Journal of Asthma and Allergy

Dovepress
open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Determinants of Asthma Attack Among Adult Asthmatic Patients Attending at Public Hospitals of West Shoa Zone, Oromia Regional State, Ethiopia, 2021: Case–Control Study

Shiferaw Megersa[1], Getahun Chala[2], Kena Fikremariam[3]

[1]Department of Public Health, College of Health and Medical Sciences, Ambo University, Ambo, Ethiopia; [2]Department of Medical Physiology, College of Health and Medical Sciences, Haramaya University, Harar, Ethiopia; [3]Department of Public Relation and Communication, Ethiopia Ministry of Health, Addis Ababa, Ethiopia

Correspondence: Shiferaw Megersa, Department of Public Health, College of Health and Medical Sciences, Ambo University, Ambo, Ethiopia, Tel +251 91 082 0138, Email shifemegersa@gmail.com

Background: Asthma attacks are life-threatening episodes that place a costly burden on the individual and the community in both high- and low-income countries including Ethiopia. There is scant information on the determinant of it in the study area.

Objective: To identify determinants of asthma attack among adult asthmatic patients attending at public hospitals of West Shoa Zone, Oromia Regional State, Ethiopia.

Methods: An institutional-based unmatched case–control study design was conducted. In this study, 300 participants (100 cases and 200 controls) were included. A pre-tested structured questionnaire was used to collect data. After the data were entered into Epidata version 3.1, it was exported to SPSS version 25 for analysis. First, bivariable logistic regression was performed. Independent variables with a p-value < 0.25 in binary logistic regression were entered into a multivariable logistic regression model. In the multivariable logistic regression model, independent variables with a p-value < 0.05 were considered to be significant determinants of the outcome variable of the study.

Results: This finding identified that upper respiratory tract infection (AOR = 5.89, 95% CI: 2.72, 12.79), obstructive sleep apnea (AOR = 3.48, 95% CI: 1.58, 7.66), passive smoker (AOR = 5.93, 95% CI: 2.07, 16.96), spring season (AOR = 2.49, 95% CI: 1.27, 4.89), pet ownership (AOR = 3.63, 95% CI: 1.82, 7.22), kitchen smoke (AOR = 2.31, 95% CI: 1.6, 4.6), rhinitis (AOR = 4.49, 95% CI: 2.25, 8.93) and being jobless (AOR = 5.68, 95% CI: 1.94, 16.68) were significant determinants of asthma attack.

Conclusion: In this study, upper respiratory tract infection, obstructive sleep apnea, passive smoker, spring season, kitchen smoke, pet ownership, rhinitis, and being jobless were identified as significant determinants of an asthma attack. Because asthma attacks are life-threatening events, effective methods and interventions on determinants of asthma attack incidence should be implemented.

Keywords: adult, asthma attack, determinants, season, Ethiopia

Introduction

Asthma attacks are worsening of shortness of breath, cough, wheezing, or chest tightness that requires unplanned and urgent medical interventions that include systemic administration of corticosteroids, emergency room visits, and hospital admissions.[1] As stated by the 2018 global asthma report, the global burden of disease study estimated that there were 339 million people worldwide affected by an asthma attack and it is expected to reach 400 million by 2025.[2] When measured in disability-adjusted life years (DALYs), it is the 16th most common cause of disability and the 28th most common source of disease burden.[3] Asthma attacks are one of Africa's most serious public health issues and it claimed the lives of at least 400,000 people in 2016.[4] Also, an asthma attack is the 10th most common environmental burden by illness category [DALYs/1000 capita] per year in Ethiopia, with a prevalence rate of 9.1%.[5]

Received: 3 June 2022
Accepted: 10 August 2022
Published: 24 August 2022

Many research studies identified that asthma attack is influenced by numerous factors stemming from the environmental factors such as gene-environment interactions, environmental acquaintances, comorbidities, age, causal disease severity, health-care availability, psychological factors, disease response to management, and disease load, which includes asthma exacerbations and mortality, as well as long-term chronic morbidity.[6,7] In addition, chronic sinusitis, obstructive sleep apnea (OSA), psychological dysfunctioning, active cigarette smoking, passive cigarette smoking, low level of education, lack of corticosteroid use, and upper respiratory tract infection (URTI) were also identified as significant determinant factors of an asthma attack.[8–10]

Determinants commonly identified may vary across countries depending on the contexts. In Ethiopia, where asthma attacks are the leading cause of adult mortality, identifying and managing the contributing factors early on is critical to preventing the occurrence of the disease and lowering the adult mortality rate. Furthermore, there is a scarcity of data on determinant factors in the study setting. As a result, identifying the specific determinants in a specific area is critical to take appropriate local measures. Therefore, this study aimed to identify the determinants of asthma attack among adult asthmatic patients attending at Public Hospitals of West Shoa Zone, Central Ethiopia.

Methods

Study Area and Period

The study was done at public hospitals of West Shoa Zone, Oromia Regional State of Ethiopia, from August 16 to October 16, 2021.

Study Design

An institutional-based unmatched case–control study design was used.

Source and Study Population

All adult asthmatic patients who have attended at public hospitals of West Shoa Zone, Oromia regional state, Ethiopia, were the source population. All adult asthmatic patients who have visited public hospitals of West Shoa Zone during the data collection period were the study population.

Eligibility Criteria

Inclusion Criteria

The patients that had the following history were included in the case of the study:

- Adult asthmatic patients who visited the emergency unit due to asthma attack during the data collection period; or
- Adult asthmatic patients that experienced the history of emergency visits due to asthma attack in the past 12 months but who were visiting the chronic outpatient department (OPD) either for asthma follow-up or other diseases during the data collection period.

Adult asthmatic patients who did not have asthma attack requiring emergency visit for the last 12 months, but who visited the chronic OPD either for asthma follow up or another disease during the data collection period were included as a control.

Exclusion Criteria

The patients that had the following history were excluded from the case of the study:

- Patients with a physician-diagnosed having a history of pulmonary embolism, Chronic Obstructive Pulmonary Disease (COPD), active pulmonary tuberculosis, known congestive heart failure;
- Asthmatic patients under the age of 18 and are mentally unstable;
- Patients who had developed an asthma attack after participating as a control group during the study period were excluded from the case to prevent selection bias of case and control selection;

- Adult asthmatic patients, who visited an emergency unit due to asthma attack after participating as a case during the study period and those who had a history of emergency visits due to asthma attacks in the previous 12 months but visited the chronic OPD twice or more during the study period were excluded from the case to prevent double counting.

The patients that had the following history were excluded from the control of the study:

- Asthmatic patients less than 18 years old and mentally unstable;
- Patients with physician-diagnosed having a history of pulmonary embolism, COPD, active pulmonary tuberculosis and known congestive heart failure;
- Adult asthmatic patients who did not have asthma attack requiring emergency visit for the last 12 months, but who visited the chronic OPD twice or more after participating as control either for asthma follow-up or other diseases during study period were excluded from the control to prevent double counting.

Sample Size Determination

The sample size for the study was calculated using a two-population proportion for unmatched case control study in Epi-info version-7. The sample size was calculated using the assumptions of a confidence level of 95%, a power of 80%, a control-to-case ratio of 2:1, percent of controls exposed 31.6 and percent of cases with exposure 50 (Spring season was used as the major exposure variable in a previous study in Ethiopia Tigray central zone hospital, to find a 2.165 odds ratio).[11] Accordingly, by adding 10% non-response rate, the total sample size using Fleiss w/cc method was 300 (100 cases and 200 controls).

Sampling Procedure

All public hospitals in the West Shoa Zone, Oromia Regional State of Ethiopia were included for the study. The total number of asthma patients attending at study hospitals based on last year's data on similar time period with the data collection period two month record (August 16 to October 16, 2020) were totally 360 (109 cases and 251 controls). By calculating sample fraction, the sample size was proportionally allocated to each selected hospital based on the total record of patients taken from each hospital. Finally, all asthma attack cases were included without sampling in the study during study period, whereas two comparable controls were selected consecutively after each asthma attack case was enrolled until the sample size specified for each hospital is attained during the study period to represent the control group. Controls were selected from the respective hospitals that yielded the cases.

Study Variables

Dependent Variable

Asthma attack status.

Independent Variables

Socio-demographic variables: Age, Gender, Marital status, Residence, Educational level, Employment and Occupational status.

Behavioral related factors: Physical exercise, vigorous activity, Smoking cigarette.

Environmental related factors: Exposure to humidity, Exposure to dust, kitchen smoke exposure, and Seasonal fluctuation.

Clinical related characteristics: URTI, Sleep apnea, Missing follow-up/appointments.

Other triggers factors: Allergens (allergic rhinitis, sinusitis) and Pet ownership (the presence of a dog, cat and both).

Operational Definitions

Asthma Attack: Individuals who come with severe wheezing, shortness of breath, cough, and chest tightness and are diagnosed by a physician as having an asthma attack.[1]

Asthma attack status: In this study, asthma attack status was measured as 1 (one) if an adult asthmatic patient attended emergency OPD due to asthma attack at least once from the last 12 months to the end of data collection period otherwise 0 (zero).

Vigorous activity: Participants engaged in vigorous exercise for more than 10 minutes at a time, such as carrying or lifting large weights, digging or construction work, or cutting firewood.[12]

Pet ownership: Having any pet, such as a cat, dog, or both, and evaluating contact with them, which can be divided into two categories: regular contact (at least once a day and at least five times per week) and occasional contact (less than once a day).[13]

Smoker: (Daily smoker and non-daily smoker) those who currently smokes or those who quit smoking less than one year before the assessment and passive smoker: Smoke inhaled involuntarily by nonsmokers or Cigarettes smoked by patient's household.[12]

Physical exercise: If patients make moderate regular physical activities like Walking, Jogging, Cycling for at least 30 minutes per day or at least 5 days per week (≥150 minutes per week).[12]

Data Collection Tool and Technique

A structured questionnaire was used to collect data, which was adapted from past research.[10,11,13–15] A questionnaire developed in English and translated into the official language of the region (Afan Oromo) was used to gather data. The Afan Oromo version was then retranslated into English by language experts and researchers to ensure coherence with the original version. The questionnaire was divided into five sections: socio-demographic, environmental, behavioral, pet characteristics and clinical features. Ten nurses, who were supervised by two BSc nurses in selected units, collected data after the study unit's doctors had finished their session using a questionnaire based on face-to-face interviews and patient chart reviews. They received appropriate COVID-19 transmission prevention measures such as hand sanitization, mask use, and physical distance. After that, data from cases in emergency OPD were gathered after they have received all necessary medical care and have recovered from their attack, whereas data from cases and controls in chronic OPD were gathered after they have completed their physician's examination and the last record review from their file.

Data Quality Control and Management

One day training was given by the principal investigator for data collectors and supervisors (BSc Nurses) based on the content of questionnaire, data collection methods, ethical concerns and the purpose of the study. The questionnaire prepared in English was translated to Afan Oromo language and back to English to keep the consistency of the questions. Data collection tool was pretested on 5% of the sample (5 cases and 10 controls) to ensure the quality of data in Sire primary hospital, which was not included in the actual data collection and necessary modifications were made based on the nature of gaps identified in the questionnaire before actual data collection. During data collection follow-up was done by supervisors. The collected data were reviewed and checked for consistency, clarity, completeness, and accuracy throughout the data collection process by data collectors and supervisors, daily correction actions were taken.

Data Processing and Analysis

Data were first checked manually for completeness then coded and entered in to Epi data version 3.1 and exported to SPSS version 25 for further analysis. Descriptive analysis was performed to calculate mean, frequencies and percentages. Bi-variable binary logistic regression analysis was conducted to see the association of each independent variable to the outcome variable and variables with p-values of < 0.25 were identified. Variance inflation factor (VIF) was used to assess multi collinearity between the independent variables. Finally, screened variable were fitted to the multiple binary logistic regression model to reduce the effects of confounders and to identify the independent effects of each variable on the outcome variable. Hosmer and Lemeshow goodness fit model was used to check model fitness. Adjusted odd ratio with 95% Confidence Interval and p-value < 0.05 were reported to declare significant determinants of asthma attack. Finally, the results were presented with texts and tables.

Ethical Consideration

The study was conducted after approval of the ethical principles stated in the Declaration of Helsinki by the research review and ethical committee of the College of Health and Medical Sciences, Ambo University with the reference number PGC/184/2021. Then, officials at different levels of the selected hospitals had been communicated through a cooperation letter written by the postgraduate coordinator. After, an explanation of the study objectives, benefits of the research and its findings, written informed consent was obtained from all participants before participation. The participants were informed about the confidentiality of the personal information they gave. The study participants were informed of the right to refuse to participate or withdraw consent to participate at any time without punishment.

Results

Socio Demographic Characteristics of the Study Participants

A total of 300 (100 cases and 200 controls) participants were involved in this study with a response rate of 100%. Among the participants, 65 (65%) of the cases and 123 (61.5%) of the controls were females. The mean age of the participants of cases and controls were 43.1 (SD ± 12.99) and 44.9 (SD ± 10.91) years, respectively. Majority (64%) of the cases and 86% of controls were married. About one-third (33%) of both the cases and controls were within 41–50 years age range. From the study participants, 58 (58%) of the cases and 108 (54%) of controls were urban dwellers. Among participants, about 29 (29%) of the cases and nearly one-fourth, 45 (22.5%) of controls had no formal education. But one-third of both the cases and controls had college and above, whereas nearly one-fourth, 22 (22%), of the cases and one fourth, 49 (24.5%), of the controls had primary education. In terms of the occupational status, 27 (27%) of the cases and 59 (29.5%) of the controls were farmers and government employee, respectively; whereas nearly one-fourth, 23 (23%), of the cases and one-tenth, 18 (9%), of the controls were jobless. Statistically, there is a significant difference between case and control with regard to occupational ($p = 0.02$) and marital status ($p = 0.001$) (Table 1).

Table 1 Socio-Demographic Characteristics of Adult Asthmatic Patients Attending at Public Hospitals of West Shoa Zone, Oromia, Ethiopia, 2021

Variables	Cases (n = 100)	Controls (n=200)	X^2-test	*p*-value
	N (%)	N (%)		
Gender				
Female	65(65%)	123(61.5%)	0.349	0.555
Male	35(35)	77(38.5)		
Age in year				
21–30	22(22%)	30(15%)	7.696	0.103
31–40	20(20%)	38(19%)		
41–50	33(33%)	68(34%)		
51–60	14(14%)	51(25.5%)		
> 60	11(11%)	13(6.5%)		
Religion				
Orthodox	43(43%)	84(42%)	2.930	0.403
Protestant	43(43%)	86(43%)		
Muslim	9(9%)	26(13%)		
Catholic	5(5%)	4(2%)		

(*Continued*)

Table 1 (Continued).

Variables	Cases (n = 100)	Controls (n=200)	X^2-test	*p*-value
	N (%)	N (%)		
Ethnicity				
Oromo	66(66%)	160(80%)	7.136	0.068
Amhara	19(19%)	22(11%)		
Tigre	4(4%)	4(2%)		
Gurage	11(11%)	14(7%)		
Educational status				
No formal education	29(29%)	45(22.5%)	1.570	0.814
Only can read and write	11(11%)	24(12%)		
Primary education (1–8)	22(22%)	49(24.5%)		
Secondary education (9–12)	5(5%)	12(6%)		
College and above	33(33%)	70(35%)		
Occupational status				
Government employ	20(20%)	59(29.5%)	13.418	0.020*
Farmer	27(27%)	58(29%)		
Self- employ	8(8%)	18(9%)		
Merchant	18(18%)	43(21.5%)		
Jobless	23(23%)	18(9%)		
Marital status				
Single	14(14%)	7(3.5%)	22.362	0.001*
Married	64(64%)	172(86%)		
Divorced	13(13%)	16(8%)		
Widowed	9(9%)	5(2.5%)		
Place of residence				
Urban	58(58%)	108(54%)	0.432	0.511
Rural	42(42%)	92(46%)		

Note: *Statistically significant at *p*-value < 0.05.
Abbreviations: N, number; n, sample size.

Behavioral Related Characteristics of Study Participants

Among the participants, 11 (11%) of the cases and 11 (5.5%) of the controls were smokers, while one fourth 25 (25%) of the cases and 12 (6%) of the control were passive smokers. In terms of vigorous activity, there were more than one-third, 35 (35%), of the cases and nearly half, 97 (48.5%), of controls who engaged in vigorous activity. The majority of the individuals, 75 (75%) of the cases and 157 (78.5%) of the controls, were engaged in physical activity.

Environmental Related Characteristics of Study Participants

In terms of the seasons of a year, spring season had the highest percentage of asthma attack 54 (54%) compared to the other season. About 42% of cases and 43.5% of controls open their window/door while they were cooking. Concerning the kitchen of the participants nearly one-third 34 (34%) of the cases and half, 101 (50.5%), of the control's kitchens have no kitchen smoke (chimney). Statistically, there is a significant difference between case and control with regard to kitchen smoke ($p = 0.007$) (Table 2).

Clinical Related Characteristics of Study Participants

Among the participants, more than half 51 (51%) of the cases and one-tenth 22 (11%) of the controls had URTI and nearly half 47 (47%) of the cases and few of the controls 27 (13.5%) had OSA. Also, about 57 (57%) of the cases and 85 (42.5%) of the controls had missing follow-up.

Table 2 Environmental Related Characteristics of Adult Asthmatic Patients Attending at Public Hospitals of West Shoa Zone, Oromia, Ethiopia, 2021

Variables		Cases (n=100)	Controls (n=200)	X^2-test	*p*-value
		N (%)	N (%)		
Seasonal fluctuation	Autumn	48(48%)	107(53.5%)	1.313	0.252
	Winter	10(10%)	28(14%)		
	Spring	54(54%)	62(31%)		
	Summer	30(30%)	98(49)		
Exposed to Vapors	Yes	2(2%)	3(1.5%)	0.102	0.750
	No	98(98%)	197(98.5%)		
Exposed to Gases	Yes	36(36%)	59(29.5%)	1.302	0.254
	No	64(64%)	141(70.5%)		
Exposed to Dust	Yes	95(95%)	180(90%)	2.182	0.140
	No	5(5%)	20(10%)		
Exposed to Fumes	Yes	83(83%)	159(79.5%)	0.524	0.469
	No	17(17%)	41(20.5%)		
Exposed to Humidity	Yes	85(85%)	159(79.5%)	1.328	0.249
	No	15(15%)	41(20.5%)		
Open window while cooking	Yes	42(42%)	87(43.5%)	0.061	0.805
	No	58(58%)	113(56.5%)		
Kitchen smoke	Yes	34(34%)	101(50.5%)	7.333	0.007*
	No	66(66%)	99(49.5%)		
Cooking material	Coal/ Wood	100(100%)	197(98.5%)	1.515	0.218
	Gas	56(56%)	71(35.5%)		
	Electric	75(75%)	135(67.5%)		

Note: *Statistically significant at *p*-value < 0.05.
Abbreviations: N, number; n, sample size.

Determinants of Asthma Attack

In order to identify determinants of asthma attack, multivariate logistic regression was computed after adjusting independent variables that had a *p*-value < 0.25 in the univariate analysis. The multivariable logistic regression model estimated that adult asthmatic patients who had no job were 5.68 times (AOR= 5.68, 95% CI: 1.94–16.68; $p = 0.002$) more likely to be attacked as compared with asthmatic patients whose occupation was government employee. Those asthmatic patients who were passive smoker were 5.93 times (AOR=5.93, 95% CI: 2.07–16.96; $p = 0.001$) more likely to be attacked than asthmatic patients who did not have the history of smoking. Asthma attack was 2.49 times higher during spring season (AOR=2.49, 95% CI: 1.27–4.89; $p = 0.008$) as compared to other seasons. Asthmatic patients with no habit of kitchen smoke were 2.31 times (AOR=2.31, 95% CI: 1.16–4.6; $p = 0.017$) more likely to develop asthma attack as compared to those who had kitchen smoke. Asthmatic patients who had URTI were 5.89 times more likely to develop asthma attack (AOR=5.89, 95% CI: 2.72–12.79; $p = 0.001$) as compared to those who had no URTI. Asthmatic patients who had OSA were 3.48 times more likely to develop asthma attack (AOR=3.48, 95% CI: 1.58–7.66; $p = 0.002$) as compared to those who had no OSA. Asthmatic patients who had pet were 3.63 times more likely to develop asthma attack (AOR=3.63, 95% CI: 1.82–7.22; $p = 0.001$) as compared to those who had no pet. Asthmatic patients who had rhinitis were 4.49 times more likely to develop asthma attack (AOR=4.49, 95% CI: 2.25–8.93; $p = 0.001$) as compared to those who had no rhinitis (Table 3).

Table 3 Bivariate and Multivariate Binary Logistic Regression Analysis of Determinants of Asthma Attack Among Adult Asthmatic Patients Attending at Public Hospitals of West Shoa Zone, Oromia, Ethiopia, 2021

Variables		Case (n=100)	Control (n=200)	COR (95% CI)	AOR (95% CI)	*p*-value
Occupational status						
Government employ		20(20)	59(29.5)	1	1	
Farmer		27(27)	58(29)	1.37(0.69, 2.72)	1.52(0.59, 3.91)	0.388
Self-employ		8(8)	18(9)	1.31(0.49, 3.48)	1.28(0.34, 4.88)	0.713
Merchants		18(18)	43(21.5)	1.24(0.58, 2.61)	1.78(0.65, 4.89)	0.266
Jobless		23(23)	18(9)	3.77(1.69, 8.38)	5.68(1.94, 16.68)	0.002*
Smoker	No	89(89)	189(94.5)	1	1	
	Yes	11(11)	11(5.5)	2.12(0.89, 5.08)	1.62(0.45, 5.84)	0.460
Passive smoker	No	75(75)	188(94)	1	1	
	Yes	25(25)	12(6)	5.22(2.49, 10.93)	5.93(2.07, 16.96)	0.001*
Vigorous activity	No	65(65)	103(51.5)	1	1	
	Yes	35(35)	97(48.5)	0.57(0.35, 0.94)	0.66(0.33, 1.32)	0.238
Seasonal fluctuation						
Autumn	No	52(52)	93(46.5)	1	1	
	Yes	48(48)	107(53.5)	0.8(0.49, 1.29)	0.79(0.40, 1.58)	0.511
Winter	No	90(90)	172(86)	1	1	
	Yes	10(10)	28(14)	0.68(0.32, 1.47)	0.43(0.15, 1.27)	0.128
Spring	No	46(46)	138(69)	1	1	
	Yes	54(54)	62(31)	2.61(1.59, 4.28)	2.49(1.27, 4.89)	0.008*

(*Continued*)

Table 3 (Continued).

Variables		Case (n=100)	Control (n=200)	COR (95% CI)	AOR (95% CI)	*p*-value
Summer	No	70(70)	101(51.5)	1	1	
	Yes	30(30)	98(49)	0.45(0.27, 0.74)	0.73(0.36, 1.47)	0.372
Exposed to dust	No	5(5)	20(10)	1	1	
	Yes	95(95)	180(90)	2.11(0.77, 5.80)	1.26(0.29, 5.44)	0.758
Kitchen smoke	No	66(66)	99(49.5)	1.98(1.20, 3.26)	2.31(1.16, 4.6)	0.017*
	Yes	34(34)	101(50.5)	1	1	
URTI	No	49(49)	178(89)	1	1	
	Yes	51(51)	22(11)	8.42(4.66, 15.21)	5.89(2.72, 12.79)	< 0.001*
OSA	No	53(53)	173(86.5)	1	1	
	Yes	47(47)	27(13.5)	5.681(3.23, 9.99)	3.48(1.58, 7.66)	0.002*
Missing follow up	No	43(43)	115(57.5)	1	1	
	Yes	57(57)	85(42.5)	1.79(1.10, 2.91)	1.1(0.53, 2.27)	0.808
Pet ownership	No	44(44)	154(77)	1	1	
	Yes	56(56)	46(23)	4.26(2.55, 7.13)	3.63(1.82, 7.22)	< 0.001*
Rhinitis	No	39(39)	158(79)	1	1	
	Yes	61(61)	42(21)	5.88(3.48, 9.96)	4.49(2.25, 8.93)	< 0.001*
Sinusitis	No	70(70)	179(89.5)	1	1	
	Yes	30(30)	21(10.5)	3.65(1.96, 6.81)	1.25(0.49, 3.17)	0.641

Note: *Statistically significant at *p*-value < 0.05.
Abbreviations: 1, reference; AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; URTI, upper respiratory tract infection; OSA, obstructive sleep apnea.

Discussion

In this study, the odds of getting an asthma attack among adult asthmatic patients having URTI were 5.89 times more than those who did not have URTI. This finding is consistent with studies conducted at Liaquat University of Medical and Health Sciences, Uganda and Tigray regional state of Ethiopia.[8,11,16] The reason for this could be due to viral infections causing asthma attack through a variety of mechanisms, including increased respiratory tract responsiveness, increased eosinophilic inflammation, increased lower airway neutrophilic inflammation, and direct lower airway infection.[17] In contrast to this finding, a single study conducted in Pretoria found that URTI was not a risk factor for an asthma attack.[10] This might be due to there were few patients in the study with respiratory tract infections, which result in insufficient statistical power to detect the significant association between acute respiratory infection and asthma attack.[18]

The presence of passive smoker at home or at workplace was also demonstrated to be an associated factor of asthma attacks in the study. Asthmatic patients with passive smoker presentation in their home or at workplace were 5.9 times more likely to develop asthma attack than those with no passive smoker presentation in their home or at workplace. This finding is comparable with studies done in South Africa and Addis Ababa, Ethiopia.[13,19] The justification for this could be the effect of smoking on the airway that tobacco smoke flowing inward to inflammatory cells such as neutrophils, lymphocytes, eosinophils, mast cells, and macrophages, which can cause bronchial irritation and precipitate acute episodes in patients with asthma.[20] On the other hand, a study conducted in Uganda contradicts this finding by stating

that there is no significant association between passive tobacco smoking and asthma attacks.[8] This could be owing to the research population's diversity, as well as the magnitude of passive cigarette smoking in their homes or workplace.

Odds of asthma attack among asthmatic patients with OSA were 3.48 folds greater than those who did not have OSA. This finding is consistent with studies conducted in United States, Gondar and Tigray regional state of Ethiopia.[9,11,21] This could be due to possible mechanism of neuro-mechanical reflex bronchoconstriction that increased vagal tone while sleeping, increased prevalence of gastro-esophageal reflux with OSA, increased inflammation, and the indirect effect of OSA-induced cardiac dysfunction on dyspnea.[22]

Similarly, asthmatic patients with concomitant of rhinitis had 4.49 times higher odds of asthma attack than those who did not have rhinitis. This finding is comparable with studies conducted in England and Jimma of Ethiopia.[23,24] This could be because allergic rhinitis has been linked to the aggravation of asthma symptoms by increasing lower airway inflammation.[25]

This study also demonstrated that the odds of developing asthma attack among the presence of pets within living homes and regular contact with them was 3.63 times more than those who did not. This finding is comparable with studies done in Addis Ababa and Jimma, Ethiopia.[13,23] This could be due to the fact that it causes an increase in asthma symptoms as a result of an allergic reaction to the animals, which causes airway hyper responsiveness, inflammation, and irritation.

In this study, seasonal variation was a significant determining factor of asthma attacks. The chances of having an asthma attack among asthmatic patients were 2.49 times higher in the spring season than in the other seasons. This finding is in line with studies done in Tigray regional state of Ethiopia.[11] This could be due to tree pollen, mold spores, and grass have the ability to irritate and restrict the airways of persons with asthma throughout the spring season. The result of this study was different from a study conducted in Inner city and Spain, which was resulting autumn and winter season as higher risk of developing asthma attack, respectively.[26,27] This might be due to seasonal differences between the research areas, owing to the influence of temperature and humidity that could account for the disparity.

Moreover, asthmatic patients who have no kitchen smoke in their kitchen were 2.31 folds at higher risk of asthma attack than those who had kitchen smoke. This finding is in line with studies done in India and Tigray, Ethiopia.[11,14] This is because kitchen smoke (chimney) is a method of eliminating smokes and fumes from the kitchen, leaving it clean and smoke-free, resulting in lower indoor air pollution and preventing asthma attack.[28]

Odds of asthma attack among asthmatic patients with jobless (having no occupation) were 5.68 fold greater compared to their counter parts. This finding agrees with studies conducted in Brazil and Debra Berhan of Ethiopia.[15,29] This could be owing to the fact that those who are unemployed or do not have a job are more likely to have a low income, as well as the poor quality of life these patients have.[30] In contrast to this study, an employment or occupational status was no risk factor for asthma attack according to a single study conducted in Bertha Gxowa Hospital in South Africa.[10] The possible explanation might be due to there were few patients in the study with a low proportion of no-occupation status or no-employment status, which result in insufficient statistical power to detect the significant association between them as well as due to the distinct study location and socio economic status of the study participants.[18]

Although there is a shortage of data on determinants of asthma attack in Ethiopia, this study has a few limitations. First, since the study was done in institutions, it might not be generalized to the general population with asthma attack. Second, this study may have recall bias, since some of the information was based on the recall of the study participants. Third, this study is quantitative; it might be better if qualitative approach was also employed to investigate in detail on extra determinant of asthma attack. Fourth, all measures used regarding exposure status were based on self-reporting, this might end up with social desirability bias. However, this study has the strength by recruiting the case and control group from the same facility to account for the study participants' context differences and including all of the public hospitals in the zone.

Conclusion

In conclusion, this study has found that URTI, passive smoker, pet ownership, rhinitis, OSA, kitchen smoke, being unemployed (jobless) and spring season were the determinants of asthma attack. Since asthma attack is currently a major cause of adult mortality and morbidity, effective strategies and interventions should be taken to reduce the incidence of asthma attack.

Abbreviations

AOR, Adjusted Odds Ratio; CI, Confidence Interval; COPD, Chronic Obstructive Pulmonary Disease; COR, Crude Odds Ratio; OPD, Out Patient Department; OSA, Obstructive Sleep Apnea; URTI, Upper Respiratory Tract Infection; WHO, World Health Organization.

Data Sharing Statement

All data obtained are available in this manuscript. However, any reasonably required data will be available per corresponding author on request.

Acknowledgments

We would like to forward our special thanks to Ambo University, College of Health and Medical Sciences, Department of Public Health for providing Ethical clearance approval for the study. In addition, our gratitude goes to our data collectors and supervisors Mr. Mulatu Ayana and Mr. Gerbaba Guta for their assistance. Finally, we want to convey our gratitude to study participants and staff of study hospitals for their cooperation during data collection period.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

There is not any funding for this research.

Disclosure

The authors declare that there is no competing interest.

References

1. Park HW, Tantisira KG. Genetic signatures of asthma exacerbation. *Allergy Asthma Immunol Res*. 2017;9(3):191–199. doi:10.4168/aair.2017.9.3.191
2. The global asthma report 2018. Auckland, New Zealand: Global Asthma Network; 2018. Available from: https://www.globalasthmanetwork.org. Accessed March 21, 2022.
3. Vos T, Lim SS, Abbafati C, et al. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2020;396(10258):1204–1222.
4. Ndlovu V, Chimbari MJ, Sibanda E. Assessing the nature of asthma in African epidemiological studies: a scoping review protocol. *Syst Rev*. 2020;9(1):1–7. doi:10.1186/s13643-020-01491-7
5. Lual KP, Yizengaw MA. Factors associated with suboptimal control of asthma among adult asthma patients: a cross-sectional study. *Open Respir Med J*. 2021;15:35–42. doi:10.2174/1874306402115010035
6. Kang MG, Lee HS, Tantisira KG, Park HW. Genetic signatures of acute asthma exacerbation related with ineffective response to corticosteroid. *Allergy Asthma Immunol Res*. 2020;12(4):626–640. doi:10.4168/aair.2020.12.4.626
7. Al-Ghamdi BR, Koshak EA, Omer FM, Awadalla NJ, Mahfouz AA, Ageely HM. Immunological factors associated with adult asthma in the Aseer Region, Southwestern Saudi Arabia. *Int J Environ Res Public Health*. 2019;16(14):2495. doi:10.3390/ijerph16142495
8. Sanya RE, Kirenga BJ, Worodria W, Okot-Nwang M. Risk factors for asthma exacerbation in patients presenting to an emergency unit of a national referral hospital in Kampala, Uganda. *Afr Health Sci*. 2014;14(3):707–715. doi:10.4314/ahs.v14i3.29
9. Belachew SA, Erku DA, Yimenu DK, Gebresillassie BM. Assessment of predictors for acute asthma attack in asthmatic patients visiting an Ethiopian hospital: are the potential factors still a threat? *Asthma Res Pract*. 2018;4(1):1–7. doi:10.1186/s40733-018-0044-7
10. Kabundji DM. *Severity and Associated Triggers for Acute Asthma Attack in Patients Presenting to the Emergency Department of the Bertha Gxowa Hospital [Dissertation]*. Johannesburg: University of the Witwatersrand. Corpus. 2016.
11. Negash M, Tsegabrhan H, Meles T, et al. Determinants of acute asthma attack among adult asthmatic patients visiting hospitals of Tigray, Ethiopia, 2019: case-control study. *Asthma Res Pract*. 2020;6:1. doi:10.1186/s40733-020-00054-w
12. Ethiopian Public Health Institute. Ethiopia steps report on risk factors for chronic non- communicable diseases and prevalence of selected NCDs. ISSUP; 2016. Available from: https://www.issup.net/knowledge-share/publications/2021-05/ethiopia-steps-report-risk-factors-non-communicable-diseases. Accessed February 23, 2022.
13. Abebe Y. *The Role of Household Fuel Exposure and Housing Characteristics on Asthma in Selected Public Hospitals of Addis Ababa, Ethiopia, 2020: Matched Case-Control Study Design [Dissertation]*. Addis Ababa: Addis Ababa University; 2020.

14. Sharma GL, Choudhary GS. Assessment of risk factors for acute asthma attack in asthmatic patients: a hospital based study. *Int Arch Bio Med Clin Res*. 2018;4(4):46–48.
15. Shine S, Muhamud S, Demelash A. Prevalence and associated factors of bronchial asthma among adult patients in Debre Berhan Referral Hospital, Ethiopia 2018: a cross-sectional study. *BMC Res Notes*. 2019;12(1):1–6. doi:10.1186/s13104-019-4670-9
16. Ansari SF, Memon M, Kumar R, Rizwan A. Risk factors associated with frequent acute exacerbations of asthma. *Cureus*. 2020;12(10). doi:10.7759/cureus.11090
17. Adeli M, El-Shareif T, Hendaus MA. Asthma exacerbation related to viral infections: an up-to- date summary. *J Fam Med Prim Care*. 2019;8(9):2753. doi:10.4103/jfmpc.jfmpc_86_19
18. Grieve AP. Medical statistics. In: Griffin JP, Posner J, Barker GR, editors. *The Textbook of Pharmaceutical Medicine*. 6th ed. New York City: Wiley online library; 2013:189–218.
19. Musonda JM, Kabundji DM, Eyassu MA. Triggers of acute asthma in patients attending emergency centre in a Peri-urban District Hospital, Johannesburg, South Africa. *Texila Int J Acad Res*. 2021;50–56. doi:10.21522/TIJAR.2014.SE.21.01.Art007
20. Jindal SK, Gupta D. The relationship between tobacco smoke & bronchial asthma. *Indian J Med Res*. 2004;120(5):443–453.
21. Kong DL, Qin Z, Shen H, Jin HY, Wang W, Wang ZF. Association of obstructive sleep apnea with asthma: a meta-analysis. *Sci Rep*. 2017;7(1):4088. doi:10.1038/s41598-017-04446-6
22. Alkhalil M, Schulman E, Getsy J. Obstructive sleep apnea syndrome and asthma: what are the links? *J Clin Sleep Med*. 2009;5(1):71–78. doi:10.5664/jcsm.27397
23. Geleta LA, Dadi LS, Sona AA. Determinants of uncontrolled asthma among adult asthmatic patients on follow-up at chest clinic of Jimma Medical Center: unmatched case-control study. *J Asthma*. 2022;59(6):1103–1109. doi:10.1080/02770903.2021.1908351
24. Bloom CI, Palmer T, Feary J, Quint JK, Cullinan P. Exacerbation patterns in adults with asthma in England. A population-based study. *Am J Respir Crit Care Med*. 2019;199(4):446–453. doi:10.1164/rccm.201808-1516OC
25. Oka A, Matsunaga K, Kamei T, et al. Ongoing allergic rhinitis impairs asthma control by enhancing the lower airway inflammation. *J Allergy Clin Immunol Pract*. 2014;2(2):172–178. doi:10.1016/j.jaip.2013.09.018
26. Teach SJ, Gergen PJ, Szefler SJ, et al. Seasonal risk factors for asthma exacerbations among inner-city children. *J Allergy Clin Immunol*. 2015;135(6):1465–73.e5. doi:10.1016/j.jaci.2014.12.1942
27. Pola-Bibian B, Dominguez-Ortega J, Vilà-Nadal G, et al. Asthma exacerbations in a tertiary hospital: clinical features, triggers, and risk factors for hospitalization. *J Investig Allergol Clin Immunol*. 2016. doi:10.18176/jiaci.0128
28. Eisner MD, Yelin EH, Katz PP, Earnest G, Blanc PD. Exposure to indoor combustion and adult asthma outcomes: environmental tobacco smoke, gas stoves, and woodsmoke. *Thorax*. 2002;57(11):973–978. doi:10.1136/thorax.57.11.973
29. Fernandes AG, Souza-Machado C, Coelho RC, et al. Risk factors for death in patients with severe asthma. *J Bras Pneumol*. 2014;40(4):364–372. doi:10.1590/S1806-37132014000400003
30. Nogueira KT, Silva JR, Lopes CS. Quality of life of asthmatic adolescents: assessment of asthma severity, comorbidity, and lifestyle. *J Pediatr*. 2009;85(6):523–530.