Health Related Quality of Life and its Associated Factors Among Adults Living with Asthma Attending at Selected Public Hospitals in North-Western, Ethiopia: A Multi-Centered Cross- Sectional Study

Eyayaw Ashete Belachew (✉ eyayawashete2016@gmail.com)

University of Gondar

Sumeya Tadess

University of Gondar

Mekuriaw Alemayehu

University of Gondar

Research Article

Keywords: Asthma, Health related quality of life, Ethiopia

Posted Date: December 30th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-1207358/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Abstract

Background: Asthma is a major public health challenge with most of the patients are not diagnosed and treated appropriately. Health related quality of life is an important measure of health outcomes of asthmatic patient that reflects the impact of an illness and its treatment from the patient's perspective. Hence, the aim of this study was to assess the health-related quality of life and its determinants among asthmatic patient at selected public hospitals in northwestern, Ethiopia

Method: A multicenter facility based cross-sectional study was conducted in North-Western Ethiopia, from May to July, 2021. A systematic random sampling technique was employed to include 409 study participants. Simple and multivariable linear regressions were conducted to determine variables that are the independent predictors of health-related quality of life. A p-value of <0.05 was considered statistically significant.

Result: A total of 409 patients were included in the final analysis and more than half (59.2%) of subjects had good quality of life. Concerning to determinants of health-related quality life, asthma control score ($\beta=0.14$, $P<0.001$), insurance user ($\beta=0.15$, $P=0.04$), high role of patient enablement ($\beta=0.39$, $P<0.001$), belief to asthma medication ($\beta=(-0.23)$, $P=0.001$), health care provides non-adherence to guideline ($\beta=(-0.30)$, $P<0.001$) and being house wife ($\beta=(-0.21)$ $P=0.04$) were some of significant predictor of health-related quality of life of asthmatic patient.

Conclusion: The health-related quality of life among adults with asthma was largely dependent to the level of asthma control. Socio- demographic, clinical, health care related and medication related, variables were significantly health related quality of life. Therefore, our study highlights multifaced interventions including comprehensive asthma education along with an integrated treatment plan to improve asthma control and quality of life.

Background

Asthma is a chronic inflammatory airway disease characterized by a heterogeneous illness, symptoms include wheezing, shortness of breath, tightness of the chest, or cough and restriction of expiratory airflow affecting the day and night time activities [1]. It could be triggered by dirty settings, upper respiratory tract infection, house hold pests, colds, laughter, tobacco smoke and robust smell [2].

Globally, asthma is a big health care concern and the 14th most important disorder in terms of the extent and duration of disability [3]. According to 2018 report, it is estimated to affect more than 339 million people globally [4], In Africa the prevalence in total population increased from 74.4 million to 119.3 million within just two decades (1990-2010) [5]. Reports from, Sub-Saharan- Africa countries also showed surge of prevalence; In contrast , a study conducted in Nigeria reported lower prevalence of asthma compared with other sub-Saharan countries which reported that approximately 1.5% of the total population lived with asthma [6].

Health related quality of life (HRQoL) is a multidimensional concept that includes global health perspectives, symptom status, functional status, biological and physical variables, individual and environmental characteristics and general health perception [7]. According to the World Health Organization (WHO), Quality of life (QoL) is defined as an individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns [8]. This definition considers individuals' satisfaction on their physical, psychological, social relationships, environment, and spiritual aspects of their life [9]. Quality of life is overall sense of well-being, including aspects of happiness and satisfaction with life [10]. It is broader term and remain to be subjective [11].

Quality of life in asthmatic patients is affected by several clinical, socio demographic, treatment related and behavioral factors. Some of the factors that predict QoL of asthmatic patients are being female, level of asthma control, comorbidities, health care provider adherence to guideline usage and insurance user for health care service [7, 12-18].

Several studies had used generic quality of life instruments as a crucial to measure the burden of asthma as perceived by the patient, but now a days there are several asthma specific quality of life measurement that consist of items measuring the individual's functional status (ability to perform daily functions; limitations on daily or desired activities) or health status (frequency and intensity of asthma symptoms, need to use short-acting β -agonist (SABA), need for urgent medical care), and/or social or emotional functioning [19]. Its purpose is to measure health outcomes or disease and /or treatment impact.

Many studies have provided important information on HRQoL of asthmatic patient worldwide [7, 14, 15, 20-25]. However, there is knowledge gap on the HRQoL of asthmatic patient in the study area. Therefore, the aim of the present study was to assess the level of HRQoL and its predictor among adult living with asthma at north western Ethiopia.

Methods

Study design

Facility based cross-sectional study was employed to determine the HRQoL and its determinant among adult living with asthma who visited the health facilities in Northwest Ethiopia.

Study settings and population

From five comprehensive specialized hospitals found in northwestern Ethiopia, three of them selected randomly. The study was conducted from August, 01/2021 to October, 30/2021 at University of Gondar comprehensive specialized hospital (UOGCSH), Felege Hiwot Comprehensive Specialized Hospital (FHCSH) and Tibebe Ghion Comprehensive Specialized Hospital (TGCSH) ambulatory care. University of Gondar comprehensive specialized hospital is a public comprehensive referral health facility present in northern Ethiopia which serves as a teaching hospital for the University of Gondar, College of medicine and

health sciences students. The hospital is located around 738 km far from the capital city of Ethiopia. The asthma follow up run every Monday and reviews at least 280-300 asthmatic patients monthly as per the UOGCSH records [26].

Felege Hiwot Comprehensive Specialized hospital which is found in Bahir Dar city, which is located on in the northwest and 565 km away from the capital of Ethiopia. This is one of the three governmental Hospitals in the city. It has 200 beds and three medical outpatient department (OPD) serves for medical patients of which one serve as referral and follow up clinic for patients with chronic diseases. The chest clinic of the hospital serves for chronic asthma and chronic obstructive pulmonary diseases (COPD) patients. The asthma follow up run from Monday to Friday on average reviews at least 190-200 patients monthly as FHCSH medical records.

Tibebe Ghion Comprehensive Specialized Hospital a teaching hospital under college of medicine and health sciences of Bahir Dar University located in Bahir Dar, Ethiopia. This is one of the 43 governmental hospitals in Amhara region. The hospital serves more than five million people in the catchment area. This teaching hospital has more than 500 beds, and 2000 patients per day in both inpatient and outpatient services. From the OPD service asthma follow up run every Wednesday and reviews on average 70-80 patients per month as FGS medical records.

The sample size was determined by using single population proportion formula. Thus, considering as W= marginal error of 5% ($w=0.05$), $Z_{\alpha/2}$ = the degree of accuracy required (95% level of significance = 1.96), since there was no studies conducted on HRQoL of asthmatic patient in the study area P was taken 50%.

In view of the said points a single proportion formula is calculated as follows:

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

Where n= sample size required,

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

$$(0.05)^2$$

Finally, considering a 10% contingency for possible non-response rate, and missed data. The calculated sample size was to be 422. A total of 1695 asthmatic patients 900,570 and 225 were from Gondar, Felegehiwot and Tibebe region hospitals, respectively were taken as study population. Proportional allocation was done to get the representative sample by taking the total number of asthmatic patient in each study area (UOGCSH $900/1695 \times 422 = 224$, FHCSH $570/1695 \times 422 = 142$ and TGCSH $225/1695 \times 422 = 56$) patients were included.

Sampling technique

Patients who fulfill the inclusion criteria were included in the study using systematic random sampling technique. As to University of Gondar asthma ambulatory care records, on average 300 asthma patients

have been visited the ambulatory care per month , as to Felege Hiwot Comprehensive hospital chest clinic records on average 190 patients have been visited per month and according to Tibebe Ghion Specialized Hospital ambulatory care records on average 75 patients have been visited per month (minding that all the asthma patients will be attended from one to three month in all hospitals), Since asthma patients are recommended to visit the ambulatory for a minimum of one month and a maximum of three month .So that adding all average three month number of the patient yield about 900 at Gondar, 570 at Felegehiwot and 225 at Tibebe Ghion hospitals were visited and the overall number of patient per three months in all hospitals had 1695. Taking into consideration, the sample was collected within three months, this makes the sampling fraction (k-interval) $1695/422=4$ approximately the initial study subject was selected by lottery method and then study participants was chosen by every four person and there corresponding medical records were collected, and relevant data was taken. Side by side the selected respondent was interviewed. For this medical record of study subjects that met the inclusion criteria was considered and whenever one medical record on hand was not eligible, the next immediate one be selected, and the same approach was followed throughout the entire data collection procedure

The study populations were Adult asthmatic patients who visited UOGCSH, FHCSH and TGCSH ambulatory care follow up from August to October, 2021. During the study period, Adult asthmatic patients whose age 18 years and above, had a diagnosis for asthma and on treatment for minimum of three months, attended at UOGCSH, FHRH and TGRH ambulatory ward for their asthma routine management and follow-up, provided their verbal informed consent to participate in the study were included in the study. Participants, who were unable to communicate, had incomplete medical records and patients requiring admission were excluded.

Data collection tools and procedures

The ACT and the Mini-AQLQ tools were employed in this study to measure the levels of asthma control and the HRQoL, respectively. These tools are standardized and are applicable across populations worldwide [27, 28]. For this population, the data collectors were interviewed the participants and mitigating against such obstacles as language barrier and low literacy levels Amharic version of the tool were used. The Asthma Control Test (ACT) tool is a simple test for asthmatic patients aged 12 years and above and measures the level of asthma control. It contains 5 questions on a 5-point scale depicting the frequency of asthma symptoms and usage of rescue medication by participants in the previous four weeks. The overall score is in the ranges of 5 (worse control) to 25 (total control) [27].

The mini- AQLQ is a disease specific tool for measuring the HRQoL due to asthma. It contains 15 questions in sections in four domains: Symptoms, Activity Limitation, Emotional Function and Environmental Stimuli. Participants were asked about how their conditions had been in the previous two weeks prior to enrollment into the study. Investigators were recorded participant responses to each of the 15 questions on the 7-point scale onto the questionnaire. The overall mini AQLQ score was the mean of all the 15 responses while each domain score were the mean of responses to items in that particular domain [28].

Factors associated with HRQoL were collected based on structured questionnaire that included socio demographic factor, modifiable and non-modifiable factor, triggers, patient compliance and clinical factors that influence asthma control and consequently, HRQoL. Medication Adherence Rate Scale (MARS-A) [29] was used to measure adherence of the patient to their medication, old version of Beliefs about Medicine Questionnaire (BMQ) [30] was used to measure the belief of the patient on their medication and other different literatures [2, 31] were used to develop other related questions.

A belief about Medicine Questionnaire is a 10-item questionnaire that assesses the patient beliefs to their prescribed medication. It is composed of two-five item scales that are specific necessity and specific-concerns scale. The specific-necessity scale that assesses patients' beliefs about prescribed medication to maintain their health now and in the future. However, specific concerns scale assesses patients' perception about adverse consequences of taking medicines related to long term effect and dependence [32]. The patients' level of beliefs about medicine (s) before and during clinical appointments towards their asthma management care were computed using a 5-point Likert-type scale ranging from strongly disagree=1 to strongly agree=5 [33].

Adherence to ICS was measured using the MARS-A, a self-reported adherence tool that demonstrated good test–retest reliability ($r=0.65$, $p\text{-value} < 0.001$), internal consistency reliability of 0.85, sensitivity of 0.82, and specificity of 0.69. The responses were measured using a 5-point Likert scale (1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always). Self-reported adherence is reported as the average score of the 10 items (1–5), where higher scores indicate higher levels of reported adherence. High self-reported adherence was defined as a MARS-A score of 4.5 or higher) [34].

The modified patient enablement index (mPEI) was used to evaluate enablement of the patient and a score of >6 indicate clinically meaningful enablement. It contains six items assess the patient's ability to deal with life, understand the illness, cope with it, keep healthy, remain confident about health, and help oneself[35]. Comorbidity index was done by using charlson comorbid index and classified as mild, moderate and severe whose comorbidity index score 1 and 2, 3 and 4, greater than 4 respectively, to determine the burden of comorbidity on asthma control and HRQOL [36].

All the above tools were translated into Amharic by English and Amharic versed persons. Translation was verified for compatibility with the original version in a process of forward and backward translation. Face validity of the survey was assessed among three clinical pharmacy teachers for clarity of the questions. Then, the survey was pretested for content, design, readability, and comprehension on 42 people, and socio-cultural adoption were made by using WHO recommendations and modifications were made based on the response. So that the survey was simple to understand and answer, yet provided accurate data.

Training of research assistants

The principal investigator (PI) identified six data collectors (two data collectors for each study area) and trained for two days before commencement of the research. The data collectors were nurses working in the ambulatory care of UOGCSH, FHCSH chest clinic and TGCSH ambulatory care. The training entailed an

explanation of the nature of the study, its objectives and importance. Demonstration and practical training of use of the data collection tools was done. Ethical considerations and overall expectation from scientific research were explained. The competence of the data collectors was assured by the PI during pre-testing before the study commence through. This was done by assessing how correctly the collector extracted data and filled up the questionnaires. Where further training was required, it was provided and reinforced until competence was ascertained. Finally, after the data was checked for its completeness, it was cleaned and analyzed. Pre-test on the 5% (42) patients of the sample size was done by administered 42 copies of the questionnaires to target population at the ambulatory ward. Based on the results obtained, modification of the questionnaire was done. The Cronbach alpha was done for tools and medication belief ($\alpha=0.73$), MARS-A ($\alpha=0.90$), mini-AQLQ ($\alpha=0.90$), ACT (0.83) and role of patient enablement (0.92).

Data analysis and management

The data was checked for its completeness, cleanness, then coded and entered to Epi Info Version 7 database and export to SPSS Version 26 for analysis. Descriptive statistics, means, median, proportions, tables and figures, were used to describe the characteristics of the study patients and displayed the study results. First, the test assumptions (normality test, correlation coefficients tests, linearity tests, outliers, multicollinearity and homoscedasticity) of all the statistical methods for all variables were tested and those fulfilled the assumptions were entered in further analysis. Variables such as hospitalization, triggering factor and exercise were excluded from the analysis because they did not met linearity. Linearity was checked by generating separate scatter plots with the dependent variable on the y-axis and the independent variables on the x-axis. The relationship between mean score of HRQoL and another continuous variable was checked by the P-P plot. Similarly, the categorical variables linear relationship was checked by drawing a line between the mid-points of the observations at each level. The variables which had no linear relationship with the outcome were excluded from analysis. The variation around the regression line was tested by examining a plot of the standardised residuals versus standardised predicted values of the dependent variable and it was constant for all values of xi for each X variable. Additionally, histogram ,normal probability plot of the residuals and Shapiro wilk test were done to examine the data distribution and the test indicated that the residuals had approximate to be normally distributed. Results of the regression analysis were expressed in un-standardized coefficient β . Beta coefficients are measured in units of standard deviation and refer to the average change in the dependent variable for a unit increase in the predictor variable. Finally, assumptions of multiple linear regressions met (normality test, correlation coefficients tests, linearity tests, outliers, multicollinearity and homoscedasticity). Then, variables with a p-value ≤ 0.2 in bi-variable analysis were entered to multivariable linear regression to identify the independent predictor variables of HRQoL. The statistical significance was declared using a p-value less than 0.05. The adequacies of the models were checked by the F-test of goodness of fit for linear regression.

Ethical considerations and Confidentiality

Ethical clearance was obtained from the Institutional Review Board of University of Gondar. Letter of permission was obtained from each hospital clinical directorate. Study medical records numbers was used in place of patient names during the data collection and analysis process in order to conceal and safeguard participant's identity. All the data collection materials were safely kept in a cabinet under lock and key. The databases were password protected by the PI for limited access during the entire study period. The collected data was used only for the purpose of the study. Verbal consent was taken after the purpose and objective of the study was explained to the selected participants. Moreover, all participants were informed that participation was on voluntary basis and they can withdraw from the study at any time if they are not comfortable about the questionnaire. Any identifiers of the study participants were not recorded.

Results

Socio-demographic characteristics of the study population

409 participants were included with a response of 96.7%. The mean ($\pm$ SD) age of the study participants was 49.82 ($\pm$ 16.1) and most of them were in a range of 35-64 years. More than half (60.1%) of them were females. More than two-thirds (71.9%) of the respondents were married and about three-fourth (73.3%) were urban dwellers. The majority of the respondents (88.5%) had biomass fuel user for cooking food and from these Charcoal and wood were used as a main sources of food preparations (82.4 %). Majority (87.5%) of study subjects had no smoking history (Table1).

Clinical characteristics and the triggering factors of asthma exacerbations

More than three-fourth (76%) of the study participants were diagnosed for asthma after their 12 years of age. The mean ($\pm$ SD) duration on the medications after the onset of the condition was 5.4 ($\pm$ 5.8) years. In the last one-year period, more than half (53.1%) had at least one episode of asthma exacerbation and 95.4% of them had at least one triggering factor for their exacerbations. More than half (53.5%) of them had exacerbated their symptoms during exercise which is the leading causes for asthma exacerbation followed by the dust particles combined with cold weather and the cold weather alone which accounts (44.5%) and 22.5%, respectively. Regarding the female respondents, only (8.1%) of them had menstruation induced asthma exacerbations (figure 1). After maintenance therapy has been initiated, the median (IQR) time to visit an emergency department was 11.95 ($\pm$ 13.6) months. Most patients had taken medication 1-5 years. Almost one-third (33.3%) of the patients were hospitalized in the last 12 months and of these 6.1% were sent to the ICU unit. Concerning the medication experiences, more than one-third (37.2%) used oral steroids. According to GINA based severity classifications, (56.7%) of the respondents had moderately persistent and (26.2%) had mild persistent asthma (Table 2).

Pattern of Antiasthmatic Drug use

Drug utilization pattern suggested that multiple-drug therapy (two or three) drug combinations were used by almost all patients (99 %). More than three-fourth (76.5%) had Salbutamol puff PRN and Beclomethasone puff Bid followed by Salbutamol puff PRN and Beclomethasone puff Bid and Prednisolone (11.5%). Medication Adherence Rating Scale showed that (13.9%) patients had high level of adherent to the prescribed controller medication (s). A large proportion 305 (74.6%) respondents were on optimal dosage of asthma medication at various steps. Asthma medication combination therapy were appropriately selected for (71.1%) of subjects. In prescribing pattern, about 21.8% of prescribers had not adherent to current guideline recommendation. Nearly three fourth 74.3% of the respondent was adequately educated about their asthmatic state and its management. From the participants 91.7% and 89.5% were good relationship with health care providers and had satisfied by the care respectively (Table 3).

Comorbidities and concurrent medications

Regarding the Charleston comorbidity index (CCI), almost sixty percent of the respondents were found in the mild range of categorizations and about forty percent of the individuals had comorbidities. More than one-third (38.3 %) of patients were prescribed with concurrent medications (Table 4). In this study, a number of comorbidities were documented. Large proportion of participant had (21.5%) cardiovascular disease followed by Diabetes meatus (10%) and also the two most commonly used class of concurrent medication were cardiovascular drugs 18.6% followed by endocrine drugs 10.5% (figure 2).

Beliefs about medicines in the study population

The patients' mean ($\pm$ SD) belief score measured with the Specific-Necessity Scale and Specific Concerns Scale towards their anti-asthmatic medications out of 25 were 17.9 ($\pm$ 4.4) and 16.5 ($\pm$ 4.9), respectively. The overall mean ($\pm$ SD) score of the participants were 3.46 ($\pm$ 0.54) out of five (Table 5).

HRQoL outcomes

The Mini-AQLQ mean score was 4.1($\pm$ 0.9). In individual domains, emotional, environmental, and symptom stimulation had the lowest mean score. Determination of HRQoL was made using the mini-AQLQ questionnaire. Out of the 409 participants, 242 (59.2%) had good HRQoL mean score $\geq$ 4.1 while 167 (40.8%) had poor HRQoL the scored was below 4.1 (Table 6). Further data analysis was conducted to identify the independent predictor of HRQoL by using linear regression. Pearson correlation analysis was done to assesses the relationship between min-AQLQ score of participants and ACT score and the results showed our dependent variable were strongly associated ($r=0.59$; $P< 0.01$). Mini-AQLQ increased with the increasing level of asthma control.

Factors associated with HRQoL

A linear regression analysis was employed to identify potential variables determining quality of life of asthmatic patient. The model fitness of the linear regression was run and significantly associated ($F=11.68$; $P<0.001$). A multivariable analysis has identified factors that potentially associate with HRQoL are occupation, health care service, role of patient enablement, adherence to guideline, total asthma control score and belief to anti-asthmatic medication. The results of the regression indicated that the model explained by 45.6% the variance; the variance inflated factor for all variables had less than five.

Compared with government employer, being a housewife had decreased the HRQoL, with B score of 0.21 times ($\beta=-0.21$, 95%CI (-0.39, -0.01) indicating that on average, housewife asthmatic patients had 0.21 times lower HRQoL than government employer, use insurance for health care service ($\beta=0.15$, 95%CI (0.010, 0.29), $p=0.036$) which implies that, on average insurance user have 0.148 times higher HRQOL than payment, patients with high role of enablement have higher HRQOL than patients who have low enablement score by 0.39 (95%CI (0.25, 0.54), $p<0.001$) percentage point, for every one increase of asthma control score, the HRQOL of the patient is increased by 0.136 times (95% (0.09, 0.17), $p<0.001$) percentage point, on average patients whose health care provider non-adherence to guideline have 0.30 times (95%CI (-0.47, -0.15), $p<0.001$) lower HRQOL than whose care provider adherence to guideline and every one increase of belief to anti-asthmatic medication score, the HRQOL decreased by 0.23 times (95%CI (-0.36, -0.101) percentage point. The above listed variables had identified as significant predictor of health-related quality of life, but the other variables had lost its effect on multiple variable analysis (table 7).

Discussion

In this multicenter public institutional based study, the min-AQLQ measurement tools were applied to present the HRQoL among asthmatic patients. This study findings reported that the overall mean ($\pm$ SD) HRQoL was 4.1 ± 0.9 (out of 7).

The HRQoL status of the current study revealed that about 60% of the asthmatic patients had scored the mean ($\pm$ SD) of 4.1 ± 0.9 and more than this score. This finding is coincided to the study results reported in Iran, in which 53% of patients had a good quality of life [37]. In contrast, it was much higher than the findings from Pakistan where only 28.6% of study subjects had good quality of life [38]. The possible explanations for the higher numbers of patients who had good quality of life in the present study might be the mean age levels of the respondents in which their age were in middle ranges compared with those Pakistan where their age ranges were found in older groups.

For the factors associated with HRQoL the following variables were disclosed; health insured patients, having advanced role of patient enablement and improved in the asthma control levels were significantly increased the HRQoL status. On the other hand, being housewife, patients not treated with as per the guidelines and individuals positively believed to their medication were significantly declined the HRQOL status.

According to the result of this study patients those who uses health insurance were correlated significantly with HRQoL. This positive association between health insurance and HRQoL were supported by other studies [12, 24, 25, 39-44]. The possible explanation for this positive association might be mainly to high

levels of adherence, reduce out of pocket cost for drug and use of treatment as per guidelines increased in health insured participants. Additionally, might be due to insurance users have less risk of asthma exacerbation because which reduce stress, increase adherence to medication and it would have impact on over all hospital cost minimization [45].

The present study revealed that, the role of patient enablement had significantly associated with mini-Asthma QoL; which is supported by some evidence that the mPEI may be sensitive enough to detect changes in the patients quality of life, as shown by United Kingdom study[35]. There are several possible reasons why measures of patient enablement had significantly associated with quality of life. Although self-management training programs may bring about only mild to moderate outcome for selected chronic diseases [46], but may improve asthma control in patients compared with usual care [47]. They can improve trust in treatment, improving adherence to therapeutic plans [48], which indirectly leads to increase quality of life in asthmatic patient.

High level of asthma control was identified as positive independent predictor of HRQoL. This findings correspond with those of multiple relevant studies conducted worldwide for instance in Brazilian and United Kingdom, researchers found that the degree to which asthma was controlled had a significant impact on a patient's HRQoL [15, 49, 50]. Asthma control reflects the disease's effect in a patient as arrested by fluctuations in their symptoms, limitations in their range of activities, their environmental as well as emotional functioning. The relationship between asthma control and HRQoL was also emphasized by the results of an Italian study which found that close to one-third of their population had optimal HRQoL and it was neither associated with the duration of severity of asthma nor rhinitis, but the degree of asthma control [39]. Similar study, in a France and UK study, it was reported that poor asthma control was the only factor that independently impacted HRQoL [42]. These consistent outcomes confirm that asthma control is indeed the single most important determinant factor of an individual's HRQoL. The negative impact of asthma on patients' HRQoL could be reduced if patient care focused on achievement of good control of the disease. To achieve optimal control therefore, variables that significantly impact it in populations need to be identified and addressed, so that patients can live near normal lives

The finding of this study indicated that history of occupational risk exposure to asthma triggers like house wife worker had poor HRQoL that was significantly associated. This findings interrelated with a similar study in the United States which indicated that individuals with work related asthma were significantly more likely to have poor HRQoL as compared to those with non-work-related asthma [51]. The possible explanation for this is being house wife increases exposure for asthma triggers like bakery, rubber/plastic work, cleaning, spray painting and food processing. Additionally, being female is more exposed for asthma trigger due to the natural hormone associated with estrogen and increased asthma exacerbation during menstruation [52], which leads to negative impact on HRQoL.

This study found a significant association between HRQoL and guideline usage by the prescribers. Our results were comparable to those of a study based on GINA guidelines where investigators found that well controlled patients who had achieved guideline-based asthma control reported consistently higher overall HRQoL than their uncontrolled counterparts in whom guidelines were not followed [13]. In another cross-

sectional study where half the treatment regimens were considered non-adherent to guideline recommendations, only those patients in whom treatment was in accordance to guidelines had significantly higher HRQoL[16]. In this study 21% of the patients had not treated based on guideline in whom guidelines were not followed either had their controller medications prescribed once daily, were on SABA only instead of combination with controller medication, or their asthma severity level required step-up to a higher dose or addition of other medications to the ones they had been put on. Therefore, non-adherence to guideline would reduce the level of asthma control and by extension, HRQoL of asthmatic patient.

In this study belief to asthmatic medication had identified as independent predictor of HRQoL, Which is supported by another study [53].The reason behind is belief to medication have impact on quality of life by increase stress and stimulating positive/negative illness perceptions and might be impact on adherence, which in turn might lead to compromised disease control and impaired HRQoL.

Strengths and Limitations

The study has several strengths. It was real-life study and used well validated tools to measure outcomes and it was multi-centered study which increases generalizability. The study location being a referral institution was well capable in terms of resources. In addition, the systematic sampling technique was used. It could have reduced source of bias in this study.

The findings of this article will be interpreted with the following limitations. Some of the responses in the questionnaires were patient subjective reports which could have been biased either by under-reporting or exaggeration. Lack of objective measurement (spirometer or peak flow meter) which have for better assessment of asthma control. Despite these limitations, our study was adequately powered and findings compared well with those of other similar studies conducted worldwide.

Conclusion

Our study revealed that slightly over half of study participants have reported good HRQoL. Health related quality of life outcome among patients was largely dependent upon the degree to which asthma was controlled. Regarding to the factors associated with the HRQoL of asthmatic patients, being house wise, health care provider non-adherence to guide usage and belief to anti-asthmatic medication were significantly decrease HRQoL. On the other hand, insurance user for health care service, higher role of patient enablement and total asthma control score were significantly increase HRQoL. So respective hospitals would be prepare schedule for client's education on patients' behavior like the importance of adherence and its medication by each team on weekly base and future researchers would be worked on HRQoL and its associated factors in asthmatic patients on at lower health care facilities that may not have the infrastructure and resources available in higher level facilities.

Abbreviations

ACT: Asthma Control Test; AQLQ: Asthma Quality of Life Questionnaire; BMQ: Beliefs about Medicine Questionnaire ; CCI: Chalsone Comorbidity Index; COPD: Chronic Obstructive Pulmonary Disease ; FHCSH: Felege Hiwot Comprehensive Specialized Hospital; GINA: Global Initiative for Asthma; HRQoL: Health Related Quality of Life; ICS: Inhaled Corticosteroids; LABA: Long-Acting Beta-2 Agonists; mPEI: Modified Patient Enablement Index; MARS-A : Medication Adherence Rating Scale; OPD: Outpatient Department; PI: Principal Investigator; QoL: Quality of Life; SABA: Short Acting Beta-2 Agonists; SD: Standard Deviation; TASH: Tkure Anebesa Specialized Hospital; TGCSH: Tibebe Ghion Comprehensive Specialized Hospital; USA: United States America ; UOGCSH: University of Gondar Comprehensive Specialized Hospital; WHO: World Health Organization

Declarations

Acknowledgment

We forward our appreciation to the clinical directors of all sites for allowing us to conduct this research. Our special appreciation goes to the study participants for their volunteer participation.

Funding

The study was not gained any financial support

Availability of data and materials

The datasets supporting the conclusions of this article are available upon request to the corresponding author. Due to data protection restrictions and participant confidentiality, we do not make participants data publicly available.

Authors' contributions

EAB, ST and MA participated in the conception and design of the study, EAB collected data, ST and MA interpreted the data. EAB drafted the initial manuscript. All authors read and approved the final manuscript, contributed the critical review and the content

Competing interest

The authors declare that they have no competing interest.

Consent for publication

Not applicable.

Ethics approval and consent to participate

Ethical clearance was obtained from Institutional Review Board of University of Gondar (SOP/131/2021). Then official letter obtained from clinical director of University of Gondar comprehensive specialized hospital, FHCSH and TGSCH. The purpose of study was well explained to the study participants and informed consents were obtained. Confidentiality was maintained at all levels of the study by avoiding use of name and other identifiers. Participants' involvement in the study was on voluntary basis; participants who were unwilling to participate in the study and those who wish to quit their participation were informed to do so without any restriction

References

1. GINA, Pocket Guide For Asthma Management and Prevention, GINA (Global Initiative for Asthma). 2018
2. see, K.C., J. Phua, and T.K. Lim, Trigger factors in asthma and chronic obstructive pulmonary disease: a single-centre cross-sectional survey. Singapore medical journal, 2016. **57**(10): p. 561.
3. Asher, M.I. and P. Ellwood, The global asthma report . Global Asthma Network ,2014.
4. network, g.a., Global Asthma Report. december,2018.
5. Davies Adeloye, K.Y.C., and Igor Rudan „ An estimate of asthma prevalence in Africa: a systematic analysis. Croatian medical journal, ,2013. **54**(6): p. 519-531.
6. Obaseki, D.O., et al., Low prevalence of asthma in sub Saharan Africa: a cross sectional community survey in a suburban Nigerian town. 2014. **108**(11): p. 1581-1588.
7. Wilson, I.B. and P.D.J.J. Cleary, Linking clinical variables with health-related quality of life: a conceptual model of patient outcomes. 1995. **273**(1): p. 59-65.
8. Wu, A.W.J.A., Quality of life assessment comes of age in the era of highly active antiretroviral therapy. 2000. **14**(10): p. 1449-1451.
9. medicine, W.G.J.P., Development of the World Health Organization WHOQOL-BREF quality of life assessment. 1998. **28**(3): p. 551-558.
10. Qoltech, Measurement of Health-Related Quality of Life & Asthma Control 2018.
11. Prevention., C.f.D.C.a., Measuring Healthy Days. Atlanta, Georgia:. Novemeber 2000.
12. Apter, A.J., et al., The influence of demographic and socioeconomic factors on health-related quality of life in asthma. 1999. **103**(1): p. 72-78.
13. Bateman, E., L. Frith, and G.J.E.R.J. Braunstein, Achieving guideline-based asthma control: does the patient benefit? 2002. **20**(3): p. 588-596.
14. Hallstrand, T.S., et al., Quality of life in adolescents with mild asthma. 2003. **36**(6): p. 536-543.
15. Wijnhoven, H.A., et al., Gender differences in health-related quality of life among asthma patients. 2003. **40**(2): p. 189-199.
16. Pont, L., et al., Relationship between guideline treatment and health-related quality of life in asthma. 2004. **23**(5): p. 718-722.

17. Bateman, E., et al., The correlation between asthma control and health status: the GOAL study. 2007. **29**(1): p. 56-62.
18. Braidó, F., et al., Does asthma control correlate with quality of life related to upper and lower airways? A real life study. 2009. **64**(6): p. 937-943.
19. Wilson, S.R., et al., Asthma outcomes: quality of life. 2012. **129**(3): p. S88-S123.
20. Juniper, E.F., et al., Measuring quality of life in the parents of children with asthma. 1996. **5**(1): p. 27-34.
21. Khanna, D. and J.J.A.J.o.M.C. Tsevat, Health-related quality of life-an introduction. 2007. **13**(9): p. S218.
22. de Sousa, J.C., et al., Asthma control, quality of life, and the role of patient enablement: a cross-sectional observational study. 2013. **22**(2): p. 181-187.
23. Sullivan, P.W., et al., Asthma in USA: its impact on health-related quality of life. 2013. **50**(8): p. 891-899.
24. Upton, J., et al., Asthma-specific health-related quality of life of people in Great Britain: A national survey. 2016. **53**(9): p. 975-982.
25. Sundh, J., et al., Health-related quality of life in asthma patients-A comparison of two cohorts from 2005 and 2015. 2017. **132**: p. 154-160.
26. Office:, U.S.a.I., Annual Report on Health Services and Employees, Gondar, Ethiopia. unpublished, 2019.
27. Jia, C.E., et al., The Asthma Control Test and Asthma Control Questionnaire for assessing asthma control: systematic review and meta-analysis. 2013. **131**(3): p. 695-703.
28. Juniper, E., et al., Development and validation of the mini asthma quality of life questionnaire. 1999. **14**(1): p. 32-38.
29. Thompson, K., J. Kulkarni, and A.J.S.r. Sergejew, Reliability and validity of a new Medication Adherence Rating Scale (MARS) for the psychoses. 2000. **42**(3): p. 241-247.
30. Horne, R., et al., The beliefs about medicines questionnaire: the development and evaluation of a new method for assessing the cognitive representation of medication. 1999. **14**(1): p. 1-24.
31. Gebremariam, T.H., 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. 2017. **10**(1): p. 1-6.
32. Neame, R. and A.J.R. Hammond, Beliefs about medications: a questionnaire survey of people with rheumatoid arthritis. 2005. **44**(6): p. 762-767.
33. Mahler, C., et al., Patients' beliefs about medicines in a primary care setting in Germany. 2012. **18**(2): p. 409-413.
34. Cohen, J.L., et al., Assessing the validity of self-reported medication adherence among inner-city asthmatic adults: the Medication Adherence Report Scale for Asthma. 2009. **103**(4): p. 325-331.
35. Haughney, J., et al., The use of a modification of the Patient Enablement Instrument in asthma. 2007. **16**(2): p. 89-92.
36. Charlson, M., et al., Validation of a combined comorbidity index. 1994. **47**(11): p. 1245-1251.
37. Motaghi-Nejad, M., et al., Quality of life in asthmatic patients. 2015. **4**: p. 3757-3762.
38. Ali, R., et al., Assessment of quality of life in bronchial asthma patients. 2020. **12**(10).

39. Braido, F., et al., Determinants and impact of suboptimal asthma control in Europe: The INTERNATIONAL CROSS-SECTIONAL AND LONGITUDINAL ASSESSMENT ON ASTHMA CONTROL (LIAISON) study. 2016. **17**(1): p. 1-10.
40. Dogra, S., et al., Exercise is associated with improved asthma control in adults. 2011. **37**(2): p. 318-323.
41. Hans-Wytrychowska, A., et al., The influence of the socioeconomic status on the control of bronchial asthma and the assessment of health-related quality of life (HRQoL) own research. 2010. **12**(2): p. 202-206.
42. Hernandez, G., et al., Impact of asthma on women and men: Comparison with the general population using the EQ-5D-5L questionnaire. 2018. **13**(8): p. e0202624.
43. Kant, S.J.T.I.j.o.m.r., Socio-economic dynamics of asthma. 2013. **138**(4): p. 446.
44. Refaat, A., M.J.E.J.o.C.D. Gawish, and Tuberculosis, Effect of physical training on health-related quality of life in patients with moderate and severe asthma. 2015. **64**(4): p. 761-766.
45. Leidy, N. and C.J.Q.o.L.R. Coughlin, Psychometric performance of the Asthma Quality of Life Questionnaire in a US sample. 1998. **7**(2): p. 127-134.
46. Warsi, A., et al., Self-management education programs in chronic disease: a systematic review and methodological critique of the literature. 2004. **164**(15): p. 1641-1649.
47. Thoonen, B., et al., Self-management of asthma in general practice, asthma control and quality of life: a randomised controlled trial. 2003. **58**(1): p. 30-36.
48. Buhl, R. and D.J.I.J.o.C.P. Price, Patients' perceptions of well-being using a guided self-management plan in asthma. 2004. **58**: p. 26-32.
49. Pavord, I.D., et al., The impact of poor asthma control among asthma patients treated with inhaled corticosteroids plus long-acting β 2-agonists in the United Kingdom: A cross-sectional analysis. 2017. **27**(1): p. 1-8.
50. Pereira, E.D.B., et al., Asthma control and quality of life in patients with moderate or severe asthma. 2011. **37**: p. 705-711.
51. Abrahamsen, R., et al., Association of respiratory symptoms and asthma with occupational exposures: findings from a population-based cross-sectional survey in Telemark, Norway. 2017. **7**(3): p. e014018.
52. Koper, I., K. Hufnagl, and R.J.W.A.O.J. Ehmann, Gender aspects and influence of hormones on bronchial asthma—Secondary publication and update. 2017. **10**: p. 46.
53. Kosse, R.C., et al., Asthma control and quality of life in adolescents: The role of illness perceptions, medication beliefs, and adherence. 2020. **57**(10): p. 1145-1154.

Tables

Table 1

Socio-demographic characteristics of adult asthmatic patients attending ambulatory care units of selected public hospitals in Northwestern Ethiopia, 2021 (N=409)

Variable		Number (%)
Age, mean ($\pm$ SD)		49.82 ($\pm$ 16.1)
	18-34	83 (20.3%)
	35-64	238 (58.2%)
	$\geq$ 65	88 (21.5%)
Gender	Male	163 (39.9%)
	Female	246 (60.1%)
Residency	Urban	300 (73.3%)
	Rural	109 (26.7%)
Marital Status	Single	41 (10%)
	Married	294 (71.9%)
	Divorced	16 (3.0%)
	widow	58 (14.2%)
Education level	No formal education ^a	174 (42.6%)
	Primary education	72 (17.6%)
	Secondary education	89 (21.8%)
	Higher institute	74 (18.1%)
Occupation	Government employee	115 (28.1%)
	Farmer	66 (16.1%)
	Housewife	112 (27.4%)
	Merchant	54 (13.2%)
	Other ^b	62 (15.1%)
Yearly Income level ($\pm$ SD)/birr		41433.83 $\pm$ 42641.0
Access of health care	Insurance	173 (42.3%)
	Free	83 (20.3%)
	Out of pocket	153 (37.4%)
Biomass use	Yes	362 (88.5%)
	No	47 (11.5%)

Fuel type	Kerosene	15 (3.7%)
	Charcoal and wood	337(82.4 %)
	Ethanol	6 (1.5%)
	Disel-fuel	13 (3.2%)
Smoking	Never smoker	358 (87.5%)
	Current smoker	13 (3.2%)
	Ex-smoker	38 (9.3%)

^a: Those unable to read and write; read and write due to informal education like religious teaching

^b: Include individual with daily labor, student, self-employed

Table 2

Clinical characteristics and triggering factors of adult asthmatic patients attending ambulatory care units of selected public hospitals Northwestern Ethiopia, 2021 (N=409)

Variable		Number (%)
Age of onset (year)	< 12 year	98 (24%)
	≥ 12 years	311 (76%)
Duration on medication (years ±SD)		5.4 ±5.8
	<1 year	93 (22.7%)
	1-5years	
	5-10years	180 (44%)
	>10 years	87 (21.3%)
		49 (12%)
Exacerbations in last 12 months	Yes	217 (53.1%)
	No	192 (46.9%)
Time to emergency visit after start maintenance therapy (In month) (±IQR)		11.95 ±13.6
Hospitalization in the last 12 month:	Yes	136 (33.3%)
	No	273 (66.7%)
Admitted to ICU (intubated) in the last 12 months	Yes	25 (6.1%)
	No	284 (93.9%)
Oral steroid use	Yes	152 (37.2%)
	No	257 (62.8%)
Oral SABA use	Yes	253 (61.9%)
	No	156 (38.1%)

Asthma severity stage	Intermittent	25 (6.1%)
	Mild persistent	107 (26.2%)
	Moderately persistent	232 (56.7%)
	Severely persistent	45 (11%)

Table 3

Drug utilization pattern among adult asthmatic patients and anti-asthmatic medications adherence at ambulatory care units of selected public hospitals Northwestern Ethiopia, 2021 (N=409)

Variable				Number (%)
Salbutamol puff PRN + Beclomethasone puff Bid				313 (76.5%)
Salbutamol puff PRN + Prednisolone oral daily				25 (6.1%)
Salbutamol puff PRN + Beclomethasone puff Bid + Prednisolone				47 (11.5%)
Salbutamol puff PRN + Beclomethasone puff Bid+ theophylline daily				6 (1.5%)
Salbutamol puff PRN +Budesonide puff bid				4 (1%)
Theophylline +Salbutamol puff PRN				4 (1%)
Theophylline +Salbutamol puff PRN + prednisolone daily				1 (.2%)
Fluticasone puff +Salbutamol puff PRN				2 (0.5%)
Beclomethasone puff bid+ Salbutamol puff PRN+symicort				2 (.5%)
Almetamin				3 (.7%)
Oral SABA +salbutamol puff				2 (0.5%)
Medication adherent	High	Low		57 (13.9%)
				352 (86.1%)
Dose of the anti-asthmatic drug	Optimal		Sub	305 (74.6%)
	optimal			104 (25.4%)
Appropriateness of drug selection based on severity	appropriate			291 (71.1%)
	inappropriate			118 (28.8%)
Health care provider adherent to guideline	Yes			320 (78.2%)
	No			89 (21.8%)
Patient information provided	Yes			304

	No	(74.3%)
		105 (25.7%)
Patient relationship with health care provider	Good	375 (91.7%)
	Poor	34 (8.3%)

Table 4

Charleston comorbidity index, comorbidity history and concurrent medication use among asthmatic patient

Variables		Number (%)
CCI	Mild	241 (58.9%)
	Moderate	132 (32.3%)
	Severe	36 (8.8%)
Comorbidities	Yes	162 (39.6%)
	No	244 (59.4%)
Concurrent medication use	Yes	157 (38.4%)
	No	252 (61.6%)

Table 5

Percentage of respondents agreed/strongly agreed to their medication beliefs on their asthmatic medications

category	Variable	Number (%)	Mean (±SD)	Mean score of Specific Necessity Scale	
Specific-Necessity Scale	My health at present depends on my asthma medicines	351 (85.8%)	3.9 (±0.7)	±4.4	17.9
	My life would be impossible without my asthma medication	175 (42.8%)	3.2 (±1.1)		
	Without my asthma medication I would be very ill	273 (66.7%)	3.6 (±0.9)		
	My health in the future will depend on my asthma medication	250 (61.1%)	3.5 (±0.9)		
	My asthma medication protects me from becoming worse	323 (79%)	3.7 (±0.8)		
Specific-Concerns Scale	Having to take asthma medication worries me	154 (38%)	3.4 (±1.0)		
	I sometimes worry about the long-term effects of my asthma medication	244 (59.7%)	3.4 (±1.0)		
	My asthma medication is mystery to me	223 (53.5%)	3.6 (±1.0)		
	My asthma medication disrupts my life	253 (61.8%)	3.6 (±1.0)		
	I sometimes worry about becoming too dependent on my asthma medication	315 (77%)	3.6 (±0.9)		

**Sum of mean score of specific-Concerns
Scale**

1. $\pm$ 4.9

Over all medication belief mean score 3.54 $\pm$ 0.54

Table 6

The mini- asthma QoL outcome measures

Variable	Mean($\pm$ SD)
Mini-AQLQ, mean ($\pm$ SD)	4.1($\pm$ 0.9)
Symptom's domain	3.9 ($\pm$ 1.0)
Environmental domain	3.85($\pm$ 1.0)
Emotional domain	3.8 ($\pm$ 1.0)
Activity domain	4.7 ($\pm$ 1.0)
Overall quality of life	
Good	242 (59.2%),95%CI (54.1,64.1)
Poor	167 (40.8%),95%CI (35.9,45.2)

mini-AQLQ = Mini-Asthma Quality of Life Questionnaire; SD standard deviation

Table 7

Simple and multiple linear regression analysis for determinant of asthma quality of life among asthmatic patient at North Northwestern, Ethiopia (N=409)

Variable		SLR β (95% CI)	p-value	Adj R ² %	MLR β (95% CI)	p-value
Yearly income/birr		2.406	0.016	1.4	1.1	0.21
Total asthma control score		0.12 (0.11,0.14)	0.000	34.6	0.14(0.09, 0.17)	0.001**
medication burden		-0.08(-0.16,0.01)	0.068	0.6	-0.03(-0.12, 0.06)	0.49
CCI		-0.05(-0.10,0.01)	0.139	0.3	0.01(-0.05,0.06)	0.66
Belief to medication Mean score		-0.393(-0.54, -0.24)	0.000	6	-0.23- (0.358,0.101)	0.001*
Sex	Female	-0.237(-0.407, -0.068)	0.006	1.6	-0.04(0.20,0.12)	0.61
	Male ^R	0			0	
Marital status	Single	0.24 (-0.04,0.52)	0.09	0.7	0.14(-0.09,0.36)	0.23
	Divorced	-0.11 (-0.54,0.32)	0.61		-0.19(-0.58,0.20)	
	Window	-0.13 (-0.36,0.12)	0.32		0.13(-0.16,0.41)	
	married ^R	0			0	
Level of education	Informal	0.05 (-0.13,0.24)	0.57	0.7	-0.068(-0.27,0 0.13)	0.51
	High level	0.27(0.03,0.5)	0.20		0.082(-0.22,0.38)	
	Low level ^R	0			0	
Occupation	Farmer	0.06(-0.18,0.30)	0.61	6.3	-0.01(-0.22,0.22)	0.96
	Private work	-0.33(-0.60,0.05)	0.02		-0.17(-0.35,0.02)	
	House wife	-0.56(-0.82,0.31)	0.001		-0.21(-0.39, -0.012)	
	Gov,t employ ^R	0			0	
Biomass use	No	0.24 (-0.03,0.50)	0.08	0.8	0.07 (-0.41, 0.54)	0.78
	Yes ^R	0			0	
Type of fuel used	kerosene	0.13 (-0.86,1.13)	0.79	4.9	0.1 (-0.88,0.67)	0.78

	charcoal	0.44 (-0.47,1.35)	0.35		0.17 (-0.15,0.05)	0.29
	Dissel fuel	1.41 (0.37,2.46)	0.008		0.56 (-0.08, 1.041)	0.22
	wood	-0.30(-1.14,0.81)	0.51		-0.12 (-0.73,0.49)	0.70
	Kerosene and charcoal	-0.20(-1.31,0.91)	0.74		-0.33 (-1.0,0.39)	0.36
	Ethanol ^R	0			0	
Health care Service	free	0.10 (-0.13,0.33)	0.38	1.5	-0.22 (-0.41,0.04)	0.21
	Insurance	0.114 (0.42, 0.491)	0.020		0.148 (0.01, 0.29)	0.036*
	Payment ^R	0			0	
Year of onset	< 12 years	-0.21(-0.49,0.10)	0.003	2	-0.08 (-0.23, 0.08)	0.32
	≥ 12year ^R	0			0	
Role of enablement	high	0.79 (0.62,0.95)	0.000	17.4	0.39 (0.25, 0.54)	0.001**
	low ^R	0			0	
Patient satisfaction by service	Yes	0.31 (0.12,0.66)	0.005	1.7	0.05 (-0.11,0.29)	0.704
	No ^R	0			0	
Relationship to HCP	good	0.78 (0.491,1.077)	0.000	6.1	0.01 (-0.19,0.38)	0.52
	poor ^R	0			0	
Asthma severity	Mild-intermittent	0.76 (-0.28,0.429)	0.67	1.2	0.16 (-103.0.44)	0.22
	Mild persistent	0.28 (0.08,0.48)	0.005		0.068(-0.085, .221)	0.381
	Severe persistent	0.07(-0.20,0.34)	0.61		0.14 (-0.09,0.36)	0.23
	Moderatepersisten ^R	0			0	
Adherence	Adherent	0.23 (0.13,0.33)	0.000	4.4	0.02 (-0.13,0.08)	0.64
	Non-adherent ^R	0			0	
Comorbidity	Yes	0.79 (-0.06,0.21)	0.26	0.1	-0.050(-0.8, 0.078)	0.443
	No ^R	0			0	
HCP	No	-0.58 (-)	0.000	7.8	-0.30(-0.47,-0.14)	0.001**

adherence to guideline	(0.79,0.38)	
Yes ^R		0
SLR: simple linear regression MLR: multiple linear regressions ^R ; Reference * ;significant p< 0.05** p<0.001 Confidence interval ; adjusted R ² =45.7 ,F=11.68; P<0.001,VIF<5		

Figures

Figure 1

Triggering factors for asthma exacerbations

Figure 2

Type of comorbidity and commonly used class of concurrent medication among adult asthmatic patients

CVD: cardiovascular GI: gastrointestinal