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Factors associated with uncontrolled asthma among adult asthmatic patients in eastern Ethiopia: A multicenter study

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Abstract

Objective: Asthma is a major public health problem worldwide. Despite various attempts, it is still uncontrolled in most parts of the world. Moreover, it is contributing to the national and global burden of non-communicable diseases. Studying factors associated with uncontrolled asthma in different parts of Ethiopia is crucial to control the disease and improving the quality of life of asthmatic patients. Thus, this study aimed to determine the factors associated with uncontrolled asthma among adult asthmatic patients in Eastern Ethiopia.

Methods: Facility-based cross-sectional study was employed from 1st October 2020 to 30th January 2021. A total of 416 adult asthmatic patients participated in the study from six hospitals follow-up clinics. Asthma control test was used to assess the participants level of asthma control and a score of ⩽19 were regarded to have uncontrolled asthma. Data were analyzed using SPSS version 24. Bivariable and multivariable analyses were carried out to identify factors associated with uncontrolled asthma and variables with a p value of less than 0.05 were considered statistically significant.

Result: The prevalence of uncontrolled asthma was 66.1 % (95% confidence interval: 61.5–70.4). Not attending scheduled medical follow-up (adjusted odds ratio: 2.54; 95% confidence interval: 1.28–4.99), poor knowledge about asthma (adjusted odds ratio = 4.59; 95% confidence interval: 2.01–10.51), negative attitude toward asthma (adjusted odds ratio = 3.72; 95% confidence interval: 1.83–7.59), and poor adherence to medications (adjusted odds ratio = 2.53; 95% confidence interval: 1.25–5.13) were significantly associated with uncontrolled asthma.

Conclusion: In this study, the prevalence of uncontrolled asthma was considerably high. Not attending scheduled medical follow-up, poor knowledge about asthma, negative attitude toward asthma, and poor adherence to anti-asthma medications were associated with uncontrolled asthma. Therefore, it is crucial to focus on increasing the patients' level of awareness about asthma control, improving medication adherence, and avoiding triggering factors.

Keywords

Asthma, uncontrolled asthma, eastern Ethiopia, 2021, adult, asthmatic patients

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Introduction

The global morbidity and mortality from non-communicable diseases such as cardiovascular diseases, diabetes, cancer, and chronic respiratory disorders are on the rise. Chronic respiratory diseases were the third leading cause of death worldwide resulting in 7% of deaths.[1,2]

Asthma is a respiratory non-communicable inflammatory disease affecting a large number of people irrespective of age, sex, or socioeconomic status.[3] It affects both developed and developing countries and poses a major problem irrespective of their economic development.[3,4] In 2019, more than 461,000 people died from asthma worldwide, with an estimated 262 million individuals suffering from the disease.[5] Poor and middle-income nations account

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for more than 80% of asthma mortality.[4] Asthma prevalence has increased in Africa during the last two decades, with an estimated 119.3 million people affected.[6,7] According to the data of a cross-sectional world health survey conducted in 2012, the prevalence of clinical asthma in Ethiopia was 2%.[8]

Uncontrolled asthma harms the individual, family, and national levels. It causes various serious issues, adding to the national and global burden of non-communicable illnesses. It also results in mortality and studies showed that oral corticosteroid use is associated with an increased risk of mortality among asthmatic patients.[9,10] In addition, it reduces and limits the physical activity, mood, and social life of asthmatic patients, lowering their quality of life and productivity.[8,11]

Asthma cannot be cured, but if effective asthma care and management are employed, most individuals with asthma can control it since monitoring the level of asthma control is an important component of effective asthma care and management.[12,13] Despite efforts to incorporate international asthma management guidelines and the presence of an internationally standardized tool to measure the level of asthma control, the prevalence of uncontrolled asthma in Ethiopia remains high, ranging from 53.3% to 75.8%.[14] In the studies conducted in Ethiopia, factors including poor knowledge about asthma, negative attitude toward asthma, non-adherence to inhaled corticosteroids, longer duration of asthma, asthma exacerbation in the last 12 months, low monthly income, presence of comorbidity, and use of short acting beta2 agonist alone as anti-asthmatic medication were significantly associated with uncontrolled asthma.[15–18]

Approaches to improve symptom control have the potential to significantly reduce both the humanistic and economic burdens of asthma. However, just a few researches have been conducted to determine the substantial percentage of uncontrolled asthma and predicting factors in Ethiopia. Those studies were done in a single hospital and assessed a few variables that might be associated with uncontrolled asthma, but this is a multicenter study conducted in different types of hospitals including different independent variables and different types of patients which in turn helps to determine the true burden of the problem in the country. Thus, this study is intended to investigate the prevalence and determinants of uncontrolled asthma in Eastern Ethiopia to tailor national strategies and interventions.

Methods

Study setting and study design

Facility-based cross-sectional study was conducted from 1st October 2020 to 30th January 2021, in six hospitals that are found in Harar and Dire Dawa, Eastern Ethiopia. Hiwot Fana Comprehensive Specialized Hospital, Jugal General Hospital, and Federal Police Harar General Hospital are located in Harar whereas Dilchora Referral Hospital, Sabian General Hospital, and East Command Level Three Referral Hospital are found in Dire Dawa.

Ethics approval

The study was conducted following the Declaration of Helsinki Ethical principle for medical research involving human subjects. The ethical approval was obtained from the Institutional Health Research Ethical Review Committee (IHRERC) of the College of Health and Medical Science of Haramaya University with the reference number of (IHRERC/014/2020). An official letter of cooperation was written and submitted to the respective health bureaus, and hospitals. Informed written voluntary consent was obtained from the heads of the hospitals and all the study participants. Participants' confidentiality was maintained throughout the process.

Population and sample

The study included asthmatic patients over the age of 18 years who had been taking anti-asthmatic medications for at least 6 months, where the diagnosis was based on medical history, physical examination, and spirometer results. Asthmatic patients who were mentally unstable or critically ill and patients with physician-diagnosed chronic obstructive pulmonary disease, active respiratory infections, congestive heart failure, and pulmonary hypertension were excluded from the study. The sample size was calculated by using single population proportion formula considering a 95% confidence interval (CI), a 5% margin of error, and a proportion of 53.3%.[17] After adding a 10% non-response rate, the final sample size was 420. Prior 6 months of patient enrollment records from the respective hospitals' follow-up registration books were used to proportionally allocate the sample size, and then a consecutive sampling method was applied to recruit study participants.

Data collection instruments and procedure

Data were collected by face-to-face interviews using a structured and pretested questionnaire. Six trained nurses participated in the data collection process. The questionnaire was first prepared in English, then it was translated to *Amharic, Afaan Oromo*, and *Af Somali* languages by language experts and it was back-translated to English to check for consistency. The questionnaire included socio-demographic characteristics and patients' treatment history and disease-related factors. To assess the level of asthma control, the Asthma Control Test (ACT) tool which includes five questions was used. Participants in the study with scores greater than 19 were deemed to have controlled asthma, while those with scores less than or equal to 19

were regarded to have uncontrolled asthma.[19] The Medication Adherence Reporting scale (MARs) which includes 10 questions was used to assess participants' level of medication adherence. To minimize the social desirability bias, the questions were framed as negative statements. It was measured based on 5 points Likert-type scale ranging from always to never. Accordingly, participants who scored a mean value of 4.5 and more were considered to have good adherence.[20,21] The study participants' knowledge about asthma was assessed by 20 questions. Accordingly, participants who scored greater than or equal to 13 were considered to have good knowledge, 9–12 average knowledge, and ⩽8 poor knowledge.[22,23] Five questions on a 5-point Likert-type scale were used to examine patients' attitudes toward asthma. Participants with scores greater than or equal to 15 were classified as having a positive attitude, while those with scores less than 15 were classified as having a negative attitude.[22,23] Lung function test was measured and Forced Expiratory Volume in 1 second (FEV1) was recorded by portable digital Diagnostic Easy One Plus model 2001 SN spirometer. Body mass index (BMI) was calculated and those respondents with values $<25\,kg/m^2$ were categorized as underweight or normal, respondents with BMI between 25 and $<30\,kg/m^2$ were categorized as overweight, and the remaining, whose BMI was $\geqslant 30\,kg/m^2$ were categorized as obese.[24]

Data quality control

Pretest was conducted among 5% (21) of the sample size at Haramaya Hospital, in Haramaya district. Data collectors and supervisors were trained on the research objectives, data collection tools, procedures, and interview techniques for one day. An introductory orientation was given to the study participants by data collectors about the purposes of the study. Informed written voluntary consent was taken from all selected participants before the data collection. Data were first checked for completeness and consistency and then double data entry was done and cross-validated.

Statistical analysis

The data were entered into Epi-data version 3.1.0 and exported to SPSS version 24 for analysis. Descriptive statistics including frequencies, percentages, median, range, and interquartile range (IQR) were computed to describe the variables. Bivariable logistic regression analysis was done to determine the association between each independent variable and uncontrolled asthma. All the variables with a p value less than 0.25 in the bivariable analysis and clinically important variables were entered to the final multivariable logistic regression. To identify factors associated with uncontrolled asthma, multivariable analysis was carried out. To measure the strength of association, crude odds ratio (COR) and adjusted odds ratio (AOR) along with 95% CI were estimated. The Hosmer–Lemeshow test was used to determine the model's fitness, and a p value greater than 0.05 was considered fit. Multicolinearity test was carried out to see the correlation between independent variables using a variance inflation factor (>10). To declare the presence of statistical significance, a p value of <0.05 was taken.

Result

Socio-demographic characteristics and patient-related factors

The study included 416 participants. The median (25th–75th percentile) age of participants was 41 years (30–50) with a range of 18–79. Of the total participants, 215 (51.7%) were females, 247 (59.4%) were married, the BMI for 262 (63%) of the participants was normal or underweight, the majority of them 91.6% were urban residents and 174 (41.8%) had monthly income between 1201 and 2499birr (22.94–47.76$). Of the total participants, 243 (58.4%) did not attend their regular medical follow-up as scheduled. This study also showed that 357 (85.8%) participants had never smoked, 243 (58.4%) of them chew khat, 186 (44.7%) had poor knowledge about asthma, and 217 (52.2%) had a positive attitude toward asthma (Table 1).

Prevalence of uncontrolled asthma

In this study, the prevalence of uncontrolled asthma was 275 (66.1%; 95% confidence interval: 61.5–70.4), while the prevalence of controlled asthma was 141(33.9 %).

Disease-related factors

Two hundred fifty-seven (61.8%) of the study participants use medications regularly to control asthma, and the remaining 159 (38.2%) use them only to relieve signs and symptoms. Most of the study participants 355 (85.3%) used Short Acting Beta2 Agonist (SABA) inhalers. Among those who used anti-asthma medications, 147 (35.3%) had poor adherence to medications. The median (25th–75th percentile) duration of asthma was 6 years (3–12.75) with a range of 1–41 years. Around half of the study participants, 211(50.7%) had asthma exacerbation in the past 12 months, 164 (39.4%) had a comorbid illness, and only 47 (11.3%) were admitted to the hospital within the past 12 months. The reason for hospital admission for 17 (36.2%) out of the 47 admitted patients was asthma, and 133 (32%) of the study participants had a family history of asthma. Forced Expiratory Volume in 1 s was less than 80% in 245 (78.3%) of the participants. Three hundred twelve (75%) mentioned seasonal variation as their major asthma triggering factor (Table 2).

Table 1. Socio-demographic characteristics and patient-related factors of adult asthmatic patients on follow-up at governmental hospitals, eastern Ethiopia.

Variable		Frequency (%)	Controlled asthma	Uncontrolled asthma	p value
Age in years	18–34	136 (32.7)	53 (37.6)	83 (30.2)	
	35–54	198 (47.6)	68 (48.2)	130 (47.3)	0.087
	>55	82 (19.7)	20 (14.2)	62 (22.2)	
Sex	Male	201 (48.3)	67 (47.5)	134 (48.7)	0.815
	Female	215 (51.7)	74 (52.5)	141 (51.3)	
Marital status	Single	86 (20.7)	42 (29.8)	44 (16)	
	Married	247 (59.4)	78 (55.3)	169 (61.5)	0.008
	Divorced/separated	35 (8.4)	9 (6.4)	26 (9.5)	
	Widowed	48 (11.5)	12 (8.5)	36 (13.1)	
BMI	Normal/underweight	262 (63)	81 (57.4)	181 (65.8)	0.246
	Overweight	110 (26.4)	43 (30.5)	67 (24.4)	
	Obese	44 (10.6)	17 (12.1)	27 (9.8)	
Educational status	No formal education	70 (16.8)	20 (14.2)	50 (18.2)	0.745
	Primary education	74 (17.8)	27 (19.1)	47 (17.1)	
	Secondary education	113 (27.2)	38 (27)	75 (27.3)	
	Higher education	159 (38.2)	56 (39.7)	103 (37.5)	
Occupation	Merchant	91 (21.9)	27 (19.1)	64 (23.3)	0.791
	Daily laborer	48 (11.5)	15 (10.6)	33 (12)	
	Private employee	50 (12)	20 (14.2)	30 (10.9)	
	Government employee	103 (24.8)	36 (25.5)	67 (24.4)	
	Housewife	73 (17.5)	24 (17)	49 (17.8)	
	Farmer	17 (4.1)	8 (5.7)	9 (3.3)	
	Other[a]	34 (8.2)	11 (7.8)	23 (8.4)	
Residence	Urban	381 (91.6)	135 (95.7)	246 (89.5)	
	Rural	35 (8.4)	6 (4.3)	29 (10.5)	0.029
Average monthly income in Ethiopia	⩽1200 ETB (22.93$)	113 (37.2)	20 (14.2)	93 (33.8)	<0.001
	1201–2499 ETB(22.94–47.76$)	99 (23.8)	36 (25.5)	63 (22.9)	
	⩾2500 ETB (47.77$)	204 (49)	85 (60.3)	119 (43.3)	
Regular medical follow-up	Yes	173 (41.6)	85 (60.3)	88 (32)	
	No	243 (58.4)	56 (39.7)	187 (68)	<0.001
Smoking	Currently smoking	41 (9.9)	11 (7.8)	30 (10.9)	0.313
	Previously smoking	18 (4.3)	4 (2.8)	14 (5.1)	
	Never smoked	357 (85.8)	126 (89.4)	231 (84)	
Khat chewing	Yes	173 (41.6)	75 (53.2)	98 (35.6)	0.001
	No	243 (58.4)	66 (46.8)	177 (64.4)	
Knowledge about asthma	Good knowledge	134 (32.2)	66 (46.8)	68 (24.7)	
	Average knowledge	90 (21.6)	42 (29.8)	48 (17.5)	
	Poor knowledge	192 (46.2)	33 (23.4)	159 (57.8)	<0.001
Attitude toward asthma	Positive attitude	206 (49.5)	107 (75.9)	101 (36.7)	
	Negative attitude	210 (50.5)	34 (24.1)	174 (63.3)	<0.001

BMI: body mass index; ETB: Ethiopian Birr.
[a]Other: no occupation, student.

Factors associated with uncontrolled asthma

Bivariable logistic regression was used to assess an association between different factors and the occurrence of uncontrolled asthma. Those variables which showed an association at p value < 0.25 and clinically important variables were entered into the multivariable logistic regression model. In the multivariable analysis, participants who did not attend their scheduled regular follow-up had 2.5 times higher odds to have uncontrolled asthma than those who attended their regular follow-up. (AOR: 2.527; 95% CI: 1.281–4.986). Asthmatic patients who had poor knowledge about asthma had 4.5 times higher odds to have uncontrolled asthma than those who

Table 2. Disease-related factors for adult asthmatic patients on follow-up at governmental hospitals, eastern Ethiopia.

Variable		Total	Controlled asthma	Uncontrolled asthma	p value
Type of medication used	SABA	355 (85.3)	110 (78)	245 (89.1)	0.003
	ICS	238 (57.2)	86 (61)	152 (55.3)	0.264
	OCS	60 (14.4)	18 (12.8)	42 (15.3)	0.491
	ICS and LABA	39 (9.4)	15 (10.6)	24 (8.7)	0.527
	ICS, OCS, and LABA	28 (6.7)	9 (6.4)	19 (6.9)	0.839
	Antihistamine	14 (3.4)	4 (2.8)	10 (3.6)	0.669
Medication adherence	Good adherence	110 (42.8)	55 (60.4)	55 (33.1)	
	Poor adherence	147 (57.2)	36 (39.6)	111 (66.9)	<0.001
Duration of asthma	<10 years	242 (58.2)	84 (59.6)	158 (57.5)	
	11–20 years	89 (21.4)	25 (17.7)	64 (23.3)	0.570
	21–30 years	44 (10.6)	16 (11.3)	28 (10.2)	
	>30 years	41 (9.8)	16 (11.3)	25 (9.1)	
Exacerbation in the past 12 months	Yes	211 (50.7)	67 (47.5)	144 (52.4)	0.349
	No	205 (49.3)	74 (52.5)	131 (47.6)	
FEV1	<80%	245 (78.3)	89 (77.4)	156 (78.8)	0.773
	>80%	68 (21.7)	26 (22.6)	42 (21.2)	
Comorbid illness	Yes	164 (39.4)	98 (69.5)	154 (56)	0.008
	No	252 (60.6)	43 (30.5)	121 (44)	
Types of comorbid illness	Allergic rhinitis	27 (16.5)	9 (20.5)	18 (15)	0.406
	Hypertension	75 (45.7)	19 (43.2)	56 (46.7)	0.692
	Diabetes mellitus	87 (53)	21 (47.7)	66 (55)	0.409
	HIV/AIDS	21 (12.8)	7 (15.9)	14 (11.7)	0.473
	Others[a]	12 (7.3)	2 (4.5)	10 (8.3)	0.416
Hospital admission in the past 12 months	Yes	47 (11.3)	13 (9.2)	34 (12.4)	0.339
	No	369 (88.7)	128 (90.8)	241 (87.6)	
Reason for prior hospital admission	Asthma	17 (36.2)	4 (30.8)	13 (38.2)	0.634
	Other[b]	30 (7.2)	9 (69.2)	21 (61.8)	
Family history of asthma	Yes	133 (32)	40 (28.4)	93 (33.8)	0.260
	No	283 (68)	101 (71.6)	182 (66.2)	
Triggering factors	Seasonal variation	312 (75)	101 (71.6)	211 (76.7)	0.257
	Dust	221 (53.1)	79 (56)	142 (51.6)	0.396
	Pets	166 (39.9)	52 (36.9)	114 (41.5)	0.367
	Stressful events	101 (24.3)	31 (22)	70 (25.5)	0.435
	Pollen	84 (20.2)	27 (19.1)	57 (20.7)	0.704
	Physical exercise	61 (14.7)	22 (15.6)	39 (14.2)	0.993
	Molds	65 (15.6)	22 (15.6)	43 (15.6)	0.698
	Emotions	57 (13.7)	19 (13.5)	38 (13.8)	0.923
	Smoke	52 (12.5)	17 (12.1)	35 (12.7)	0.845
	Other[c]	14 (3.4)	4 (2.8)	10 (3.6)	0.669

SABA: short acting beta2 Agonist; ICS: inhaled corticosteroid; OCS: oral corticosteroid; LABA: long acting beta2 agonist; FEV1: forced expiratory volume in 1 s.

[a]Others: chronic kidney disease, breast cancer, chronic liver disease, and thyroid disease.

[b]Other; for child birth, diabetic ketoacidosis, pneumonia, tuberculosis, appendicitis, head injury, peptic ulcer disease, and anemia.

[c]Others: strong odor, aspirin, and detergent.

had good knowledge (AOR: 4.593; 95% CI: 2.007–10.514). Patients who had a negative attitude toward asthma had 3.7 times higher odds to have uncontrolled asthma than those who had a positive attitude (AOR = 3.724; 95% CI: 1.825–7.597). Participants who had poor medication adherence had 2.5 times higher odds to have uncontrolled asthma than those who had good medication adherence (AOR = 2.533; 95% CI: 1.251–5.128; Table 3).

Table 3. Bivariate and multivariate analysis for factors associated with uncontrolled asthma among adult asthmatic patients on follow-up at governmental hospitals, eastern Ethiopia.

Variable	Category	Asthma control		COR (95% CI)	AOR (95% CI)	p value
		Controlled (%)	Uncontrolled (%)			
Age	18–34	53 (37.6)	83 (30.2)	1	1	
	35–54	68 (48.2)	130 (47.3)	1.221 (0.776–1.919)	0.797 (0.317–2)	0.628
	>55	20 (14.2)	62 (22.2)	1.98 (1.075–3.645)	1.232 (0.364–4.175)	0.738
Sex	Male	67 (47.5)	134 (48.7)	1.05 (0.699–1.576)	1.221 (0.608–2.449)	0.575
	Female	74 (52.5)	141 (51.3)			
Marital status	Single	42 (29.8)	44 (16)	1	1	
	Married	78 (55.3)	169 (61.5)	2.068 (1.253–3.412)	1.624 (0.588–4.486)	0.349
	Divorced/separate	9 (6.4)	26 (9.5)	2.758 (1.158–6.569)	1.028 (0.217–4.876)	0.978
	Widowed	12 (8.5)	36 (13.1)	2.864 (1.315–6.236)	1.158 (0.269–4.989)	0.844
BMI	Normal/underweight	81 (57.4)	181 (65.8)	1.407 (0.726–2.725)	1.648 (0.54–5.028)	0.380
	Overweight	43 (30.5)	67 (24.4)	0.981 (0.479–2.011)	1.148 (0.358–3.678)	0.817
	Obese	17 (12.1)	27 (9.8)		1	
Income	⩽1200ETB(22.93$)	20 (14.2)	93 (33.8)	3.321 (1.902–5.8)	1.42 (0.571–3.532)	0.450
	1201–2499ETB (22.94–47.76$)	36 (25.5)	63 (22.9)	1.25 (0.762–2.051)	0.463 (0.199–1.076)	0.074
	⩾2500ETB (47.77$)	85 (60.3)	119 (43.3)	1	1	
Residence	Urban	135 (95.7)	246 (89.5)	1	1	
	Rural	6 (4.3)	29 (10.5)	2.652 (1.074–6.549)	1.092 (0.222–5.361)	0.914
Regular medical follow-up	Yes	85 (60.3)	88 (32)	1	1	
	No	56 (39.7)	187 (68)	3.225 (2.115–4.918)	2.527 (1.281–4.986)*	0.007
Chewing Khat	No	75 (53.2)	98 (35.6)	1	1	
	Yes	66 (46.8)	177 (64.4)	2.052 (1.358–3.101)	1.387 (0.679–2.833)	0.369
Knowledge about asthma	Good knowledge	66 (46.8)	68 (24.7)	1	1	
	Average knowledge	42 (29.8)	48 (17.5)	1.109 (0.65–1.894)	1.443 (0.638–3.268)	0.379
	Poor knowledge	33 (23.4)	159 (57.8)	4.676 (2.822–7.751)	4.593 (2.007–10.514)*	<0.001
Attitude toward asthma	Positive attitude	107 (75.9)	101 (36.7)	1	1	
	Negative attitude	34 (24.1)	174 (63.3)	5.422 (3.432–8.564)	3.724 (1.825–7.597)*	<0.001
SABA	No	31 (22)	30 (10.9)	1	1	
	Yes	110 (78)	245 (89.1)	2.302 (1.328–3.989)	2.188 (0.969–4.941)	0.060
OCS	No	123 (87.2)	233 (84.7)			
	Yes	18 (12.8)	42 (15.3)	1.232 (0.68–2.231)	1.938 (0.762–4.929)	0.165
Adherence	Good adherence	55 (60.4)	55 (33.1)	1	1	
	Poor adherence	36 (39.6)	111 (66.9)	3.083 (1.815–5.239)	2.533 (1.251–5.128)*	0.010
Exacerbation in the past 12 months	No	67 (47.5)	144 (52.4)			
	Yes	74 (52.5)	131 (47.6)	1.214 (0.809–1.823)	0.888 (0.42–1.876)	0.756
Comorbid illnesses	No	98 (69.5)	154 (56)	1	1	
	Yes	43 (30.5)	121 (44)	1.791 (1.164–2.754)	1.025 (0.448–2.343)	0.953

COR: crude odds ratio; CI: confidence interval; AOR: adjusted odds ratio; BMI: body mass index; SABA: short acting beta2 agonist; OCS: oral corticosteroid; ETB: Ethiopian birr.
*Statistically significant at $p < 0.05$.

Discussion

A total of 275 (66.1%) of the respondents in this study had uncontrolled asthma. Not attending regular medical follow-ups, poor knowledge about asthma, negative attitude toward asthma, and poor adherence to medications were significantly associated with uncontrolled asthma.

This study revealed that the prevalence of uncontrolled asthma was 66.1%. According to studies from health facilities in the Middle East and Northern Africa, the United States, and China, 41.5%, 50%, and 31.6% of patients, respectively, had uncontrolled asthma.[16,25–28] Asthma control among patients living in developed nations could be better as there are superior health infrastructures, quality

care provision, and a sufficient quantity of health care personnel. Comparable results (70.1%) were found in a local study conducted in Gondar, Ethiopia.[17] In contrast, studies from other parts of the country reported lower percentage of uncontrolled asthma. For example, a study from Addis Ababa, Ethiopia discovered a 53.3% prevalence of uncontrolled asthma, whereas a study from Jimma discovered 50.4% prevalence.[16,28] This disparity may be explained by differences in study regions and the number of study settings. Furthermore, the higher values in this study may be related to the larger sample size used, as well as the inclusion of more health facilities. Nonetheless, this study showed the need for stringent action to be taken in response to the problem.

It was found that not attending scheduled regular medical follow-ups was significantly associated with uncontrolled asthma. Participants who did not attend their scheduled regular follow-up had 2.5 times higher odds to have uncontrolled asthma than those who attended their regular follow-up. This is in line with the one conducted in Jimma University Specialized Hospital, Ethiopia.[28] The significant association might be due to that attending and following scheduled medical follow-up helps the patients to control their asthma with the help of healthcare professionals.

In this study, participants who had poor knowledge about asthma had 4.5 times higher odds to have uncontrolled asthma than those who had good knowledge about asthma. This finding is similar to the one conducted in Jimma University medical center, Ethiopia.[23] This significant association might be due to the fact that poor knowledge about asthma affects the patients' practice to control their asthma. Having inadequate knowledge about asthma triggering factors, signs and symptoms, management of acute exacerbation of asthma, and when and how to take prescribed medication might lead to uncontrolled asthma.

Participants who had a negative attitude toward asthma had 3.7 times higher odds to have uncontrolled asthma than those who had a positive attitude. This study is in line with the study done at Jimma University medical center, Ethiopia.[23] This might be because having a negative attitude toward the sign and symptoms, management, triggering factors, and other aspects of asthma might lead asthmatic patients to practice unacceptable management measures to control asthma.

In this study, participants who had poor medication adherence had 2.5 times higher odds to have uncontrolled asthma than those who had good medication adherence. This finding is in line with the studies done in Jimma university medical center, Ethiopia and China.[23,29] But it is different from the one conducted in the Middle East and North Africa, where asthmatic patients who had poor medication adherence were 0.5 times less likely to have poorly controlled asthma than those who had good medication adherence.[26] The discrepancy might be due to the difference in sample size, which was around 16 times higher than this study. In addition to the above reason the significant association between poor knowledge and negative attitude with uncontrolled asthma in this study might lead to poor medication adherence.

Generally, this study will be useful for policymakers to plan and incorporate health education programs to the level of specific knowledge regarding asthma and establish a care delivery system that allows training concerning level of asthma control. It is also used for the patients since this study helps the health care professionals to enhance knowledge of asthmatic patients through regular health education about different aspects of asthma.

Strength and limitation

This study was conducted in six hospitals including general and referral hospitals which helped us to recruit different types of patients with different characteristics. Using the standardized and internationally validated ACT questionnaire tool was also a strength. Despite being a multicenter study, this study's results are not without limitations. The use of cross-sectional study design cannot show cause and effect relationships. Only FEV1 was recorded from the spirometer thus we were not able to evaluate the effect of airflow obstruction in the multivariable model. In addition, some of the data were collected by recalling things from the past so; it might have caused a recall bias.

Conclusion

There was a high prevalence of uncontrolled asthma in this study. Factors including not attending scheduled regular medical follow-ups, poor knowledge about asthma, negative attitude toward asthma, and poor adherence to medications were associated with uncontrolled asthma. Thus, it is important to improve the level of asthma control through different methods by incorporating professionals, administrators, policymakers, and researchers.

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Authors contribution

All the authors made a significant contribution in the conception, study design, execution, acquisition of data, analysis and interpretation, all of them took part in drafting, substantially and critically reviewing the article; have agreed on the journal to which the article is going to be submitted; agreed on all versions of the article before submission,; and agreed to be accountable for all aspects of the article.

Availability of data and materials

All the data are available from the corresponding author upon reasonable request.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics approval

The ethical approval for the study was obtained from the Institutional Health Research Ethical Review Committee (IHRERC) of the College of Health and Medical Science of Haramaya University on February 17 (Ref. No. IHRERC/014/2020).

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Informed consent

Official letters of cooperation were written and submitted to the respective health bureaus, and hospitals. Informed written voluntary consent was obtained from all the study participants and their confidentiality was maintained throughout the process.

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Supplemental material

Supplemental material for this article is available online.

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