<30	4.36(2.19-8.66)	<0.001	1.74(0.66-4.55)	0.26
≥30	1		1	
Current medications				
ICS-SABA	0.56(0,29-1.07)	0.08	0.44(0.20-0.95)	0.037
SABA alone	0.072(0.034-0.15)	<0.001	0.07(0.03-0.18)	**<0.001**
ICS-LABA	*1*		1	
Health care access				
Insurance	1.53(1.01-2.32)	0.04	1.85(1.05-3.26)	**0.031**
Out of pocket	1		1	
ICS adherence				
Adherent	9.2(4.94-17.12)	<0.001	4.36(2.09-9.09)	**<0.001**
Non adherent	1		1	
ER admission (last 1yr.)				
Not at all	5.08(2.44-10.60)	<0.001	3.77(1.51-9.41)	**0.004**
Once & above	1		1	
Biomass fuel use				
No	5.51(2.86-10.58)	<0.001	3.25(1.36-7.74)	**0.008**
Yes	1		1	

Inhaler technique				
Correct	4.5(2.88-7.28)	<0.001	4.31(2.37-7.84)	**<0.001**
Incorrect	1		1	
Number of reliever canister used(last 1month)				
<1	9.69(6.21-15.12)	0.000	5.09(3.01-8.62)	**<0.001**
≥1	1		1	

Others: include Divorced and Widowed

9. DISCUSSION

The goal of asthma treatment is to reach and maintain well controlled asthma. This needs continuous cycle of assessment of control level, treatment modification as well as evaluation of response. The purpose of cyclic assessment is to decrease exacerbation risk, airway damage, treatment related side effects and hence decrease patient's burden and improve quality of their life.

In this public institutional based cross-sectional study the main objective was to determine level of asthma control among bronchial asthma patients attending government hospitals in Bahir Dar and 34%(95% CI 29.5-39.1) of participants had well controlled asthma,22.8%(95% CI 18.5-26.5) had partly controlled and 43.2%(95% CI 37.8-48) had poorly controlled asthma. This finding is consistent with other studies conducted in Addis Ababa, Nigeria and Saudi Arabia where participants achieved 32%, 37% and 31% of well controlled asthma respectively(44–46). But participants in this study achieved lower level of controlled asthma as compared to study conducted in Cameroon(58%)(47).

This difference could be due to difference in adherence to controller medications and improper inhaler technique in our participants (19.3% vs 17.7% of participants were not adherent to controller medication in this and mentioned study respectively).The proportion of poorly controlled asthma [43.2%(95% CI 37.8-48)] in our study was lower as compared to similar study which was conducted in Addis Ababa (53.3%)(48). This difference could be due to different reasons; higher number of biomass fuel users in the study which was conducted at Addis Ababa (37.7% vs 13.4%), higher number of participants were not adherent to controller inhaler in the mentioned study (19.3% Vs 31.9%).

The second objective of this study was to identify factors associated with level of asthma control and we found significant association with a number of study variables. To begin with biomass fuel use for cooking, The odds of having controlled asthma for non-fuel users was 3.25(95%CI 1.36-7.74,P=0.008) which is consistent with previous studies(12,49,50). Pollutants act on natural preventive respiratory clearance cells which induce the production of free oxygen radicals diffusing to the airway surfaces and cause inflammatory reactions.

Additionally, air pollutants could react with the atmospheric ozone layer which further causes the production of Reactive Oxygen Species and changes in the expression of claudins, major components of tight junctions, leading to tight junction barrier permeability and airway hyper-responsiveness(51,52).

Inhaled corticosteroids are the main stays of treatment to achieve controlled asthma. Adherence to inhaled corticosteroids were measured by using MARS-A (medication adherence scale for asthma) and participants with mean MARS-A score of greater than or equal to 4.5 were considered to be adherent.
In this study Being adherent to ICS increases the odds of having controlled asthma (AOR 4.36, 95% CI 2.09-9.09, P=<0.001).Similar studies show the same effect of inhaled corticosteroids on level of asthma control(53,54).

Having health insurance coverage for health care access was another important factor for increased level of asthma control in our study (AOR 1.85, 95% CI 1.05-3.26, P= <0.031).
This relation could be mediated by cost barriers to medications and health facility visits and our result is quit consistent with other studies on health insurance status and level of asthma control(54,55).

A fourth significant finding of this study was the relation of inhaler technique with the level of asthma control.Participants with Inhaler Technique Questionnaire (InTeQ) global score of three to five (3-5) were considered to have correct inhaler technique. In this study correct inhaler technique increases level of asthma control(AOR 4.31,95% CI 2.37-7.84,P value <0.001).our finding is consistent with similar studies (48,54–56).

Moreover, Emergency room visit for exacerbation of asthma in the previous one year was associated with level of asthma control.

In our study participants with no emergency department visit for exacerbation in the last one year had an increased asthma control (AOR 3.77,95% CI 1.51-9.41,P value-0.004).this finding was consistent with GINA guideline and other studies(48,54–58).

Another important predictor of asthma control in this study was the number of canisters used for reliever in the past one month. Those participants who used less than one reliever canister had increased asthma control (AOR 5.09, 95% CI 3.01-8.62 P value-<0.001).Other studies also show the relation of number of canisters and level of asthma control in such a way that, as the number of reliever canisters for reliever increases the level of asthma control decreases(38)(59).

Finally use of SABA alone was associated significantly with decreased asthma control level (AOR 0.07, 95% CI 0.03-0.18, P value-<0.001) which was consistent with GINA guideline and other studies conducted on the same issue(38,59–62).

10. CONCLUSION

Our study revealed that a significant number of individuals presented with suboptimal asthma control. Concerning the potential independent predictors of asthma control level; biomass fuel use for cooking, adherence to ICS, health care access modality, inhaler technique, number of canister used per month for reliever, emergency visit for exacerbation and list of current medications patient is taking were significantly associated with level of asthma control.

11. Limitation of the study

This study has few limitations. Some responses in the questionnaires were patient subjective reports, which could have introduced social desirability bias either by underreporting or exaggeration. Since GINA symptom assessment tool was administered by the operator, patients might not want to freely admit the genuine extent of their symptoms. It is easier to conceal the truth from operator interview than self-administered and if a questionnaire is used in interview based, then the patient might be caught within the lie.

In addition to the above limitation, it was difficult to get full participants as designed by sample size estimation during data collection period due to current war crisis in the study area.

Despite these limitations, this study was adequately powered and the findings compared well with those of other similar studies conducted worldwide.

12. RECOMMENDATIONS

Healthcare providers should work to improve patients' awareness of their medications adherence, inhaler technique and avoid SABA alone use for decreasing the progression of the disease, and better level of asthma control.

13. REFERENCE

1. To T, Stanojevic S, Moores G, Gershon AS, Bateman ED, Cruz AA, et al. Global asthma prevalence in adults: findings from the cross-sectional world health survey. BMC Public Health. 2012;12(1):1–8.
2. Network GA. The Global Asthma Report, Auckland, New Zealand. 2018.
3. Bousquet J, Bousquet PJ, Godard P, Daures JP. The public health implications of asthma. Bull World Health Organ. 2005;83:548–54.
4. Vijayan VK. Global surveillance, prevention and control of chronic respiratory diseases: a comprehensive approach. Indian J Med Res. 2008;128(3):326–7.
5. Accordini S, Corsico AG, Braggion M, Gerbase MW, Gislason D, Gulsvik A, et al. The cost of persistent asthma in Europe: an international population-based study in adults. Int Arch Allergy Immunol. 2012;160(1):93–101.
6. Rabe KF, Vermeire PA, Soriano JB, Maier WC. Clinical management of asthma in 1999: the Asthma Insights and Reality in Europe (AIRE) study. Eur Respir J. 2000;16(5):802–7.
7. Price D, Fletcher M, Van Der Molen T. Asthma control and management in 8,000 European patients: the REcognise Asthma and LInk to Symptoms and Experience (REALISE) survey. NPJ Prim care Respir Med. 2014;24(1):1–10.
8. Zemedkun K, Woldemichael K, Tefera G. Assessing control of asthma in Jush, Jimma, south west Ethiopia. Ethiop J Health Sci. 2014;24(1):49–58.
9. Fanta K, Daba FB. Uncontrolled asthma and associated factors among adult asthmatic patients on follow-up at chest clinic of Jimma University Specialized Hospital, South-West Ethiopia. Pharm Res. 2016;6(11):1–5.
10. Dalo A, Yarlagadda R, Tatiparthi R. Assessment of asthma treatment outcomes among adult outpatients at Nemmh Chest Clinic in Hadiya Zone, Southern Ethiopia. J Basic Clin Pharm. 2017;8(3):1–6.
11. SP P. Real-world Evaluation of Asthma Control and Treatment (REACT): findings from a national Web-based survey. J Allergy Clin Immunol. 2007;119:1454–61.
12. Gebremariam TH, Binegdie AB, Mitiku AS, Ashagrie AW, Gebrehiwot KG, Huluka DK, et al. Level of asthma control and risk factors for poor asthma control among clinic patients seen at a Referral Hospital in Addis Ababa, Ethiopia. BMC Res Notes. 2017;10:1–6.
13. Zewudie A, Nigussie T, Mamo Y, Kumela K. Determinants of poorly controlled asthma among asthmatic patients in Jimma University Medical Center, Southwest Ethiopia: a case control study. BMC Res Notes. 2019;12(1):1–6.
14. Sullivan PW, Slejko JF, Ghushchyan VH, Sucher B, Globe DR, Lin SL, et al. The relationship between asthma, asthma control and economic outcomes in the United States. J Asthma. 2014;51(7):769–78.
15. Stone B, Davis JR, Trudo F, Schiffman B, Alzola C, Brown D, et al. Characterizing patients with asthma who received Global Initiative for Asthma steps 4-5 therapy and managed in a specialty care setting. In: Allergy & Asthma Proceedings. 2018.

16. Reddel HK, Taylor DR, Bateman ED, Boulet LP, Boushey HA, Busse WW, et al. An official American Thoracic Society/European Respiratory Society statement: asthma control and exacerbations: standardizing endpoints for clinical asthma trials and clinical practice. Am J Respir Crit Care Med. 2009;180(1):59–99.
17. Pedersen S. From asthma severity to control: a shift in clinical practice. Prim Care Respir J. 2010;19(1):3–9.
18. Taylor DR, Bateman ED, Boulet LP, Boushey HA, Busse WW, Casale TB, et al. A new perspective on concepts of asthma severity and control. Eur Respir J. 2008;32(3):545–54.
19. Yonas MA, Marsland AL, Emeremni CA, Moore CG, Holguin F, Wenzel S. Depressive symptomatology, quality of life and disease control among individuals with well-characterized severe asthma. J Asthma. 2013;50(8):884–90.
20. Wertz DA, Pollack M, Rodgers K, Bohn RL, Sacco P, Sullivan SD. Impact of asthma control on sleep, attendance at work, normal activities, and disease burden. Ann Allergy, Asthma Immunol. 2010;105(2):118–23.
21. Vollmer WM, Markson LE, O'CONNOR E, Sanocki LL, Fitterman L, Berger M, et al. Association of asthma control with health care utilization and quality of life. Am J Respir Crit Care Med. 1999;160(5):1647–52.
22. Braido F. Failure in asthma control: reasons and consequences. Scientifica (Cairo). 2013;2013.
23. Partridge MR, Hill SR. Enhancing care for people with asthma: the role of communication, education, training and self-management. 1998 World Asthma Meeting Education and Delivery of Care Working Group. Eur Respir J. 2000;16(2):333–48.
24. Baiardini I, Braido F, Giardini A, Majani G, Cacciola C, Rogaku A, et al. Adherence to treatment: assessment of an unmet need in asthma. J Investig Allergol Clin Immunol. 2006;16(4):218.
25. Melani AS, Bonavia M, Cilenti V, Cinti C, Lodi M, Martucci P, et al. Inhaler mishandling remains common in real life and is associated with reduced disease control. Respir Med. 2011;105(6):930–8.
26. Guidry GG, Brown WD, Stogner SW, George RB. Incorrect use of metered dose inhalers by medical personnel. Chest. 1992;101(1):31–3.
27. Gaga M, Papageorgiou N, Yiourgioti G, Karydi P, Liapikou A, Bitsakou H, et al. Risk factors and characteristics associated with severe and difficult to treat asthma phenotype: an analysis of the ENFUMOSA group of patients based on the ECRHS questionnaire. Clin Exp Allergy. 2005;35(7):954–9.
28. Scadding G, Walker S. Poor asthma control?—then look up the nose. The importance of co-morbid rhinitis in patients with asthma. Prim Care Respir J. 2012;21(2):222–8.
29. Wong CH, Chua CJ, Liam CK, Goh KL. Gastro-oesophageal reflux disease in 'difficult-to-control'asthma: prevalence and response to treatment with acid suppressive therapy. Aliment Pharmacol Ther. 2006;23(9):1321–7.
30. Teodorescu M, Polomis DA, Teodorescu MC, Gangnon RE, Peterson AG, Consens FB, et al. Association of obstructive sleep apnea risk or diagnosis with daytime asthma in adults. J Asthma. 2012;49(6):620–8.
31. Ten Brinke A, Sterk PJ, Masclee AAM, Spinhoven P, Schmidt JT, Zwinderman AH, et al. Risk factors of

frequent exacerbations in difficult-to-treat asthma. Eur Respir J. 2005;26(5):812–8.

32. Cruz AA, Popov T, Pawankar R, Annesi-Maesano I, Fokkens W, Kemp J, et al. Common characteristics of upper and lower airways in rhinitis and asthma: ARIA update, in collaboration with GA2LEN. Allergy. 2007;62:1–41.
33. Gaga, Lambrou, Papageorgiou, Koulouris, Kosmas, Fragakis, et al. Eosinophils are a feature of upper and lower airway pathology in non-atopic asthma, irrespective of the presence of rhinitis. Clin Exp Allergy. 2000;30(5):663–9.
34. Gj B. Segmental bronchial provocation induces nasal inflammation in allergic rhinitis patients. Am j Respir Crit Care Med. 2000;161:2051–7.
35. Mastronarde JG. Is there a relationship between GERD and asthma? Gastroenterol Hepatol (N Y). 2012;8(6):401.
36. Gibson PG, Henry R, Coughlan JJL. Gastro-oesophageal reflux treatment for asthma in adults and children. Cochrane database Syst Rev. 2003;2003(1).
37. Lafond C, Series F, Lemiere C. Impact of CPAP on asthmatic patients with obstructive sleep apnoea. Eur Respir J. 2007;29(2):307–11.
38. Levy ML, Bacharier LB, Bateman E, Boulet LP, Brightling C, Buhl R, et al. Key recommendations for primary care from the 2022 Global Initiative for Asthma (GINA) update. npj Prim Care Respir Med. 2023;33(1):7.
39. Cohen JL, Mann DM, Wisnivesky JP, Horne R, Leventhal H, Musumeci-Szabó TJ, et al. Assessing the validity of self-reported medication adherence among inner-city asthmatic adults: the Medication Adherence Report Scale for Asthma. Ann Allergy, Asthma Immunol. 2009;103(4):325–31.
40. Lizano-Barrantes C, Garin O, Dima AL, Van Ganse E, De Bruin M, Belhassen M, et al. The Inhaler Technique Questionnaire (InTeQ): development and validation of a brief patient-reported measure. Int J Environ Res Public Health. 2022;19(5):2591.
41. Dalcin P de TR, Grutcki DM, Laporte PP, Lima PB de, Menegotto SM, Pereira RP. Factors related to the incorrect use of inhalers by asthma patients. J Bras Pneumol. 2014;40:13–20.
42. Romieu I, Schilmann A. Chapter 6 . Household Use of Biomass Fuels. Air Pollut Cancer [Internet]. 2013;63–74. Available from: https://www.iarc.fr/en/publications/books/sp161/AirPollutionandCancer161.pdf#page=69
43. Daniel WW. A foundation for analysis in the health sciences. Biostat Toronto, John Wiley Sons. 1991;209–15.
44. Zeru TG, Engidawork E, Berha AB. Assessment of asthma control and quality of life among asthmatic patients attending armed forces referral and teaching hospital, Addis Ababa, Ethiopia. Pulm Med. 2020;2020.
45. Johbull J, Olaiya AB, Efosa EG. Assessment of asthma control using asthma control test (ACT) and it relationship with lung function parameters. Greemer J Med Sci. 2012;3(8):276–82.
46. Al-Jahdali HH, Al-Hajjaj MS, Alanezi MO, Zeitoni MO, Al-Tasan TH. Asthma control assessment using

asthma control test among patients attending 5 tertiary care hospitals in Saudi Arabia. Saudi Med J. 2008;29(5):714.

47. Hugo MNB, Walter PYE, Maïmouna M, Malea NM, Ubald O, Adeline W, et al. Assessment of asthma control using asthma control test in chest clinics in Cameroon: a cross-sectional study. Pan Afr Med J. 2016;23(1).
48. Gebremariam TH, Binegdie AB, Mitiku AS, Ashagrie AW, Gebrehiwot KG, Huluka DK, et al. Level of asthma control and risk factors for poor asthma control among clinic patients seen at a Referral Hospital in Addis Ababa, Ethiopia. BMC Res Notes. 2017;10(1):4–9.
49. 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):1–13.
50. Mulugeta T, Ayele T, Zeleke G, Tesfay G. Asthma control and its predictors in Ethiopia: Systematic review and meta-analysis. PLoS One [Internet]. 2022;17(1 January):1–16. Available from: http://dx.doi.org/10.1371/journal.pone.0262566
51. Bontinck A, Maes T, Joos G. Asthma and air pollution: recent insights in pathogenesis and clinical implications. Curr Opin Pulm Med. 2020;26(1):10–9.
52. Kim B, Lee P, Lee S, Park C, Jang A. Impact of ozone on claudins and tight junctions in the lungs. Environ Toxicol. 2018;33(7):798–806.
53. Vähätalo I, Kankaanranta H, Tuomisto LE, Niemelä O, Lehtimäki L, Ilmarinen P. Long-term adherence to inhaled corticosteroids and asthma control in adult-onset asthma. ERJ open Res. 2021;7(1).
54. Belachew EA, Netere AK, Sendekie AK. Adherence to inhaled corticosteroid therapy and its clinical impact on asthma control in adults living with asthma in northwestern Ethiopian hospitals. Patient Prefer Adherence. 2022;1321–32.
55. Suri R, Macinko J, Inkelas M, Needleman J. The Relationship Between Insurance Status and the Affordable Care Act on Asthma Outcomes Among Low-Income US Adults. Chest [Internet]. 2022;161(6):1465–74. Available from: https://doi.org/10.1016/j.chest.2022.01.011
56. AL-Jahdali H, AL-Harbi A, Khan M, Baharoon S, Bin Salih S, Ahmed A, et al. Improper inhaler technique is associated with poor asthma control and frequent emergency department visits. Allergy, Asthma Clin Immunol [Internet]. 2013;9(1):1–7. Available from: https://aacijournal.biomedcentral.com/articles/10.1186/1710-1492-9-8%0Ahttp://europepmc.org/search?query=(DOI:10.1186/1710-1492-9-8)%0Ahttps://aacijournal.biomedcentral.com/track/pdf/10.1186/1710-1492-9-8
57. Hasegawa K, Tsugawa Y, Brown DFM, Camargo CA. A population-based study of adults who frequently visit the emergency department for acute asthma: California and Florida, 2009-2010. Ann Am Thorac Soc. 2014;11(2):158–66.
58. 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. Egypt J Bronchol

[Internet]. 2022;16(1). Available from: https://doi.org/10.1186/s43168-022-00160-8

59. Amirav I, Garcia G, Le BK, Barria P, Levy G, Aggarwal B, et al. SABAs as Reliever Medications in Asthma Management: Evidence-Based Science. Adv Ther. 2023;1–17.

60. Noorduyn SG, Qian C, Johnston KM, Soliman M, Talukdar M, Walker BL, et al. SABA use as an indicator for asthma exacerbation risk: an observational cohort study (SABINA Canada). ERJ Open Res [Internet]. 2022;8(3). Available from: http://dx.doi.org/10.1183/23120541.00140-2022

61. Worth H, Criée CP, Vogelmeier CF, Kardos P, Becker EM, Kostev K, et al. Prevalence of overuse of short-acting beta-2 agonists (SABA) and associated factors among patients with asthma in Germany. Respir Res [Internet]. 2021;22(1):1–9. Available from: https://doi.org/10.1186/s12931-021-01701-3

62. Nwaru BI, Ekström M, Hasvold P, Wiklund F, Telg G, Janson C. Overuse of short-acting β2-agonists in asthma is associated with increased risk of exacerbation and mortality: A nationwide cohort study of the global SABINA programme. Eur Respir J [Internet]. 2020;55(4). Available from: http://dx.doi.org/10.1183/13993003.01872-2019

14. ANNEXES

14.1. Information sheet

Title of the research project: Level of asthma control and it's associated factors in adults attending chest clinic at Government Hospitals,Bahir Dar,Ethiopia

Name of the principal investigator: Bekalu Sintayehu (Internal Medicine Resident)

Name of the Organization: Bahir Dar University, College of Medicine and Health science, School of Medicine, Department of internal medicine.

Introduction: Asthma has a significant impact on the lives of people. It is a major cause of morbidity and mortality. Globally World Health Organization (WHO) estimated that there were more than 339 million people with Asthma in 2018. Uncontrolled asthma negatively affects patients, their caregivers, and the country as a whole. Determining the status of asthma control and identifying associated risk factors for poor control is a key strategy to decrease the negative health impacts and financial burden of the disease.

Objective: To assess the level of asthma control and its associated factors for patients attending chest clinic at Government hospitals, Bahir Dar, Ethiopia, 2023

Benefits and risk: Being involved in this study has no harm other than taking 10-15minutes. The study may help to know the level of asthma control and associated factors among asthmatic patients attending Government Hospitals which might help to estimate disease burden and resource allocation.

Participation and withdrawal: You have the full right whether to participate or not and can withdraw at any time or ask to jump specific questions if you want to do so.

Confidentiality: All personal identifiers and information will not be taken hence your responses will be kept confidential. Data will be accessed by the principal investigator, advisors, and research assistant only and finally will be analyzed anonymously.

For further queries, comments or suggestions please contact me at the following address

Bekalu Sintayehu (Internal Medicine Resident)

aderaayenew@gmail.com Tel. +251913072958/+251928438361

14.2. Consent form

Greetings,

This is Bekalu Sintayehu, internal medicine Resident at Bahir Dar University. I am undertaking a study to gather information on Level of asthma control and it's associated factor in adults attending chest clinic at Government Hospitals, Bhir Dar, Northwest Ethiopia.

I am going to ask some questions that you will waste no more than 15 minutes. Your willingness is appreciable and you have full right to withdraw or discontinue the response. Your name will not be mentioned and your information will be kept confidential.

Are you willing to take part, please?
Yes_____ No_____
If yes, let us continue.

Respondent code (MRN):_____ Date of interview_____.

Interviewer's name_____ signature_____.

Supervisor's name _____ signature_____.

Thank you for your willingness

14.3. Questionnaire

Name of data collector----------signature----------

Supervisory name----------signature ----------

Questionnaire code----------

Date of interview (day/month/year) ----------

Name of health institution ----------

Part 1: Socio-Demographic Characteristics

S.no	Question	Response option
101	What is your age?	……. years
102	What is your sex?	1. Male 2. Female
103	Where is your residence?	1. Urban 2. Rural
105	Educational status of a participant	1. unable to read and write 2. Primary 3. Secondary 4. Diploma and above
106	What is your occupational status?	1. Housewife 2. Government employee 3. Merchant 4. student 5. Farmer
107	What is your current marital status?	1 Single 2 Married 3 Divorced 4 Widowed
108	What is your monthly income	……..

Part 2: Comorbidities

S.no	Question	Response option
201	GERD	1. Yes 2. No
202	Sinusitis	1. Yes 2. No
203	OSA	1. Yes 2. No
204	Body mass index	……
205	HTN	1. Yes 2. no
206	DM	1. Yes 2. no
207	Heart failure	1. Yes 2. no
208	CKD	1.Yes 2.no
209	Others(mention)	

Part 3: Environmental factors

S.no	Question	Response option
301	Do you have history of cigarette smoking?	1. Yes 2. No
302	If yes on Q 302, for how long did you smoke (in yrs.)?	
303	Do you use biomass fuel for cooking?	1. Yes 2. No
304	If yes on Q 303, for how long did you use biomass (in yrs?)	

Part 4 **asthma symptoms and treatment**

S.no	Question	Response option
401	Cough	1. Yes 2. No
402	Dyspnea	1. Yes 2. No
403	Chest tightness	1. Yes 2. No
	wheeze	1.yes 2.no
404	Number of ER visit for exacerbation in previous year	1. Once and above 2. Not at all
405	Duration of asthma in yrs.	……
406	How frequent was your chest clinic visit in the past one year?	1.less than 1 month 2.monthly 3.every 2 months 4.more than 2 month
407	Given treatment	1.SABA alone 2.ICS- SABA 3.ICS-LABA
408	Adherence to ICS(based on MARS-A tool)	1.adherent 2.non-adherent
409	How many reliever canisters did you use in the past 1 month?	1.less than one 2.one and above
410	Inhalation technique (based on InTeQ)?	1.correct 2.incorrect
411	How do you get the medication monthly?	1.health insurance 2.out of pocket
412	History of intubation/admission to ICU for asthma in the last yr.?	1.yes 2.no

413	Level of asthma control(based on GINNA assessment tool)	1.well controlled 2.partly controlled 3.poorly controlled

Part 5: GINA asthma control assessment tool

S.no	Question	
501	Did you have daytime asthma symptoms more than twice per week?	1. Yes 2. No
502	Did you have any waking due to asthma?	1. Yes 2. No
503	Did you use SABA reliever for symptoms more than twice per week?	1. Yes 2. No
504	Did you have any activity limitation due to asthma?	1. Yes 2. No

1. **Well controlled**-if none of the above.
2. **Partly controlled**-1 or 2 of above.
3. **Poorly controlled**-3 or 4 of above.

Medication Adherence Report Scale for Asthma (MARS-A) assessment tool

How often do you do the following?
Answers:(1)Always(2)Often (3)Sometimes (4)Rarely (5)Never

1. I only use my **[NAME OF MEDICINE]** when I need it
2. I only use it when I feel breathless
3. I decide to miss out a dose
4. I try to avoid using it
5. I forget to take it
6. I alter the dose
7. I stop taking it for a while
8. I use it as a reserve, if my other treatment doesn't work
9. I use it before doing something which might make me breathless
10. I take it less than instructed

NB: mean MARS-A≥4.5- adherent

Mean MARS-A<4.5-non-adherent

The Inhaler Technique Questionnaire (InTeQ)

Items	Response Options
Breathe out fully before use	Always
Close lips tightly around the mouthpiece	Often
Breathe in deeply through the mouthpiece	Sometimes
Hold my breath for at least 10 s after breathing in	Rarely
Breathe out very slowly after use	Never
	Don't Know

NB: Inhaler Technique Questionnaire (InTeQ) asks about the frequency of performing five steps when using inhalers (on a five-point Likert scale)

4-5-good inhaler technique

3-fair

1-2-poor inhaler technique

⁎ for our purpose see operational definition.

1. Never 3.sometimes 5.always

2. Rarely 4.often