

ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCE
SCHOOL OF PUBLIC HEALTH



**THE ROLE OF HOUSEHOLD FUEL EXPOSURE AND
HOUSING CHARACTERISTICS ON ASTHMA IN SELECTED
PUBLIC HOSPITALS OF ADDIS ABABA, ETHIOPIA:**
MATCHED CASE CONTROL STUDY DESIGN

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Examiners' Approval Sheet

We, the undersigned, members of the Board of Examiners of the final open defense by Yonas Abebe Mezemir , have read and evaluated his thesis entitled “*The role of household fuel exposure and housing characteristics on asthma in selected public hospitals of Addis Ababa, Ethiopia ,2020.*” This is to verify that the thesis has been accepted in partial fulfillment of the requirements for the Master of Public Health Degree in “Epidemiology and Biostatistics”

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List of abbreviation and acronyms

ATS-	American Thoracic Society
BMI-	Body Mass Index
COPD-	Chronic Obstructive Pulmonary Disease
CI-	Confidence Interval
COR-	Crude Odds Ratio
CRD-	Chronic Respiratory Diseases
DALYS-	Disability Adjusted Life Years
ECRHS II-	European Community Respiratory Health Survey II
FMHACA-	Food Medicine Health Care Administration and Control Authority
FMOH-	Federal Ministry of Health
GBD-	Global Burden of Disease
GINA-	Global Initiative for Asthma
IAQ-	Indoor Air Quality
ISAAC-	International Study of Asthma and Allergies in Childhood
LRTI-	Lower Respiratory Tract Infectious
MMMf-	Man Made Mineral Fibers
MOR-	Matched Odd Ratio
NCDs-	Non Communicable Diseases
OPD-	Out Patient Department
OR-	Odds Ratio
PTB-	Pulmonary Tuberculosis
SD-	Standard Deviations
SPHMMC-	St, Paul Hospital millennium medical college
SPSS-	Statistical Package for Social Sciences
TASH-	Tikur Anbessa Specialized Hospital
UK-	United Kingdom
USA-	United States of America
VIF-	Variance Inflation Factor
VOC-	Volatile Organic Compound
WHO-	World Health Organization

Abstract

Introduction: Asthma is a chronic inflammatory disorder characterized by airway obstruction and hyper responsiveness. Studies have suggested that household fuel exposure; either biomass or fossil fuel and housing characteristics have been associated with allergy. Recent analysis has also shown an increase in asthma among residential determinants of allergy. But there remains considerable uncertainty about whether this reflects an association with asthma. Hence this study was conducted to elucidate selected factors associated with asthma.

Objective: To examine whether there is an association between household fuel exposure and housing characteristics with asthma at selected public hospitals in Addis Ababa, Ethiopia.

Methods: Hospital-based case-control study design, matched with age and sex was done. Among four hundred eighty three participants, 161 were cases and 322 were controls selected using consecutive sampling technique from selected public hospitals in Addis Ababa, Ethiopia. Double population proportions formula with a 2:1 control to case ratio was used to calculate sample size with 95% confidence interval and 80% power. Data were collected between February and August, 2020 using structured questionnaire, entered into EPI info version 7.2 and then analyzed using SPSS version 24. Chi-square test was used to assure statistical significance. Conditional logistic regression model was applied to see the determinants of asthma. Both crude and adjusted odds ratios with 95% confidence interval (CI) were used to identify the strength, direction and significance of the association.

Results: Among study subjects the odds of developing asthma was 4 times higher among those who used agricultural residues for cooking (AOR: 3.809, 95% CI: 1.052, 13.79). , 5 times higher among those who used wood for cooking (AOR: 4.954, 95% CI: 2.1, 11.686). 5 times higher among those who had family history of asthma (AOR: 4.725, 95% CI: 1.544, 14.454), 6 times higher among those who smoke tobacco (AOR: 6.16, 95% CI: 1.304, 29.098) and 10 times higher among those who don't practice door opening, while cooking (AOR: 10.254, 95% CI: 3.969, 26.49).

Conclusion: To reduce the risk of asthma development, people should practice door opening, while cooking, and must avoid using wood and agricultural residues for cooking and tobacco for smoking. Family history of asthma was also noted to be another risk factor for asthma.

Key words: Household fuel exposure, Housing characteristic, TASH, SPHMMC, Asthma, Ethiopia

1. Introduction

1.1 Background

Globally, around three billion people and 90% of rural households in developing countries rely on kerosene, biomass and coal as primary source of cooking energy, those are typically burnt indoors in open fires or poorly functioning stoves, often causing extreme pollution most of the time women spent many hours breathing smoke, while cooking (1, 2). Household air pollution from inefficient cooking practices with solid fuels and kerosene causes non-communicable diseases, including chronic respiratory diseases (1).

Chronic respiratory diseases (CRD) could broadly be classified in to two, bronchial asthma and chronic pulmonary disease. Chronic pulmonary disease is classified in to three, chronic obstructive pulmonary diseases (COPD), chronic occupational lung diseases and chronic interstitial lung diseases (3).

Asthma is a chronic disease that affects the airways of the lungs. Airways are the breathing tubes that are responsible for the movement of air in and out of the lung (4). The inflammation of the airway causes swelling and the swelling causes the airways to make thick, sticky secretions called mucus. Asthma causes the muscles in and around the airways to get very tight or constrict, those three physiological changes on the airway, including swelling, mucus secretion, and tight muscles can make the airways narrower than normal and it becomes very hard to get air into and out of the lungs (5). It features variable airway obstruction and bronchial hyper responsiveness.

Clinically, asthmatics exhibit upper respiratory symptoms, like cough and lower respiratory symptom like recurrent episodes of wheeze, chest tightness, and shortness of breath (6). The 2018 global asthma report states that asthma affects 339 million people in the world (7).

Asthma can be classified in to two persistent or intermittent based on the occurrence of the symptom and also it can be classified in to seven based on the exacerbation factors, including allergic asthma, non-allergic asthma, mixed asthma, occupational asthma, exercise-induced asthma, cough variant asthma and aspirin-induced asthma (8).

1.2 Statement of the problem

According to the Global Asthma Network report, Global Initiative for Asthma (GINA), approximately 235 million people, including six million children have bronchial asthma (7). Asthma prevalence in developing countries has been raised by 50% per decade for the last 40 years and almost in each year 250,000 individuals die because of asthma (7). In the last 20 years, it has affected 5-10% of the population (9). Globally, above 397,000 deaths occurred due to asthma in 2015 and most of them occurred in developing countries, both genetic and environmental factors are responsible for the cause of asthma (10).

Globally, asthma costs are increasing, closely correlated with comorbidities, age and asthma severity and asthma continues to be a major source of global economic burden in both direct and indirect cost of the disease (11). In Europe and North America, the largest portion of the direct cost is asthma medicine, but in south east and middle east Asia the largest portion of direct cost is outpatient cost, doctor and emergency department visit (7). The cost of the disease can only be estimated using data from industrialized countries because of the lack of data from developing countries (12).

We can mention different comorbid conditions that are commonly associated with asthma, those include most frequently reported chronic rhinitis, chronic sinusitis, gastroesophageal reflux disease, obstructive sleep apnea, chronic (recurrent) respiratory infection, COPD, glottis (vocal cord) dysfunction, hormonal disturbance, obesity and smoking (tobacco addiction) and also asthma possibly increased hypertension, diabetes, ischemic heart disease, degenerative joint disease (arthritis), cardiac arrhythmia, cancer, congestive heart failure and cardiovascular disease (atherosclerosis) (13).

There are a lot of risk factors associated with the occurrence of asthma, such as indoor biomass cooking, outdoor pollution and occupational exposure particularly in developing countries (14, 15).

Variations in home characteristics, household crowding, moisture, occupancy, indoor smoke and poverty have been independently associated with asthma (16). Household pet ownership has

attracted considerable attention as an early life environment exposure, which might play a role in the development of asthma and allergy (17).

Combustion indoors produces both gases (e.g. nitrogen dioxide, carbon monoxide) and particulate matter that may affect the development or exacerbation of asthma (18). Researches done in Nigeria and India show that biomass fuel is associated with increase in the risk of developing of asthma by increasing the concentration of indoor air pollutants (19, 20). Not only biomass fuel, but also indoor cooking with gas stoves were positively associated with both allergy and asthma prevalence (21). In contrast to the above studies, research done in Bangladesh concludes that there is no significant association between indoor air pollutants from biomass fuel use and respiratory diseases especially with asthma (22).

The risk factors for asthma have been identified, but the cause of asthma is not known. Women are at risk for developing severe asthma because of many conditions (23). Social, psychological and physical factors in the environment may increase the risk for Asthma, including poverty, housing condition and indoor allergen exposures(24). There are conflicting evidences regarding the association between selected factors (indoor fuel exposure and housing characteristics) and asthma (21, 22, 25).

Most of the researches on this area are done in developed countries as a way of understanding the effect of household fuel exposure on asthma(21, 25). In Africa, only few studies exist(19, 25). And in Ethiopia, few studies tried to assess the risk factors for asthma(26). And yet there are no published studies on the association between household fuel exposure with housing characteristics and asthma in Ethiopia.

It is inappropriate to assume that previously observed relationships between household fuel exposure with housing characteristics and chronic respiratory disease applied in all contexts (27). Therefore, this study is intended to fill the information gap particularly in Ethiopia, in this area of, which the association between selected factors (such as household fuel exposure and housing characteristics) and asthma in the study area.

1.3 Rationale of the study

Despite the large population at risk worldwide, the effect of exposure to indoor solid fuel smoke has not been adequately studied (28). This study added knowledge on asthma and factors associated with it, such as household fuel exposure, housing characteristics, pet ownership, obesity, smoking, alcohol drinking, family history of asthma and physical activity. There are many types of research that describe the relation between chronic respiratory disease and their risk factors. But only a few researches explore the potential risk factor for asthma particularly in Ethiopia (29). So, this study could provide more information about selected factors and their contribution towards asthma and it may be important for researchers who are interested in this area.

1.4 Significance of the study

The findings from this study could give insight on selected factors including, household fuel exposure and housing characteristics and its association with asthma. Then the results used to influence governmental and non-governmental organizations by performing different actions that may reduce air pollution from biomass fuel. And also the data obtained from the study may have its own contribution to policy makers, such as FMOH and regulatory organization, by designing environmental policy which enforces better ventilation system in cooking rooms. such as FMHACA for planning and evaluating the management of asthma. And also to help individuals to understand the effect of household fuel exposure on asthma in Ethiopia.

2. Literature review

2.1 Magnitude of asthma

Death from non-communicable diseases scores around 41 million people each year that accounts for 71% of all deaths globally (30). Based on the prevalence rate, NCDs could be ordered, with the first being cardiovascular diseases accounting for most NCD deaths, or 17.9 million people annually, followed by cancers (9.0 million), respiratory diseases (3.9million), and diabetes (1.6 million) (31).

In Ethiopia, NCDs are estimated to account for 39% of all deaths, which include, 16% Cardiovascular diseases, 7% Cancers, 2% Chronic respiratory diseases, 2% Diabetes, 12% Other NCDs, and the other 49% represent for Communicable, maternal, perinatal and nutritional conditions, and 12% for Injuries (32).

The Global Burden of Disease (GBD) study estimated that there were 339.4 million people worldwide affected by asthma globally and asthma is ranked 16th among the leading causes of years lived with disability and 28th among the leading causes of burden of disease (7). The worldwide number of asthma death is about 180,000 per year, with a wide variation between continents, regions, age and economic groups (11). The highest prevalence ($\geq 20\%$) was generally observed in English speaking countries of Australasia, Europe and North America, and in parts of Latin America and the lowest prevalence ($< 5\%$) was observed in the Indian subcontinent, Asia-Pacific, Eastern Mediterranean, and Northern and Eastern Europe (33).

The prevalence of asthma in younger adults, aged 18-45 years, overall, 4.3% of the global population in this age group reported a doctor's diagnosis of asthma, 4.5% reported either a doctor's diagnosis or that they were taking treatment for asthma, and 8.6% reported that they had experienced attacks of wheezing or whistling breath (symptoms of asthma) in the preceding 12 months in Australia, Northern and Western Europe, and Brazil had the highest prevalence (7). Almost 44 million people in the East Asia or Pacific Region have asthma, although the prevalence rates vary markedly throughout the Region (33). The age distribution of the burden of asthma, represented as DALYs per 100,000 persons, follows a bimodal distribution with peaks at age 10-14 years and at age 75-79 years and the lowest burden occurs at age 30-34 years. The

burden is similar in males and females at ages below 30-34 years. However, in older adults, the burden is higher in males and increases with age (7). The prevalence of clinical asthma were different in different countries, Australia 21.5%, Sweden 20.2%, UK 18.2%, Netherland 15.3% and Brazil at 13.0% (34).

In Africa, intercountry prevalence data are limited to the International Study of Asthma and Allergies in Childhood (ISAAC) in which seven African countries participated (English-speaking regions: Ethiopia 9.1%, Kenya 15.8%, Nigeria 13.0%, and South Africa 20.3%; and French-speaking regions: Algeria 8.7%, Morocco 10.4%, and Tunisia 11.9% . Symptom rates are lower than in industrialized countries (35). The prevalence of asthma in sub-Saharan Africa among adults is less studied or understood (36).

In Ethiopia, according to the latest WHO data published in 2017 asthma death reached 6,269 or 0.99% of total death (37). The age-adjusted death rate is 11.98% per 100,000 of population ranks Ethiopia 50th in the world. Among the leading causes of death in Ethiopia, asthma is ranking 24th (37). The prevalence of asthma in different Ethiopian cities have different values ,for instance, a study done in Addis Ababa, reported that 18.2% have had wheezing and 2.8% reported to have bronchial asthma among school children (38), In Debre Berhan, the prevalence of bronchial asthma among adult patient was 29.6% (26) . In Gonder, 2.2% children claimed to have a label of bronchial asthma (39) , another study state that the prevalence of asthma in urban and rural Ethiopia is 3.6% and 1.3% respectively (40) and also the prevalence of wheeze in urban and rural parts of Butajira is 9.5% and 11.5% respectively (41).

2.2 Factors associated with asthma

2.2.1 Socio economic and demographic characteristics and asthma

Parental history, female sex, low physical activity, and malnutrition, have been described as risk factors together with pesticides, insecticides, wood or kerosene heating, grass mats, mud and cow dung, smoking, and car and truck diesel exhaust (4).

Demographic factors

Age

Based on the research conducted in Nigeria, increasing age was associated with a reduced risk of ever wheezing, current wheeze, and any respiratory symptoms evaluated (19). Another cross-

sectional study of 7649 people aged 5 years or more from the Butajira Rural Health Project Database, suggested that the prevalence of both wheeze and asthma increased significantly with age (41). In contrast to this, study conduct in Nigeria reported that age was not significantly associated with asthma symptoms or signs (42). Based on the study conducted to assess prevalence and determinants of asthma in adults in Kinshasa, state that the distribution of asthma was similar for various age groups (43).

Gender

Asthma prevalence and risk factors study in Northern Portugal conclude that asthma prevalence was higher for boys than for girls (44). In contradiction to that, study in Ethiopia suggest that there was no significant difference in the prevalence of allergic disorders between gender (45). Biomass fuel exposure and asthma symptoms assessment research in Nigeria says that the prevalence of current wheeze and any of the asthma symptoms were significantly higher in females than males (19). Another cross sectional community survey in Nigeria, reported that female respondents were more likely to have ‘probable asthma’ than their male counterparts (36). Beside this the study in Debre Berhan Referral Hospital, report that sex didn’t show significant association with bronchial asthma (9).

Socio economic factors

Economic states

Low SES and low household income appear to play a role in adult-onset asthma. Based on the study in Debre Berhan Referral Hospital, monthly income of the households, was significantly associated with bronchial asthma (income of household less than 1000 Et.Br/month (26).

Level of education

There was a significant association between mother’s levels of education and asthma based on a study conduct in Nigeria (46). Also an epidemiological study has shown educational level has no association with an increase in the prevalence and incidence of asthma (47). And also another study suggest that level of education was not found to be statistically significant risk factors for asthma (48).

Occupational

Occupational factors that potentially increase the risk of asthma include high-risk jobs, exposure to sensitizing agents, exposure to low-level irritants in the workplace, the mode and route of exposure, the level of exposure, as well as concomitant exposures to pollutants at the workplace

(49). In the occupational setting, isocyanate and latex sensitivity have been reported as risk factors, and poultry workers, hairdressers, gold miners, and wood choppers are reported as having increased risk of asthma and annual rainfall seems to have an influence on symptom presentation (35).

2.2.2 Behavioural factors and asthma

Smoking

Epidemiological evidence for the association between active cigarette smoking and asthma has been inconsistent. Smoking at baseline was shown to significantly increase the risk of incident asthma in adults (50). In another study, significant associations were found between asthma and smoking (51), whereas no significant association was reported in a follow-up cross-sectional analysis (48).

Physical activity

Based on a cross-sectional analysis exercise/sport was not found to be statistically significant risk factors for asthma (48).

Obesity

Obesity, a major component of metabolic syndrome, is a risk factor for incident asthma in adults. Asthma and obesity are frequently associated, and obesity may contribute to the development and severity of asthma (52). Another study also support that obesity has been associated with asthma (15). However, an epidemiological study has shown that obesity has no association with an increase in the prevalence and incidence of asthma (47).

2.2.3 Household fuel exposure and asthma

According to the WHO guidelines for indoor air quality there are nine basic pollutants that can cause serious health problem; those include benzene, carbon monoxide, formaldehyde, naphthalene, nitrogen dioxide, poly cyclic aromatic hydrocarbons, radon, trichloroethylene, and tetrachloroethylene (53).

Generally, those pollutants have serious health effects, like acute myeloid leukaemia, ischemic heart disease, sensory irritation, respiratory inflammation and malignancy, respiratory infection, lung cancer and carcinogenicity effect on liver, kidney, bile duct and non-Hodgkin's lymphoma (53). There are different parameters to measure indoor air quality, comprising of animal allergens (dust mite, dog, cat), bacteria (gram negative) count endotoxin, mould identification

and counts ergo-sterol, volatile organic compound (VOCs), carbon dioxide, man-made mineral fibers (MMMMF) (54).

Indoor cooking using biomass fuel and asthma

There are uncertainties in different literatures on the relationship between the effects of indoor cooking from the use biomass fuel and respiratory illness. Studies have yielded inconsistent results, with some studies showing an association between indoor cooking, using biomass fuel and asthma (27, 46, 55, 56). Including the study undertaken in India on 3456 children to identifying the effects of the indoor air pollutants SO₂, NO₂ and total suspended particulate matter (SPM) generated from fuel used for cooking on respiratory allergy suggests that biomass fuels increased the concentrations of indoor air pollutants that cause asthma, rhinitis and URTI in children (27).

Another study on 38,595 elderly persons included in India's second National Family Health Survey conducted in 1998–1999; indicate that elderly men and women living in households using biomass fuels have a significantly higher prevalence of asthma than do those living in households using cleaner fuels (55).

Other studies in Nigeria and Turkey have similar findings. i.e. A cross-sectional survey, in three rural communities in Nigeria concludes that the use of biomass fuel for cooking is associated with an increased risk of severe asthma symptoms (46). Another epidemiological cross-sectional study in Turkey reported a significant association between symptoms of chronic bronchitis-asthma and biomass fuel usage (56).

In contrast to the above studies, other studies have shown lack of association between indoor cooking using biomass fuel and asthma (15, 28, 42). A cross-sectional study in North Central Nigeria reported that biomass fuel smoke exposure was not associated with an increased risk of asthma symptoms or airway obstruction (42).

Based on a population-based study on 2953 participants in Peru state that indoor cooking using biomass fuel exposures were not associated with adult asthma (28). Current daily exposure to biomass fuel smoke and smoking were not associated with asthma (15).

Despite the large population at risk worldwide, the effect of exposure to indoor solid fuel smoke has not been adequately studied. Indoor air pollution from solid fuel use is strongly associated with COPD (both emphysema and chronic bronchitis), acute respiratory tract infections, and lung cancer (primarily coal use) and weakly associated with asthma, tuberculosis, and interstitial lung disease (28).

Indoor cooking using fossil fuel and asthma

Studies have different association between indoor cooking using fossil fuel and asthma. A study conducted on 600 households from six urban neighbourhoods in Bangalore, India, found associations between kerosene use and wheezing, difficulty in breathing and asthma in adults and cough and wheezing in children, though those associations were not statistically significant (57).

A cross-sectional systematic survey of households in Jimma, Ethiopia suggest that domestic combustion of refined fossil fuels increases the risk of allergic sensitization and symptoms, and may have contributed to the increasing prevalence of allergic diseases (58).

A birth cohort study, including 3000 children on development of allergy and asthma did not show a relationship between gas cooking and any of the respiratory or allergy outcomes (59) .

2.2.4 Housing characteristics and asthma

Housing characteristics can be defined in many ways, but the major focus areas are three, the first is internal environment, such as adequate ventilation, adequate lighting, floor surface free from tripping hazards, indoor air quality and moisture level (dampness). The second is internal structure, such as water supply, sewage disposal, power supply, and other internal components, as for instance (e.g. doors close, electrical wiring etc). The third is external structure, such as structural integrity (e.g. building code followed), weather tightness (e.g. Roof/window do not leak), securing (e.g. Doors lock),external materials have integrity (not broken/rotten),insulation. In general, in order to say that housing characteristics have high quality, the house must be able

to protect from cold, damp, heat, rain, wind, structural hazards, disease vectors and other threats to health (60).

Poor housing characteristics, such as crowding, need for major repairs, and compromised indoor air quality have been associated with respiratory conditions (61). Housing disarray are associated with increased early childhood asthma. Exposure to multiple stressors (i.e. poor housing quality) may increase children's risk of developing asthma more than a single stressor. Also poor housing quality for example, presence of cockroaches, rats and water leaks are associated with asthma (62). Poor housing characteristics (i.e. high moisture and low occupancy rate) has its own effect on indoor microbial ecology including fungi this has significant association with development of asthma (63, 64).

2.2.5 Other factors and asthma

Pet ownership and asthma

Based on the research done in the United kingdom, the prevalence of pet ownership is high among asthmatics, even those in regular contact with respiratory clinics, and is higher still in asthmatics managed in primary care (65). The study further suggests that pet ownership is associated with significant morbidity in asthmatic patients, the burden falling primarily on younger, atopic individuals (65). Another research suggests that Pet ownership during pregnancy and childhood is consistently associated with a reduced risk of aeroallergen sensitization and atopic asthma , but tended to be associated with an increased risk of non-atopic asthma (25). The opposing effects on atopy vs. non-atopic asthma might be considered by parents when they are deciding whether to acquire a pet(25). Another cohort study which is done in UK state that there is no association between cat exposure and wheezing and lung function among children(25).

Well-known allergens in Africa are house dust mite, cockroach, and cat and dog dander; a less well known allergen is washing soap (35). Study done in Hispanic school children living in a U.S.-Mexico border city found that ant and spider pest problems, pet dogs, fire place heat, central air conditioning, humidifier use, and cooking with wood stoves are positively associated with both allergy and asthma prevalence (21).

Family history of asthma

Family history of asthma has been reported as a risk factor for adult-onset asthma (9, 15, 66).

A study in Thailand, revealed that family history of asthma and history of atopy were significantly associated with an increased risk of developing asthma (OR= 13.62; 95% CI 5.91, 31.43 and OR= 8.54; 95% CI 5.47, 13.33 respectively) (66). A study in Debre Berhan Referral Hospital, Ethiopia concluded that family history of asthma is significantly associated with bronchial asthma (9). Another study also supports that family history of asthma was associated with asthma prevalence (15).

Most of the studies have shown that the association between indoor cooking, housing characteristics, and asthma are population based secondary data, cross sectional household studies; with limited information on controlling of confounding. No study has been conducted to assess the association of selected factors (household fuel exposure and housing characteristics) and asthma in Ethiopia using hospital based case control study design matched with age.

2.3 Conceptual frame work

The conceptual framework is originally developed for the purpose of explaining factors that are associated with the development of asthma based on hierarchal approach (distal, intermediate and proximal factors) taken from different literatures. All arrows from the five factors are pointing towards the outcome to indicate the relation with asthma.

Generally, we can categorize risk factors and triggers involved in asthma in to three (4) . Those are endogenous factors (Genetic predisposition, Atopy, Airway hyper responsiveness, Gender, Ethnicity?, Obesity?, Early viral infections?), environmental factors (Indoor allergens, Outdoor allergens, Occupational sensitizers, Passive smoking, Respiratory infections) and triggers (Allergens, Upper respiratory tract viral infections, Exercise and hyperventilation, Cold air, Sulfur dioxide and irritant gases, Drugs (-blockers, aspirin), Stress, Irritants (household sprays, paint fumes)) (4).

Asthma symptoms can be initiated by triggers, such as initiated by triggers, such as upper or lower respiratory tract viral infection, tobacco smoking, allergens, particulate pollution, ozone, change in temperature(usually cold), exercise (6) . Similarly, patients exposed for allergies like pollen, mold, house dust mite, and animal proteins are responsible for asthma triggers (67). This study mainly focused on the association of selected proximal factors (household biomass and fossil fuel exposure, and housing characteristics) with asthma. Broken arrows are used to indicate relationships that exist between variables.

Conceptual frame work

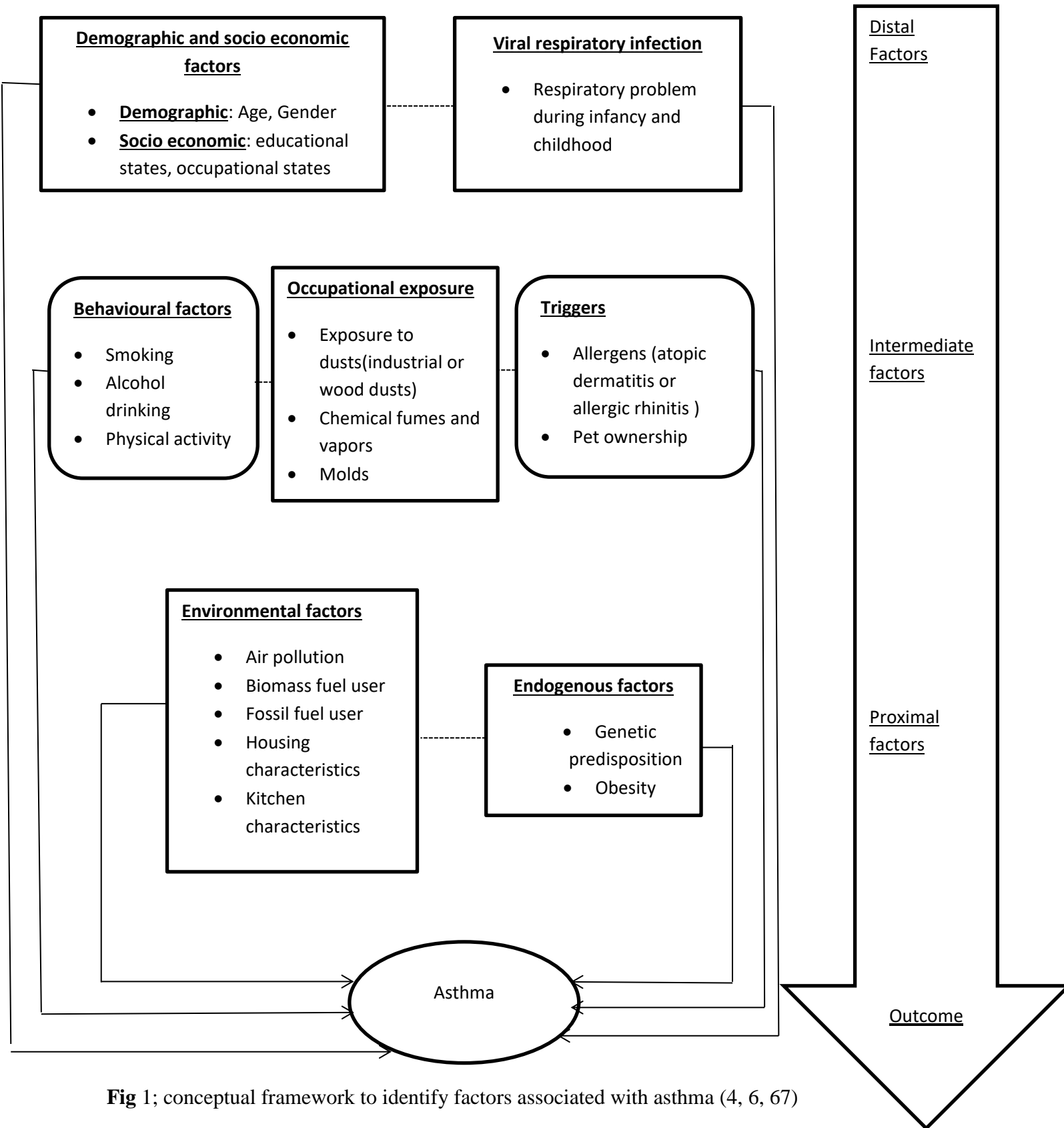


Fig 1; conceptual framework to identify factors associated with asthma (4, 6, 67)

3. Research question and objectives

3.1 Research question

- ✓ Is there any association between selected factors (household biomass fuel exposure, household fossil fuel exposure and housing characteristics) and asthma?

3.2 Research Hypothesis

3.2.1 Null hypothesis

- ✓ Household fuel exposure and housing characteristics have no association with asthma.

3.2.2 Alternative hypothesis

- ✓ Household fuel exposure and housing characteristics have association with asthma.

3.3 Objective

3.3.1 General objective

- ✓ To investigate the association between household fuel exposure and housing characteristics, with asthma.

3.3.2 Specific objectives

- ✓ To assess the association between household biomass fuel exposure and asthma.
- ✓ To determine the association between household fossil fuel exposure and asthma.
- ✓ To evaluate the role of housing characteristics on asthma.

4. Methods and materials

4.1 Study area

The study area was Addis Ababa, the Capital City of Ethiopia. Addis Ababa lies at an elevation of 2,200 meters (7,200 ft.) and is located at 9°1'48"N 38°44'24"E / 9.03000°N 38.74000°E.(68). In Addis Ababa there were 96 health centers, 12 public hospitals, 28 private hospitals and 882 clinics (69). Among the available 12 government run hospitals, the study was conducted in two public hospitals, including Tikur Anbessa Specialized Hospital and St. Paul Hospital Millennium Medical College (SPHMMC). The hospitals were selected for this study on the basis of spirometry using status, case load (from all over the country) and various specialized units (chest clinic and internal medicine OPD). TASH is the largest Teaching Hospital of the country which is found in Lideta sub-city, Addis Ababa. Originally, TASH was built to accommodate 500 beds and currently has more than 600 beds. It serves about 250,000 patients per year in its outpatient department and about 24,000 in the inpatient (70). Chest clinic is one of the 16 clinics in the hospital. On average, 500 patients with respiratory diseases are seen each month in the clinic; asthma patients account for one-third of all cases. On the other hand, Saint Paul Hospital Millennium Medical College is one of the specialized referral public hospitals in Addis Ababa with, bed capacity of about 350. The Hospital has outpatient and inpatient wards that provide different services. The hospital receives referrals from all over the country (71).

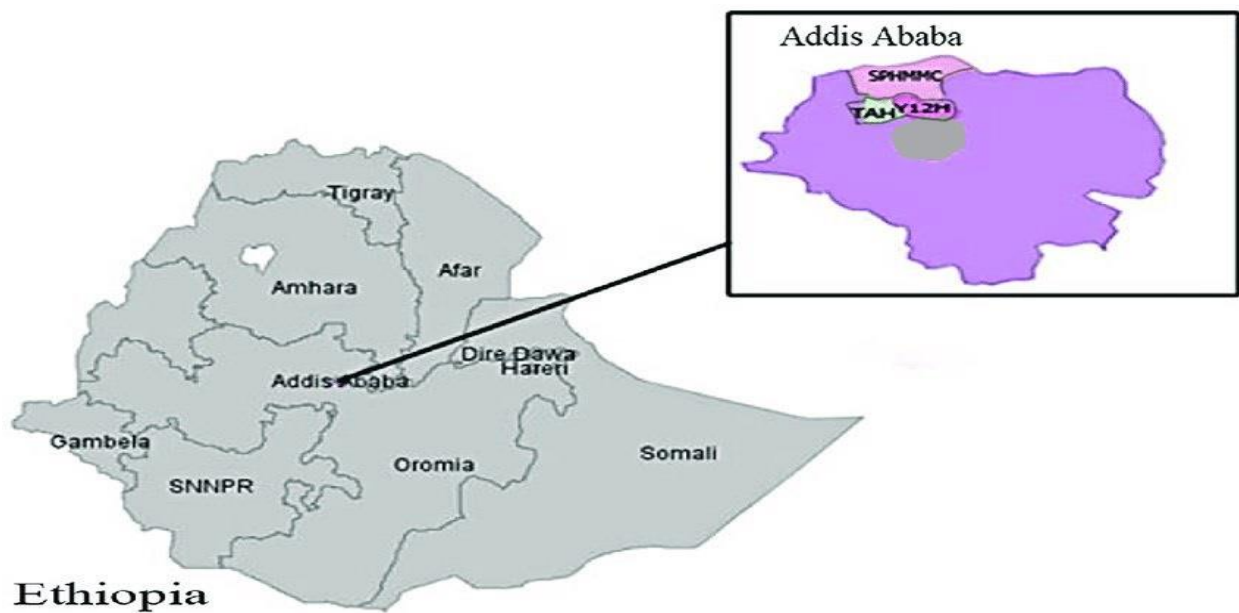


Figure 2; Map of study area

4.2 population

4.2.1 Target population

- ✓ The target population for the study were all patients who visited public hospitals in Addis Ababa between February and August 2020.

4.2.2 Source population

- ✓ The source population were all patients who visited study hospitals between February and August 2020.

4.2.3 Study population

- ✓ The study population were all patients attending study hospitals (chest clinic and internal medicine OPD) in the study period and those who fulfilled the eligibility criteria.

4.2.4 Study unit

- ✓ Single participant selected based on inclusion criteria and sampling techniques during the study period.

4.2.5 Inclusion criteria

Cases

- ✓ Spirometry confirmed asthmatic patients who were diagnosed and enrolled in the study hospitals chest clinic of internal medicine OPD.
- ✓ Age 18 years or older.

Controls

- ✓ Attendees of study hospitals non chest clinic of internal medicine OPD for non-asthma health problems.
- ✓ Matched with sex and age, we have chosen two controls in the same five year age group. (i.e. control age =case age \pm 2 years)

4.2.6 Exclusion criteria

- ✓ Cases and controls suffering from COPD, lung cancer, PTB and pneumonia were excluded.
- ✓ Controls with clinical sign or symptom suggestive of asthma were excluded.

4.3 Study Design and study period

A hospital based matched case control study design was employed in individuals with asthma and without asthma at Tikur Anbessa Specialized Hospital and St. Paul hospital from February to August 2020.

4.4 Sample size calculation

Sample size was calculated using Epi info 7 statistical software package with the assumption of double population, $n=(r+1)/r \cdot \frac{(p)(1-p)(z_{\beta}+z_{\alpha/2})^2}{(p_1-p_2)^2}$ formula. The assumptions are two-sided significance level ($\alpha=5\%$), power ($1-\beta$) =80% to detect how much exposure difference between cases and controls , 95% confidence level, ratio of control to case (R) 2:1. The largest sample size was taken. The prevalence of exposure (selected determinants, such as indoor cooking using biomass fuel, indoor cooking using fossil fuel and household crowding index) among controls are estimated from previous studies that are 10%, 19.5% and 34% respectively (72-74). Then, the sample size required for main variable with control to case ratio of 2:1 by considering the three main variable percent of control exposed was 296 (99 cases and 197 controls), 464 (155 cases and 309 controls) and 35 (12 cases and 23 controls) respectively without considering non response rate. The minimum sample size required for the study was independently established.

For the first objective (indoor cooking using biomass fuel) sample size was determined by using the following values.

Table 1 –sample size determination for objective 1 (household cooking using biomass fuel) (72)

Power	Level of significance	Proportion of exposure among control	Proportion of exposure among case	Non-response rate	Minimum sample size
80%	5%	10%	22%	5%	312 (104 cases and 208 controls)

For the second objective (indoor cooking using fossil fuel) sample size was determined by using the following values

Table 2- sample size determination for objective 2 (household cooking using fossil fuel) (73)

Power	Level of significance	Proportion of exposure among control	Proportion of exposure among case	Non-response rate	Minimum sample size
80%	5%	19.5%	31.2%	5%	487 (162 cases and 325 controls)

For the third objective (household crowding index) sample size was determined by using the following value

Table 3-sample size determination for objective 3 (household crowding index) (74)

Power	Level of significance	Proportion of exposure among control	Proportion of exposure among case	Non-response rate	Minimum sample size
80%	5%	34%	85%	5%	37 (12 cases and 25 controls)

Then, the maximum sample size was taken. Accordingly, the sample size corresponding to indoor cooking using fossil fuel objective 2 was taken (73). Finally, the calculated sample size was 464. After adjusting for 5% non-response rate, the minimum required sample size was 487 which was 162 cases and 325 controls.

4.5 Sampling procedure

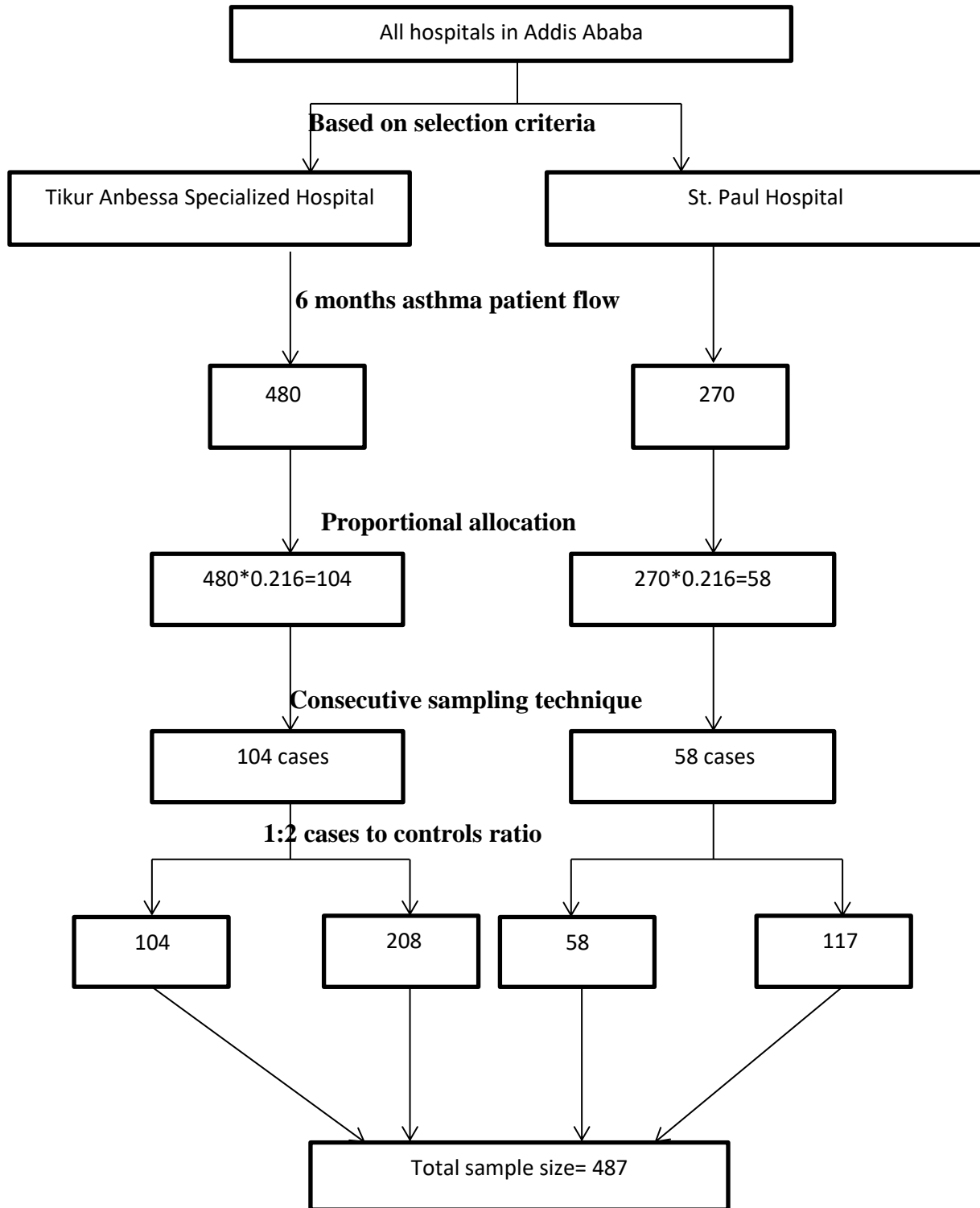
Selection criteria used to select study hospitals were first, spirometry using status for the diagnosis of asthma, second, case load (referee from Addis and other rural regions of the country) and third, various specialized units (chest unit and internal medicine OPD). Among the available 12 government run hospitals, the study was conducted on two public hospitals, including Tikur Anbessa Specialized Hospital and St. Paul Hospital millennium medical college based on the selection criteria.

From each hospital, participants were selected by consecutive/sequential sampling technique based on the proportion of selected hospitals total patient flow as denominator. The total number of asthma patients at study hospitals based on last year data on similar time with the data collection period three months report was totally 750 asthma patient; 480 from Tikur Anbessa Specialized Hospital and 270 from St. Paul Hospital.

Proportional allocation was used to select the sample size (sampling fraction=sample size/total patient flow= $162/750=0.216$). Based on the proportional allocation total number of patients were 162, including 104 ($0.216*480$) from Tikur Anbessa Specialized Hospital and 58($0.216*270$) from St. Paul Hospital.

During selection of participants based on sampling technique if the person was not eligible to be included or not willing to participate, then data collectors proceeded to the next person. The detail description of the sampling techniques is presented below.

Figure 3 - Schematic presentation of sampling procedure



4.6 Study variables

4.6.1 Dependent variable

- ✓ Asthma status (cases and controls)

4.6.2 Independent variables

4.6.2.1 Socio-demographic characteristics

- ✓ Age, Residence, Sex, Marital status, Educational status, Occupational status, Monthly income , Religion

4.6.2.2 Main exposure variables

- ✓ **Housing characteristics:** number of rooms, number of persons, household crowding index, lighting source , cooking area, cooking room floor material, cooking room wall material, cooking room roof material, window in cooking room, window opening, door opening, smoke extraction, cooking time
- ✓ **Household fuel exposure characteristics:** stove type (three stone fire, shielded mud stove, wood burning metal stove, improved charcoal stove, kerosene stove, LPG(gas) stove, solar cooker, grid powered electric stove), current household fuel type (wood, charcoal, kerosene, dung, agricultural residues, solar, grid electricity, batteries) and life time household fuel type(wood, charcoal, kerosene, dung, agricultural residues, solar, grid electricity, batteries) ,

4.6.2.3 Confounding variables

- ✓ **Pet ownership** (pet)
- ✓ **Life style characteristics** (Tobacco Smoking status, shisha smoking status, alcohol drinking, chat chewing status, drug using status, family history of asthma, physical activity)
- ✓ **Nutritional status** (body mass index, weight, height)
- ✓ **Co morbidities** (cardiac, hypertension, diabetes, nerve, kidney disease, liver disease, HIV)

4.7 Data collection procedure

Data collectors were waiting until the study unit's physicians complete their consultation. After they finish, the interviewers explained the objective of the study and got written informed consent to conduct the interview. Data were collected through questionnaire based on face to face interview by eight nurses in selected units, who received data collection training with appropriate measure to avoid risk of COVID-19 transmission such as sanitizing their hands, wearing mask properly and keeping their physical distance. The data collection tool used in this study was adopted from the previously peer reviewed studies, European Community Respiratory Health Survey II (**ECRHS II**) questionnaires and American Thoracic Society division of lung disease (**ATS-DLD-78**) questionnaires, and appropriate modifications were made to serve our purpose (75, 76). The final format had two major parts. The first part was demographic and socioeconomic characteristics items (age, gender, marital states, educational states, occupational states and family income), while the second part included items related to potentials risk factor predictors, including indoor cooking, housing characteristics, cooking room characteristics, smoking status, alcohol drinking, family history of asthma, pet ownership, physical activity and obesity. This hospital based, case control study including face to face interviews was performed by trained data collectors. A screening questionnaire was used to exclude any one with asthmatic symptoms from the control groups. The survey questionnaire was used for both case and control subjects. Data regarding patient's medical information were extracted from patient cards.

4.8 Data Quality management

Data collectors were experienced nurses that work in study hospitals. Data quality assurance was done at three steps, before, during and after data collection period. First, before data collection period, two days training was given for data collectors based on the content of questionnaire, data collection methods, ethical concerns and the purpose of the study. The training was given by the principal investigator. The questionnaire prepared in English was translated to Amharic and back to English to keep the consistency of the questions. Pre testing of the questionnaire was made to ensure the quality of data in Yekatit 12 Hospital on 25 patients, 5% of study population. Second during data collection, completeness and consistency of the questionnaire were assessed daily by field supervisors and the principal investigator. Supervisors and the principal investigator revisited the questionnaire to check the accuracy of information collected by data collectors. Third after data collection period, data were entered in to a template prepared on Epi-

Info software and inconsistencies of the entered data were reconciled by checking the questionnaire. Data cleaning was done by running frequencies and cross-tabulating with the main outcome variables. Before analysis, missing values and outliers were checked, The data were exported to SPSS version 24 for analysis.

4.9 Data analysis procedure

First, descriptive statistics were computed using frequency distribution and proportions for categorical variables and, mean and standard deviations (SD) for continuous variables (Age, monthly income, no of rooms, no of person, household crowding index, time spent for cooking weight , height and body mass index) was described. Generally, results were presented, using frequencies, cross tabulations and percentages. Chi-square test was used to assess the level of significant differences. A threshold p value of less ≤ 0.05 was used to declare significant association between asthma and its predictors in the chi-square test. Since we have used matched case control study design conditional logistic regression were performed. Hence, variables which were found to be associated with asthma were included in the conditional binary logistic regression. Furthermore, different variables were included in the conditional multivariable logistic regression to single out the effect of each covariate with asthma and adjusted odds ratios, with 95% confidence interval was consider to see the association. Co-founders, interaction and multi-collinearity were checked to minimize bias. Multi-collinearity between independent variables was checked to ensure that inserting as many variables did not introduce statistically significant multicollinearity, which was confirmed by the assumption of $VIF < 10$ as no multicollinearity. and the model goodness of the test was checked by Hosmer - Lemeshow goodness of fit test. The model is fit at $\chi^2 = 3.711$ and p-value of 0.882. A 95% confidence interval for crude and adjusted ORs and a threshold p-value of ≤ 0.05 were used to decide significance of association.

4.10 Operational definitions

- ✓ **Asthma** – based on spirometry result we should have (reversibility of airway obstruction) i.e. (greater than 12% and 200 ml increase in FEV1) following inhalation of bronchodilator.

- ✓ **Biomass fuel user-** In the questionnaire, an individual was considered as biomass fuel user, if he/she used fuel, including wood, charcoal, plant residues or agricultural waste and animal dung, mainly from domesticated animals for cooking or heating purposes. Pertaining to user classification, former biomass user means previously used biomass fuel, but stop now or not used biomass fuel with in the last 12 months, current biomass user means that uses biomass fuel with in the last 12 months and if users either current, former or both called life time user for **Q.402** and **Q.403** (77, 78).

- ✓ **Fossil fuel user** - In the questionnaire, an individual considered as fossil fuel if he/she, uses fuel such as oil, coal, natural gas, kerosene and liquid petroleum gas for cooking. Regarding user classification, former fossil fuel user means previously used fossil fuel but stop now or not used fossil fuel with in the last 12 months, current fossil fuel user means that used fossil fuel with in the last 12 months and if users either current, former or both called life time user for **Q.402** and **Q.403** (77, 79) .

- ✓ **Indoor Cooking:-** any type of Home cooking, either in kitchen or part of main living area, using both heating devices (eg, fireplaces, woodstoves, kerosene heaters, flued [i.e. vented] or non-flued gas heaters) and gas stoves for cooking for **Q.206** (18).

- ✓ **Household crowding index:** - denoted by the number of co-residents per room. i.e number of co residents (excluding newborn) divided by number of rooms (excluding kitchen and bathroom) based on this it can be categorized in to three, low when it is less than one, medium when it is between one and two, and high when it is greater than three for **Q.203** (80).

- ✓ **Window characteristics-** Cooking room shall have at least one window, the minimum total window size shall be at least eight percent of the floor area of the room. If this requirement is fulfilled our answer would be yes for **Q.304** about having window and if it is not fulfilled the answer would be no (81).
- ✓ **Door characteristics;** the environment has an opening in the windward façade and a door in the leeward façade and the minimum requirement door characteristics are width of 0.80 meter and height of 2,10 meter. If this requirement is fulfilled our answer would be yes for **Q.306** about having window and if it is not fulfilled the answer would be no (82) .
- ✓ **Pet ownership:-**having any pet that includes, cat, dog, and bird and assess contact with them and contacts can be categorized in to regular contact (at least once a day and five times per week) and some contact (less than once a day and five times per week) for **Q.501**.
- ✓ **Physical activity:** this question is measured by considering as any bodily movement produced by skeletal muscles that results in energy expenditure, it can be categorized in to occupational, sports, conditioning, household, or other activities (83). In order to say a person has normal physical activity, he/she must engage in moderate physical activity for at least 30 minutes per day for 5 or more days per week or vigorous physical activity for at least 20 minutes per day for 3 or more days per week for **Q.615** (84).
- ✓ **Alcohol drinking:** Behaviors can be measured in different ways, but for this questionnaire it was defined as follows; A person who had ever drunk any alcoholic beverage during his/her life was called an ever drinker. An ever drinker who had not drink alcohol with in the last 12 months was designated as an ex-drinker. An ever drinker who had drunk alcohol with in the last 12 months was labeled as a current drinker for **Q.607** (85).

- ✓ **Smoking states:** In this study an individual smoking status was defined as follows: A person who had smoked at least 20 packs of cigarettes or 12 oz (360 grams) of tobacco in a lifetime, or at least one cigarette per day or one cigar a week for one year was labelled an ever smoker (76). An ever smoker who had not smoked with in the last 12 months or with in the last 6 months was called an ex- smoker. An ever smoker who had smoked with in the past 30 days was called a current smoker for **Q.601** (86).
- ✓ **Body mass index (BMI)** in this study, subjects are characterized by body mass index (BMI), divided in to four subgroups, Underweight (BMI less than 19.8 kg/m²), Normal (19.8 -25 kg/m²), overweight (BMI 25.1-30 kg/m²) and obese (BMI greater than 30kg/m²) for **Q.703** (87).
- ✓ **Cooking time:** cooking time in this study was measured by asking the following question “how many minutes on average do you spend preparing, cooking and cleaning up each time per day?” And the answer were recorded in to three categories, less than 60 minutes, between 60and 120 minutes, and greater than 120 minutes for **Q.207** (88).

4.11 Ethical consideration

Before conducting the study ethical clearance was secured from the Research Ethical Committee of the School of Public Health, College of Health Sciences of the Addis Ababa University. Then, formal letters were written to study hospitals, including Yekatit 12 hospital, Tikur Anbessa Specialized Hospital and St. Paul Hospital from Addis Ababa University, School of Public Health to inform them about the study. The data collectors got written consent from the participants and informed them clearly the aim of the study and the fact that it has no invasive procedure and harm. Respondents were informed that they could refuse or discontinue participation at any time and they were informed of the fact that Information is recorded without their names being mentioned. Only codes were used to keep it anonymous and maintain confidentiality and privacy of respondents.

4.12 Dissemination of findings

The result of this study was disseminated to the School of Public Health, College of Health Sciences, Addis Ababa University. Furthermore, it is also planned to share the information with Ethiopia Food Medicine Health Care Administration and Control Authority, of the Federal Ministry of Health through hard and soft copies. The finding of the research shall be communicated through workshops. The findings shall be published in peer-reviewed journal.

5. Results

5.1 Descriptive analysis

Socio-demographic characteristics of study participant

From those patients who came for different services at TASH and SPHMMC, 487 participants that were approached, four people were excluded (1 case and 3 controls) due to failure to get age and sex matched controls. A total of 483 patients were enrolled in the study, which makes the response rate 99.17%. Age and sex were the matching variables in the study. For each case we had plus or minus two years old controls.

Socio demographic characteristics of cases and controls are depicted in Table 4. The proportion of ages less than 20, 20-40, 41-60, 61-80 and greater than 80 years were found to be 4%, 28.6%, 49.5%, 19.7% and 1.9% respectively. From total participants, 98(60.9%) cases and 202(62.7%) controls were females.

With regard to place of residents, more cases 7(4.3%) than controls (7(2.2%) were from rural area. Most of participants were female 98(60.9%) of cases and 196(60.9%) of controls. Majority 97(60.2%) cases and 225(69.9%) controls were married. And, 25(15.5%) cases and 45(14%) controls were single, 30(18.6%) cases and 46(14.3%) controls were widowed and 9(5.6%) cases and 6(1.9%) controls were Separated /divorced.

Among study participants with respect to education, 51(31.7%) of cases and 95 (29.5%) controls attained primary education. Further 18(11.2%) of cases and 37 (11.5%) of controls, 4(2.5%) cases and 10 (3.1%) of controls and 48(29.8%) of cases and 94 (29.2%) of controls completed secondary, preparatory and above diploma educational status respectively. However, 40(24.8%) of cases and 86 (26.7%) of controls were unable to read and write.

With respect to occupational status, majority of participants were employed either in government, private or self 87(54%) of cases and 193(59.9%) of controls. And also 55(34.2%) of cases and 106(32.9%) of controls, 18(311.2%) of cases and 21(6.5%) of controls, and 1(0.6%) of cases and 2(0.6%) of controls were unemployed, retired and student respectively.

With regard to monthly income, majority of participant 68(42.2%) of cases and 127(39.4%) of controls earned above 2500 EB. And 41(25.5%) of cases and 84(26.1%) of controls, 35(21.7%)

of cases and 54(16.8%) of controls and 17(10.6%) of cases and 57(17.7%) of controls got below 500 ETB, between 500 and 1500 ETB, between 1501 and 2500 ETB respectively.

Majority 104(64.6%) of cases and 218(67.7%) controls were orthodox and the rest 19(11.8%) cases and 42(13%) controls, 35(21.7%) cases and 46(14.3%) controls, and 3(1.9%) cases and 16(5%) controls were Muslim, Protestants and Catholics respectively.

Table 4: Socio-demographic characteristics of participants in selected public hospitals of Addis Ababa, Ethiopia, 2020

Variables	Cases	Control	Chi-square (x 2)	P value
	Number (%)	Number (%)		
Age:				
≤20	0(0)	2(0.6)	1.299	0.862
21-40	45(28)	93(28.9)		
41-60	79(49.1)	160(49.7)		
61-79	34(21.1)	61(18.9)		
≥80	3(1.9)	6(1.9)		
Residence :				
Rural	7(4.3)	7(2.2)	1.802	0.179
Urban	154(95.7)	315(97.8)		
Sex :				
Male	63(39.1)	126(39.1)	0.000	1
Female	98(60.9)	196(60.9)		
Marital status:				
Single	25(15.5)	45(14)	7.760	0.051
Married	97(60.2)	225(69.9)		
Widowed	30(18.6)	46(14.3)		
Separated/divorced	9(5.6)	6(1.9)		
Educational status :				
Unable to read and write	40 (24.8)	86 (26.7)	0.477	0.976
Primary (1-8)	51 (31.7)	95 (29.5)		
Secondary(9-10)	18 (11.2)	37 (11.5)		
Preparatory (11-12)	4 (2.5)	10 (3.1)		
Diploma and above	48 (29.8)	94 (29.2)		
Occupational status:				
Unemployed	55(34.2)	106(32.9)	3.579	0.311
Employed	87(54)	193(59.9)		
Retired	18(11.2)	21(6.5)		
Student	1(0.6)	2(0.6)		
Monthly income :				
Less than 500	41(25.5)	84(26.1)	5.236	0.155
500-1500	35(21.7)	54(16.8)		
1501-2500	17(10.6)	57(17.7)		
Greater than 2500	68(42.2)	127(39.4)		
Religion :				
Orthodox	104(64.6)	218(67.7)	6.474	0.091
Muslim	19(11.8)	42(13)		
Protestant	35(21.7)	46(14.3)		
Catholic	3(1.9)	16(5)		

Employed (govt,private,self), ETB(Ethiopian Birr)

Table 5 shows detailed mean and standard deviation of vital variables of participants, The mean (SD) age of participants was 49.8(14.1) and 49.4(13.8) for cases and controls, respectively. The average monthly income mean (SD) for cases and controls were 2790.0(2923.8) and 2609.7(2459.2) ETB, respectively. On the other hand mean (SD) number of room was 2.4 (1.4) and 1.9(0.9) for cases and controls, respectively. And also mean (SD) number of person was 4.4 (2.2) and 3.7(1.8) for cases and controls, respectively. Household crowding index mean and SD was 2.1(1.1) of cases and 2.1(0.8) of controls. Cooking time, weight, height and body mass index were represented by 97.1(55.8) of cases and 94.7(35.7) of controls, 66.2(9.3) of cases and 67.2(6.2) of controls, 164.9(8.6) of cases and 166.2(5.5) of controls and 24.4(2.9) of cases and 24.4(2.1) of controls respectively.

Table 5: Characteristics mean \pm SD of participants in selected public hospitals of Addis Ababa, Ethiopia, 2020

	Variables	Cases		Controls	
		Mean	SD	Mean	SD
1	Age	49.8	14.1	49.4	13.8
2	Monthly income	2790.0	2923.8	2609.7	2459.2
3	No of rooms	2.4	1.4	1.9	0.9
4	No of person	4.4	2.2	3.7	1.8
5	Household crowding index	2.1	1.1	2.1	0.8
6	Cooking time in mint	97.1	55.8	94.7	35.7
7	Weight in kg	66.2	9.3	67.2	6.2
8	Height in cm	164.9	8.6	166.2	5.5
9	Body mass index	24.4	2.9	24.4	2.1

Housing characteristics

Housing characteristics of cases and controls are shown detailed of the total study population in Table 6, majority of person have 2 rooms 59(36.6%) of cases and 104(32.3%) of controls respectively. And also persons living in the house were four or greater than four which were represented by 102(63.4%) cases and 164(50.9%) controls, the rest 13(8.1%) cases and 44(13.7%) controls, 15(9.3%) cases and 30(9.3%) controls and finally 31(19.3%) cases and 84(26.1%) controls were represented by 1, 2 and 3 persons in the household respectively. Among those participant household crowding index value lies between 1 and 2 were 70(43.5%) of cases and 151(46.9%) of controls. Majority of participant use electricity for lighting source 157(97.5%) of cases and 317(98.4%) of controls. A high proportion of cases and controls had enclosed area (kitchen) for cooking purpose reported among 117(72.7%) of cases and 241 (74.8%) of controls. On the other hand 38(23.6%) cases and 70 (21.7%) controls, 6(3.7%) cases and 11 (3.4%) controls, used part of main living area and semi- open area for cooking respectively. When we try to see smoke extraction, majority of participant use door opening practice 76(47.2%) of cases and 162(50.3%) of controls. Further 3(1.9%) of cases and 0(0%) of controls, 1(0.6%) of cases and 2(0.6%) of controls, 5(3.1%) of cases and 3(0.9%) of controls, 4(2.5%) of cases and 12(3.7%) of controls, 0(0%) of cases and 0(0%) of controls, 70(43.5%) of cases and 138(42.9%) of controls, 2(1.2%) of cases and 5(1.6%) of controls were represent permanent hole n roof, eaves spaces, chimney, windows opening, fan or air condition , door and window opening and open area. On the other hand majority of participants 74(46%) cases and 304(94.4) controls spent 60-120 minutes for cooking a day. And the rest, 71(44.1%) of cases and 2(0.6%) of controls and 16(9.9%) of cases and 16(5%) of controls spent below 60 min and above 120 min respectively.

Table 6: Housing characteristics of participants in selected public hospitals of Addis Ababa, Ethiopia, 2020

Variables	Cases	Control	Chi-square (x 2)	P value
	Number (%)	Number (%)		
Number of room:				
1	44 (27.3)	86 (26.7)	1.549	0.671
2	59 (36.6)	104 (32.3)		
3	34 (21.1)	72 (22.4)		
4 or greater than 4	24 (14.9)	60 (18.6)		
Number of person:				
1	13(8.1)	44(13.7)	7.954	0.047
2	15(9.3)	30(9.3)		
3	31(19.3)	84(26.1)		
4 or greater than 4	102(63.4)	164(50.9)		
Household crowding index:				
Less than 1	31(19.3)	54(16.8)	0.676	0.713
1-2	70(43.5)	151(46.9)		
Greater than 2	60(37.3)	117(36.3)		
Lighting source				
Lanterns/gas	4(2.5)	5(1.6)	0.509	0.475
Electricity	157(97.5)	317(98.4)		
Cooking area				
Enclosed area (Kitchen)	117 (72.7)	241 (74.8)	0.265	0.876
Semi-open area	6 (3.7)	11 (3.4)		
Part of main living area	38 (23.6)	70 (21.7)		
Smoke extraction/ ventilation				
Permanent holes in roof	3(1.9)	0(0)	9.854	0.131
Eaves spaces	1(0.6)	2 (0.6)		
Chimney	5(3.1)	3 (0.9)		
Windows openings	4(2.5)	12 (3.7)		
Door opening	76(47.2)	162 (50.3)		
Door and window opening	70(43.5)	138 (42.9)		
Open area	2(1.2)	5 (1.6)		
Cooking time				
Less than 60 min	71(44.1)	2(0.6)	125.828	0.000
60-120 min	74(46)	304(94.4)		
Greater than 120 min	16(9.9)	16(5)		

Cooking room characteristics

Cooking room characteristics of cases and controls are presented in Table 7. Majority of participant cooking room floor material were cement represented by 91(56.5%) of cases and 187(58.1%) of controls. Further cooking room floor material 52(32.3%) of cases and 99(30.7%) of controls, 9(5.6%) of cases and 21(6.5%) of controls and 9(5.6%) of cases and 15(4.7%) of controls were clay/mud, ceramic and wood respectively. With respect to cooking house wall material 63(39.1%) of cases and 94(29.2%) of controls, 38(23.6%) of cases and 82(25.5%) of controls, 59(36.6%) of cases and 146(45.3%) of controls, and 1(0.6%) of cases and 0(0%) of controls were iron sheet, burned bricks, wattle and daub and plastic respectively. On the other hand most of participants cooking room roof material were iron sheet 154(95.7%) of cases and 304(94.4%) of controls. And the rest were tiles 7(4.3%) of cases and 18(5.6%) of controls. Based on participants report, 77(47.8%) of cases and 276(85.7%) of controls has windows in cooking room. Among those who have it 76(47.2%) cases and 273(84.6%) controls practice window opening during cooking time. The detail of cooking room characteristics of the study participants is presented in the following table 7.

Table 7: cooking room characteristics of participants in selected public hospitals of Addis Ababa, Ethiopia, 2020

Variables	Cases	Control	Chi-square (x 2)	P value
	Number (%)	Number (%)		
Cooking house floor material				
Clay/mud	52 (32.3)	99 (30.7)	0.465	0.926
Cement ceramic	91 (56.5)	187 (58.1)		
wood	9 (5.6)	21 (6.5)		
	9 (5.6)	15 (4.7)		
Cooking house wall material				
Iron sheets	63(39.1)	94(29.2)	7.323	0.062
Burned bricks	38(23.6)	82(25.5)		
Wattle and daub	59(36.6)	146(45.3)		
Plastic	1(0.6)	0(0)		
Cooking house roof material				
Tiles	7 (4.3)	18 (5.6)	6.337	0.561
Iron sheets	154 (95.7)	304 (94.4)		
Window in cooking house				
No	84(52.2)	46(14.3)	78.328	0.000
Yes	77(47.8)	276(85.7)		
Window opening				
No	85(52.8)	49(15.2)	75.606	0.000
Yes	76(47.2)	273(84.6)		
Door opening				
No	47(29.2)	23(7.1)	42.110	0.000
Yes	114(70.8)	299(92.9)		

There was significant variation among cases and controls with regards to door opening practice while cooking in 95% confidence bar graph.

Among participants majority 114 (70.8%) of cases and 299 (92.9%) controls use door opening mechanism for ventilation purpose during cooking hours. Cooking room characteristics regarding with door opening practice while cooking of study participants are depicted in Figure 4.

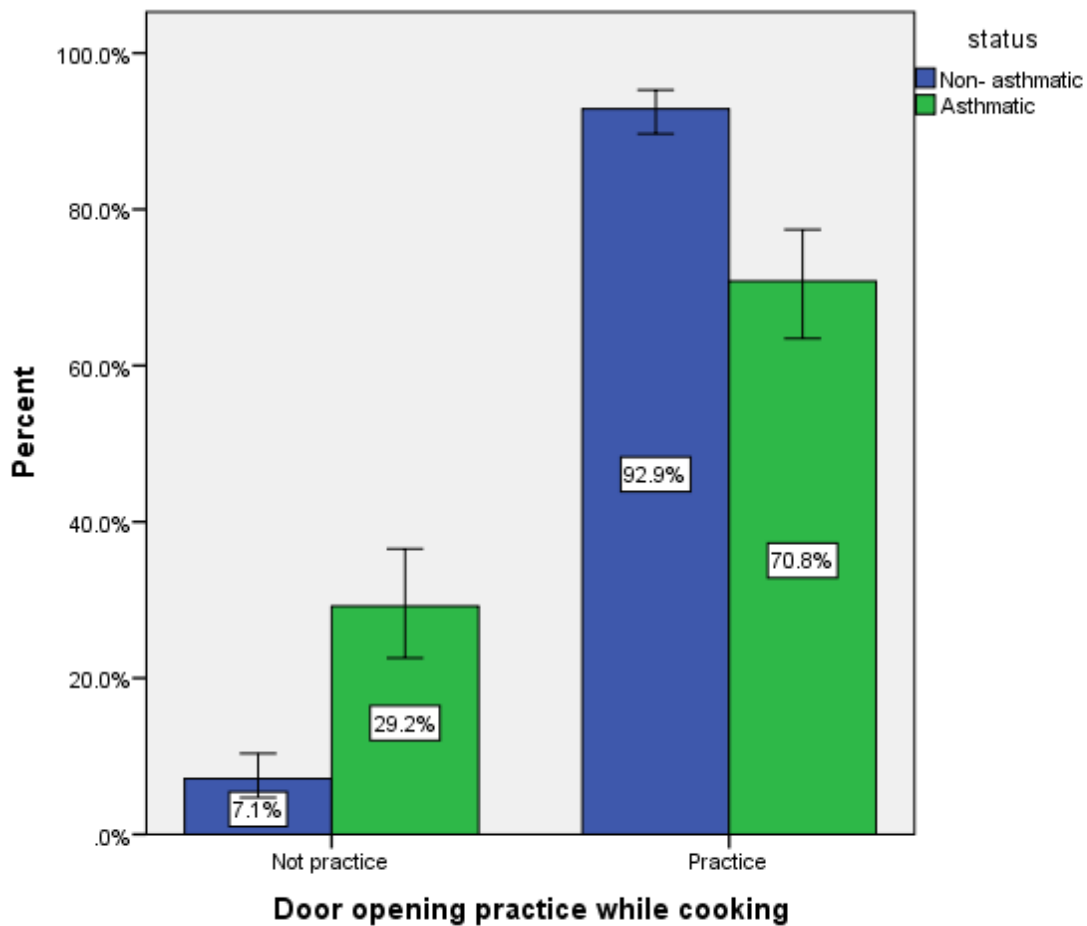


Figure 4: Door opening practice while cooking among participants in selected hospitals of Addis Ababa, Ethiopia, 2020

Household fuel exposure characteristics

The participant household fuel exposure characteristics were described in the following table with different section. In household fuel exposure characteristics we have three categories. Stove type, current household fuel exposure and life time household fuel exposure.

Stove type

Among total participant of cases in the study 19(11.8%) use three-stone fire, 12(7.5%) use shielded mud stove, 7(4.3%) use wood-burning metal stove, 108(67.1%) use improved charcoal stove, 53(32.9%) use kerosene stove, 1(0.6%) use solar cooker and 154(95.7%) use Grid powered electric stove. On the other side among controls 6(1.9%) use three-stone fire, 20(6.2%) use shielded mud stove, 19(5.9%) use wood-burning metal stove, 199(61.8%) use improved charcoal stove, 227(70.5%) use kerosene stove, 1(0.3%) use solar cooker and 310(96.3%) use Grid powered electric stove. The detail of stove type of the study participants is presented in the following Table 8.

Table 8: stove type characteristics of participants in selected public hospitals of Addis Ababa, Ethiopia, 2020

Variables	Cases	Control	Chi-square (x 2)	P value
	Number (%)	Number (%)		
Stove type:				
Three-stone fire				
No	142(88.2)	316(98.1)	21.598	0.000
Yes	19(11.8)	6(1.9)		
Shielded mud stove				
No	149(92.5)	302 (93.8)	0.268	0.605
Yes	12(7.5)	20 (6.2)		
Wood-burning metal stove				
No	154(95.7)	303 (94.1)	1.033	0.309
Yes	7(4.3)	19 (5.9)		
Improved charcoal stove				
No	53(32.9)	123(38.2)	1.292	0.256
Yes	108(67.1)	199(61.8)		
Kerosene stove				
No	108(67.1)	95(29.5)	62.206	0.000
Yes	53(32.9)	227(70.5)		
Solar cooker				
No	160(99.4)	321(99.7)	0.251	0.616
Yes	1(0.6)	1(0.3)		
Grid powered electric stove				
No	7(4.3)	12(3.7)	0.110	0.741
Yes	154(95.7)	310(96.3)		

Current household fuel status

With regard to current household fuel status among cases 42(26.1%) use wood, 106(65.8%) use Charcoal, 106(65.8%) use kerosene (Paraffin), 18(11.2%) use dung, 16(9.9%) use agricultural residues, and 152(94.4%) use grid electricity. When we try to see among controls 10(3.1%) use wood, 210(65.2%) use Charcoal, 220(68.3%) use kerosene (Paraffin), 7(2.2%) use dung, 5(1.6%) use agricultural residues, 1(0.3%) use solar and 309(96%) use grid electricity. The detail presented below in Table 9.

Table 9: Current household fuel characteristics of participants in selected public hospitals of Addis Ababa, Ethiopia, 2020

Variables	Cases	Control	Chi-square (x 2)	P value
	Number (%)	Number (%)		
Current household fuel:				
Wood				
No	119(73.9)	312(96.9)	59.007	0.000
Yes	42(26.1)	10(3.1)		
Charcoal				
No	55(34.2)	112(34.8)	0.018	0.892
Yes	106(65.8)	210(65.2)		
Kerosene				
No	55(34.2)	102(31.7)	54.745	0.000
Yes	106(65.8)	220(68.3)		
Dung				
No	143(88.8)	315(97.8)	17.738	0.000
Yes	18(11.2)	7(2.2)		
Agricultural residues				
No	145(90.1)	317(98.4)	18.146	0.000
Yes	16(9.9)	5(1.6)		
Solar				
No	161(100)	321(99.7)	0.501	0.479
Yes	0(0)	1(0.3)		
Grid electricity				
No	9(5.6)	13(4)	0.595	0.440
Yes	152(94.4)	309(96)		

Current (within 12 months interval)

Life time household fuel status

With respect to life time household fuel, among cases 113(70.2%) used wood, 150(93.2%) used Charcoal, 75(46.6%) used kerosene (Paraffin), 54(33.5%) used dung, 58(36%) used agricultural residues , 151(93.8%) used grid electricity, 1(0.6%) used Batteries. On the other hand, about the control, 83(25.8%) used wood, 263(81.7%) used Charcoal, 269(83.5%) used kerosene (Paraffin), 22(6.8%) used dung, 23(7.1%) used agricultural residues, 1(0.3%) used solar and 309(96%) used grid electricity. The detail presented below in table 10.

Table 10: Lifetime household fuel characteristics of participants in selected public hospitals of Addis Ababa, Ethiopia, 2020

Variables	Cases	Control	Chi-square (x 2)	P value
	Number (%)	Number (%)		
Lifetime household fuel :				
Wood				
No	48(29.8)	239(74.2)	87.791	0.000
Yes	113(70.2)	83(25.8)		
Charcoal				
No	11(6.8)	59(18.3)	11.436	0.001
Yes	150(93.2)	263(81.7)		
Kerosene				
No	86(53.4)	53(16.5)	71.522	0.000
Yes	75(46.6)	269(83.5)		
Dung				
No	107(66.5)	300(93.2)	57.744	0.000
Yes	54(33.5)	22(6.8)		
Agricultural residues				
No	103(64)	299(92.9)	64.146	0.000
Yes	58(36)	23(7.1)		
Solar				
No	161(100)	321(99.7)	0.501	0.479
Yes	0(0)	1(0.3)		
Grid electricity				
No	10(6.2)	13(4)	1.118	0.290
Yes	151(93.8)	309(96)		

Lifetime (within and without 12 months interval)

There was significant difference between cases and controls with respect to life time agricultural residues using status for household fuel.

Of the total respondents, 58(36%) and 23(7.1%) were used agricultural residues among cases and controls respectively. Life time household biomass fuel exposure characteristics with respect to agricultural residues using status of study participants are presented in Figure 5.

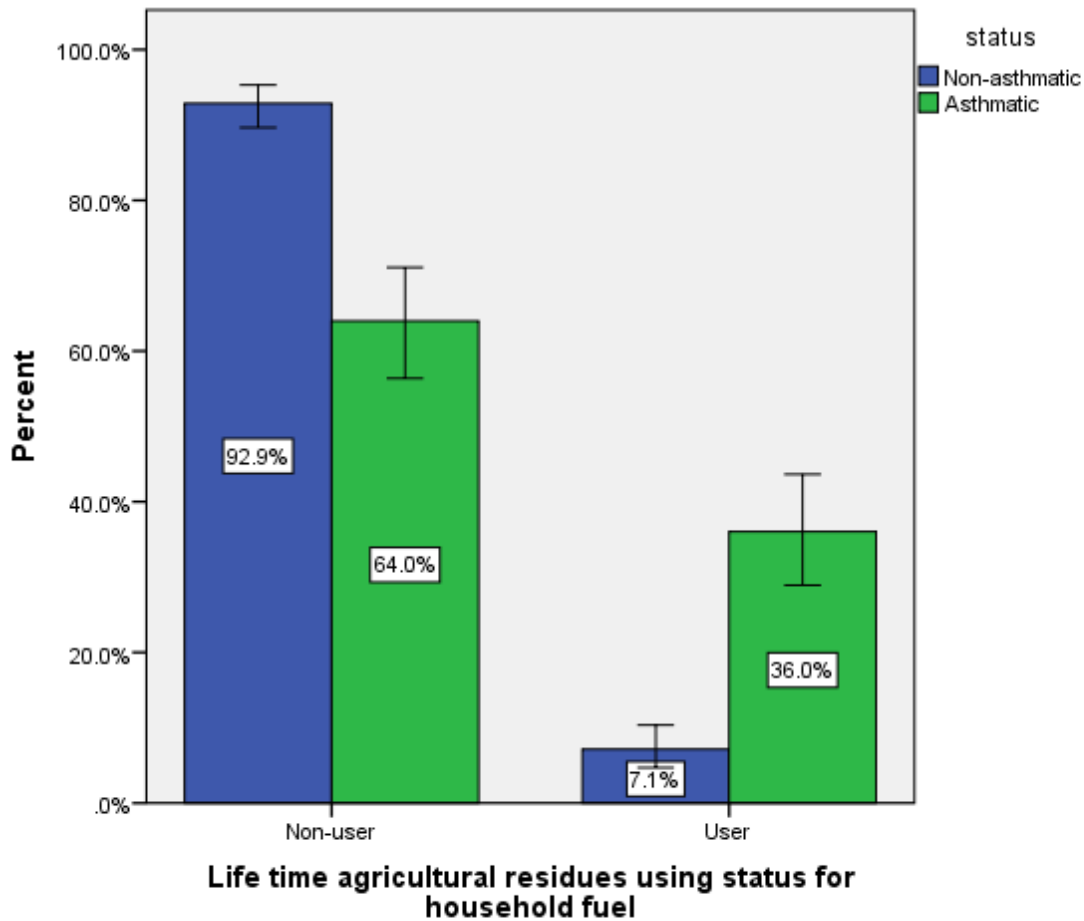


Figure 5: Life time agricultural residues using status for household fuel among participants in selected hospitals of Addis Ababa, Ethiopia, 2020

Of the total respondents, 113(70.2%) and 83(25.8%) used wood among cases and controls respectively. Life time household biomass fuel exposure characteristics with respect to wood using status of study participants are showed in Figure 6.

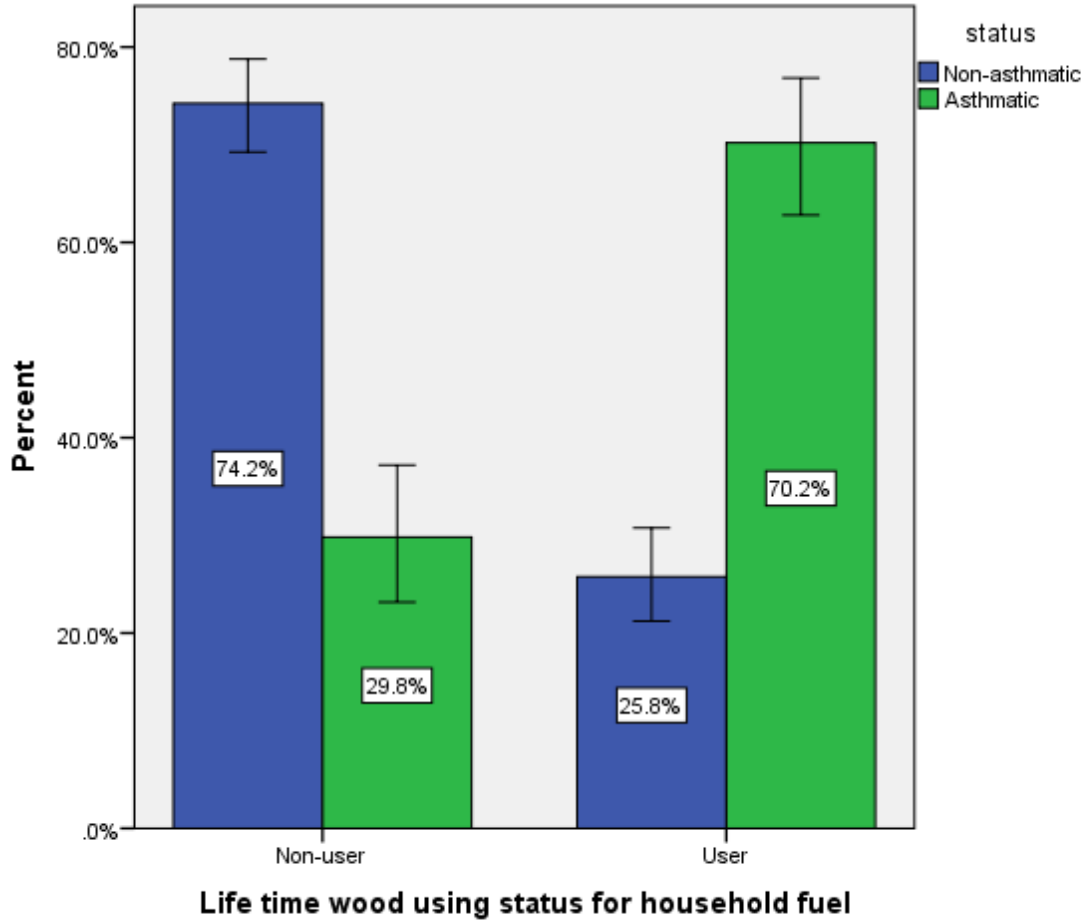


Figure 6: Life time wood using status for household fuel among participants in selected hospitals of Addis Ababa, Ethiopia, 2020

Pet characteristics, life style and nutritional characteristics

Pet characteristics, life style and nutritional characteristics together were presented in the following Table 11. From a total of 487 patients, a high proportion of cases 77(47.8%) and 73(22.7%) of controls has pet. Among cases 44(57.1%) were cat owner, 12(15.6%) were dog owner, 2(2.6%) were bird owner and 19(24.7%) were both cat and dog owner. On the other hand among controls 55(75.3%) were cat owner, 6(8.2%) were dog owner and 12(16.4%) were both cat and dog owner. Over all magnitude of ever tobacco smoking status was 22(13.7%) of cases and 7(2.2%) of controls. Similarly, alcohol drinking status was 18(11.2) of cases and 30 (9.3) of controls. Chat chewing status and shisha smoking status has very low magnitude based on participants report 10(6.2%) and 1(0.6%) among cases and 19 (5.9) and 7(2.2%) among controls. There were no drug using status in current and past time among case, but there were among controls which are 2(0.6%). Most of participants were inactive to participate in physical activity 145(90.1%) of cases and 284(88.2%)of controls. With regard to body mass index most of the participants had normal weight 95 (59.0%) of cases and 184(57.1%) of controls. Further underweight, over weight and obesity can be described 6 (3.7%) of cases and 17(5.3%) of controls, 54(33.5%) of cases and 110(34.2%) of controls and 6(3.7%) of cases and 11(3.4%) of controls respectively.

Table 11: Pet characteristics, life style and nutritional status of participants in selected public hospitals of Addis Ababa, Ethiopia, 2020

Variables	Cases	Control	Chi-square (x ²)	P value
	Number (%)	Number (%)		
Pet				
No	84(52.2)	249(77.3)	31.721	0.000
Yes	77(47.8)	73(22.7)		
Ever tobacco smoking status				
No	139(86.3)	315(97.8)	25.111	0.000
Yes	22(13.7)	7(2.2)		
Alcohol drinking status				
No	123(76.4)	252 (78.3)	0.423	0.809
Yes	18(11.2)	30 (9.3)		
Ex	20(12.4)	40 (12.4)		
Chat chewing status				
No	143(88.8)	283 (87.9)	0.314	0.855
Yes	10(6.2)	19 (5.9)		
Ex	8(5)	20 (6.2)		
Ever shisha smoking status				
No	160(99.4)	315(97.8)	2.017	0.365
Yes	1(0.6)	7(2.2)		
Drug using status				
No	161(100)	320(99.4)	1.004	0.316
Yes	0(0)	2(0.6)		
Ex	0(0)	0(0)		
Physical activity				
No	145(90.1)	284(88.2)	0.375	0.540
Yes	16(9.9)	38(11.8)		
Weight				
Less than 50	10(6.2)	29 (9)	1.130	0.288
Greater than 50	151(93.8)	293 (91)		
Height				
Less than 1.60	53(32.9)	60(18.6)	0.115	0.734
Greater than 1.60	108(67.1)	262(81.4)		
Body mass index (kg/m²)				
Under weight (<19.8)	6(3.7)	17 (5.3)	0.650	0.885
Normal weight (19.8 -25)	95(59.0)	184 (57.1)		
Over weight (25.1-30)	54(33.5)	110 (34.2)		
Obesity (>30)	6(3.7)	11 (3.4)		

Medical characteristics

With regards to medical characteristics of the study participants, presented in the following Table 12. Among the total participant 28(17.4%) of cases and 13(4.0%) of controls had family history of asthma. Similarly, 24(14.9%) of cases and 47(14.6%) of controls have cardiac problems. On the other hand 39(24.2%) of cases and 73(22.7%) controls had history of hypertension and 24(14.9%) of cases and 46(14.3%) of controls have diabetes. And also chronic kidney disease and chronic liver disease reported based on participants are 13(8.1%) and 3(1.9%) of cases, and 16(5%) and 18(5.6%) of controls. The detail is presented in the table below. Further 2(1.2%) of cases and 12(3.7%) of controls, 0(0) of cases and 7(2.2%) of controls and 5(3.1%) of cases and 8(2.5%) of controls had cancer, HIV and neurologic problem respectively.

Table 12: Medical condition characteristics of participants in selected public hospitals of Addis Ababa, Ethiopia, 2020

Variables	Cases	Control	Chi-square (x 2)	P value
	Number (%)	Number (%)		
Family asthma history				
No	133(82.6)	309(96)	24.640	0.000
Yes	28(17.4)	13(4)		
Cardiac problem				
No	137(85.1)	275(85.4)	0.008	0.928
Yes	24(14.9)	47(14.6)		
Hypertension				
No	122(75.8)	249(77.3)	0.145	0.703
Yes	39(24.2)	73(22.7)		
Diabetes				
No	137(85.1)	276(85.7)	0.033	0.855
Yes	24(14.9)	46(14.3)		
Chronic kidney disease				
No	148(91.9)	306(95)	1.834	0.176
Yes	13(8.1)	16(5)		
Chronic liver disease				
No	158(98.1)	304(94.4)	3.584	0.058
Yes	3(1.9)	18(5.6)		
Cancer disease				
No	159(98.8)	310(96.3)	2.354	0.125
Yes	2(1.2)	12(3.7)		
HIV				
No	161(100)	316(97.8)	3.551	0.059
Yes	0(0)	7(2.2)		
Neurologic problem				
No	156(96.9)	314(97.5)	0.158	0.691
Yes	5(3.1)	8(2.5)		

5.2 Association of different Characteristics of participant with Asthma

Multi-collinearity between independent variables were checked. The Hosmer-Lemeshow goodness of fit test was used to assess the fitness of the final model. The final model was fit well with $X^2 = 3.711$ and P value of 0.882.

A comparison was done between cases and controls based on different factors, such as socio demographic, housing, household fuel exposure, nutritional, life style, pet ownership and medical factors. Differences between cases and controls were analyzed using chi-square test. Then, variables found to be statistically significant with asthma in the chi-square test were entered in the conditional bi-variable and multi-variable logistic regression analysis to identify the independent predictors of asthma among study participants.

Variables, such as number of persons, window in cooking, window opening, door opening, cooking time, three stone fire, kerosene stove, current wood user, current kerosene (Paraffin) user, current dung user, current agricultural residues user, life time wood user, life time charcoal user, life time kerosene (Paraffin) user, life time dung user, life time agricultural residues user, pet ownership, ever tobacco smoking status and family asthma history were found to be significantly associated with asthma in the conditional binary logistic regression analysis. Such variables were included in the final model. The detail presented in the following Table 13.

With respect to number of persons living in the house status of the study participants, four or greater than four persons living in the house was found to be a statistically significant risk factor for asthma. The conditional bi-variable analysis indicate that the odds of developing asthma was found to be 2.52 times higher among patients with four or greater than four persons compared with patients with one person living in the house, (COR: 2.525 (1.199, 5.315)). however, the association vanished when adjusted for confounders.

Window in cooking house and window opening practice were found to be associated with asthma in the conditional bi-variable analysis. The odds of developing asthma was found to be lower among patients who have windows in cooking houses and window opening practice compared to those who have not window in cooking house and window opening practice, (COR:

6.734(4.103, 11.051) and (COR: 6.418(3.947, 10.435)) respectively. But the association vanished when adjusted for confounders.

With regard to door opening practice, the conditional multiple logistic regression analysis provided that people who didn't practice door opening, while cooking were at high risk to develop asthma compared with people who had door opening practice while cooking. The odds of developing asthma was found to be 10 times higher among people who don't have door opening practice compared to people who have door opening practice while cooking, (AOR:10.254, 95% CI, (3.969, 26.49))

Life time use of charcoal and dung were found to be significantly associated with asthma in the crude analysis in our study (COR: 3.452 (1.731, 6.885)) and (COR: 7.893 (4.199, 14.838)) respectively. However, factors were not found to be statistically significant when adjusted for confounders.

Participants who were life time wood user were at high risk to develop asthma. The conditional multivariable analysis indicated that people who use wood in their life time for cooking were 4 times at risk of developing asthma compared to people who didn't use, (AOR:4.954, 95% CI, (2.1, 11.686)).

On the other hand, people who use agricultural residues for cooking throughout their life time were found to be at risk to develop asthma compared to those who didn't use agricultural residues for cooking in their life time. The odds of developing asthma was found to be 3 times higher among people who use agricultural residues for cooking compared to people who didn't use agricultural residues throughout their life time for cooking, (AOR:3.809, 95% CI, (1.052, 13.79)).

Participants who have pet were found to be at high risk of developing asthma in conditional bi-variable analysis (COR: 3.188 (2.087, 4.87)), however, the association disappeared when adjusted for confounders.

With regard to ever tobacco smoking status, the conditional bi variable analysis identified that, tobacco use as significant risk factor to develop asthma (COR: 8.234 (3.105, 21.837)). Its association also existed when adjusted for confounders.

Current and life time kerosene users were found to be associated with asthma in the conditional bi-variable analysis. The odds of developing asthma were found to be lower among patients who use kerosene in current and life time exposure compared to those who didn't use kerosene in current and lifetime (COR: 0.226 (0.147, 0.347)) and (COR: 0.167 (0.104, 0.27)) respectively, but the association was not apparent when adjusted for confounders.

With regard to current wood user, using wood for cooking was found to be statistically significant risk factor for asthma. The conditional bi-variable analysis indicated that the odds of developing asthma was found to be 8.4 times higher among patients who use it compared with patients who don't use (COR: 8.406 (4.213, 16.773)), however the association vanished when adjusted for confounders.

As we hold all other factors in the model constant, the odds of developing asthma was found to be 6 times more likely among smoker compared to non-smokers, (AOR:6.16, 95% CI, (1.304, 29.098)).

Compared to people who hadn't family history of asthma , people who had family history of asthma were 5 times more likely to develop asthma, after keeping all independent variables constant, (AOR:4.725, 95% CI, (1.544, 14.454)).

Table 13: Conditional multivariable logistic regression analysis of factors associated with asthma among participants in selected public hospitals of Addis Ababa, Ethiopia, 2020

Variables	Cases	Control	COR at 95%, CI	AOR 95%, CI
	Number (%)	Number (%)		
Number of person:				
1	13(8.1)	44(13.7)	1	1
2	15(9.3)	30(9.3)	2.079 (0.827, 5.229)	4.104 (0.709, 23.762)
3	31(19.3)	84(26.1)	1.389 (0.627, 3.078)	2.544 (0.598, 10.819)
4 or greater than 4	102(63.4)	164(50.9)	2.525 (1.199, 5.315)	1.425 (0.298, 6.811)
Window in cooking house				
No	84(52.2)	46(14.3)	6.734 (4.103, 11.051)	1.916 (0.008, 477.767)
Yes	77(47.8)	276(85.7)	1	1
Window opening				
No	85(52.8)	49(15.2)	6.418 (3.947,10.435)	2.174 (0.009, 520.665)
Yes	76(47.2)	273(84.6)	1	1
Door opening				
No	47(29.2)	23(7.1)	5.127 (2.933, 8.963)	10.254 (3.969, 26.49)*
Yes	114(70.8)	299(92.9)	1	1
Cooking time				
Less than 60 mint	71(44.1)	2(0.6)	1	1
60-120 mint	74(46.0)	304(94.4)	1.028 (0.656, 1.611)	0.687 (0.297, 1.589)
Greater than 120 mint	16(9.9)	16(5)	2.312 (1.048, 5.103)	1.605 (0.313, 8.234)
Stove type:				
Three-stone fire				
No	142(88.2)	316(98.1)	1	1
Yes	19(11.8)	6(1.9)	5.615 (2.358,13.372)	0.202 (0.014, 2.924)
Kerosene stove				
No	108(67.1)	95(29.5)	1	1
Yes	53(32.9)	227(70.5)	0.213 (0.139, 0.326)	0.203 (0.031, 1.338)
Current household fuel:				
Wood				
No	119(73.9)	312(96.9)	1	1
Yes	42(26.1)	10(3.1)	8.406 (4.213, 16.773)	5.479 (0.432, 69.516)
Kerosene (Paraffin)				
No	55(34.2)	102(31.7)	1	1
Yes	106(65.8)	220(68.3)	0.226 (0.147, 0.347)	3.392 (0.454, 25.346)
Dung				
No	143(88.8)	315(97.8)	1	1
Yes	18(11.2)	7(2.2)	5.77 (2.283, 14.581)	0.621 (0.06, 6.461)

Agricultural residues				
No	145(90.1)	317(98.4)	1	1
Yes	16(9.9)	5(1.6)	7.648 (2.548, 22.956)	0.593 (0.041, 8.512)
Lifetime household fuel :				
Wood				
No	48(29.8)	239(74.2)	1	1
Yes	113(70.2)	83(25.8)	7.112 (4.405, 11.481)	4.954 (2.1, 11.686)*
Charcoal				
No	11(6.8)	59(18.3)	1	1
Yes	150(93.2)	263(81.7)	3.452 (1.731, 6.885)	1.361 (0.428, 4.333)
Kerosene (Paraffin)				
No	86(53.4)	53(16.5)	1	1
Yes	75(46.6)	269(83.5)	0.167 (0.104, 0.27)	0.611 (0.221, 1.693)
Dung				
No	107(66.5)	300(93.2)	1	1
Yes	54(33.5)	22(6.8)	7.893 (4.199, 14.838)	1.228 (0.306, 4.939)
Agricultural residues				
No	103(64)	299(92.9)	1	1
Yes	58(36)	23(7.1)	7.383 (4.1, 13.295)	3.809 (1.052, 13.79)*
Pet				
No	84(52.2)	249(77.3)	1	1
Yes	77(47.8)	73(22.7)	3.188 (2.087, 4.87)	1.971 (0.864, 4.493)
Ever tobacco smoking status				
No	139(86.3)	315(97.8)	1	1
Yes	22(13.7)	7(2.2)	8.234 (3.105, 21.837)	6.16 (1.304, 29.098)*
Family asthma history				
No	133(82.6)	309(96.0)	1	1
Yes	28(17.4)	13(4.0)	4.655 (2.362, 9.176)	4.725 (1.544, 14.454)*

* Significant at $P < 0.05$, 1 = reference, COR: crude odds ratio, AOR: adjusted odds ratio

6. Discussions

The aim of the study was to assess factors associated with asthma, with special reference to household fuel exposure and housing characteristics in selected public hospitals in Addis Ababa, Ethiopia. We found that door opening practice while cooking as a protective factor for asthma. On the other hand, life time uses of wood and agricultural residues for cooking purpose and tobacco for smoking purpose were found to be significant risk factors for asthma. Family history of asthma was also noted to be another risk factor for asthma.

In this study, 483 subjects participated, among them high proportion of controls had door opening practice during cooking hours 299 (92.9%) compared to cases 76(47.2%). The odds of developing asthma was 10 times higher among individuals who practice door opening while cooking compared with individuals who don't practice (AOR: 10.254, 95% CI:3.969, 26.49). The association may be due to overcrowding and inadequate ventilation for the presence of smoke measured by elevated CO₂ level, high level of benzene and other VOCs (16). This may take the responsibility for the development of asthma. The finding on this study supported by different studies like that of the study which was conducted in Alaska (16), in Japan (89) and Southern New England (63). In contrast to that, another study conducted in Peru provides unequivocal report which state there is no association between door opening practice and asthma (90). This variation may occur due to area of cooking room and other smoke extraction system.

The finding of the study demonstrated that (36%) among cases and (7.1%) among controls were using agricultural residues as a source of household fuel in their life time. Those subjects who used agricultural residues in their life time were almost four times more likely to develop asthma compared to people, who don't use agricultural residues in their life time for cooking (AOR: 3.809, 95% CI: 1.052, 13.79).

Similarly the use of wood in their life time for cooking purpose was found to be important predictor for the acquiring of asthma in this study. The odds of developing asthma was almost five times higher among subjects who use wood for cooking compared to subjects who don't use wood (AOR: 4.954, 95% CI: 2.1, 11.686). Finding from this study suggest that the risk of wood smoke exposure for asthma may be confined due to their duration of exposure to the smoke and compromised respiratory system from cooking smoke.

The association between biomass fuel smoke exposure and asthma are confirmed by different researches for instance a cross-sectional studies conducted in Turkey (56), in Nigeria (46) and in India (27, 55). The justification for this may be smoke emanating from burning biomass fuels contains toxic pollutants called oxidants, which include volatile organic compound (VOCs), particulate matter (PM), carbon monoxide (CO), and oxides of nitrogen, sulfur and Fluorine (91). Because of this oxidative stress, which is imbalance between biological pro-oxidants and anti-oxidant defense system, some changes observed like initiate cytokine production and depression of protective membrane and mediates inflammatory response or worsen asthma due to a compromised anti-oxidant defense system (91).

On the other hand, study conducted in Peru (15) and in Nigeria (42) have showed lack of association between biomass fuel smoke exposure and asthma. The discrepancies between studies may be possible due to variations in cooking area, ventilation system, as well as in type, duration and intensity of biomass fuel smoke exposure.

Smoking has also been identified as important risk factor for developing asthma by six times (AOR: 6.16, 95% CI: 1.304, 29.098). Our study produce similar finding with the study conducted in Thailand which state that there is a significant association between smoking and asthma (66). The justification for this may be the effect of smoking on airway i.e. tobacco smoke flow inward to inflammatory cell like neutrophils, lymphocytes, eosinophils, mast cell and macrophages (92). Due to this various inflammatory mediators are released which include lipids, chemokines, cytokines and growth factor and those proteolytic enzymes cause inflammatory damage and bronchial hyper responsiveness which is hall mark of asthma (92). On the other hand studies conducted in Britain (48) and Uganda (93) are in contrast with our finding by stating there is no significant association between tobacco smoking and asthma. This could be due to variation in the study population, magnitude of cigarette smoking.

Patients who had family history of asthma were more than four times more likely to develop asthma compared to those who had no family history of asthma (AOR: 4.725, 95% CI: 1.544, 14.454). The possible explanation for this association could be either due to hereditary factors or a shared environment by the member of a family contributes to the pathogenesis of asthma (15). The finding of our study is supported by other studies which were conducted in Australia (66), Thailand (94), Uganda (95), New Zealand (96) and California (97) , which conclude that family

history of asthma is one of the major risk factor for the development of asthma. The justification for the similarity might be the study setting in which most of the studies were conducted in a hospital setting. However, another study conducted in Britain is not in agreement with our finding, which states that there is no significant relationship between family history of asthma and asthma (93). This may be due to study design and population characteristics.

On the other hand, conditional multivariable analysis showed that there is no statistically significant difference between cases and controls related to number of person living in a household (AOR:4.104, 95% CI, (0.709, 23.762)), (AOR:2.544, 95% CI, (0.598, 10.819)) and (AOR:1.425, 95% CI, (0.298, 6.811)) despite a significant association was found in conditional bi-variable analysis.

In our study, statistical significant association was not found between both having window in cooking house and window opening practice during cooking time with the risk of asthma when adjusted for confounders ((AOR:1.916, 95% CI, (0.008, 477.767)) and (AOR:2.174, 95% CI, (0.009, 520.665))) respectively. Despite significant association was found in the crude analysis.

With regard to cooking time, the conditional multivariable analysis yield that there is no statistically significant association between cooking time and asthma (AOR: 0.687, 95% CI, (0.297, 1.589)) and (AOR: 1.605, 95% CI, (0.313, 8.234)). Despite significant association was found in crude analysis.

According to this study regarding stove type, statistically significant association was not found between both three stone fire stove and kerosene stove with the risk of asthma when adjusted for confounders (AOR:0.202, 95% CI, (0.014, 2.924)) and (AOR:0.203, 95% CI, (0.031, 1.338)) respectively. Despite significant association was found in conditional bi-variable analysis.

With respect to current household fuel type such as wood, kerosene, dung and agricultural residues have no relationship with the risk of asthma after adjusted for covariates (AOR:5.479, 95% CI, (0.432, 69.516)), (AOR:3.392, 95% CI, (0.454, 25.346)), (AOR:0.621, 95% CI, (0.06, 6.461)) and (AOR:0.593, 95% CI, (0.041, 8.512)) respectively though statistically significant association was found in the crude analysis.

Except wood and agricultural residues , life time household fuel type such as charcoal, kerosene and dung on conditional multivariable analysis revealed that statistically significant was not found between life time house hold fuel type (charcoal, kerosene and dung) and asthma ((AOR: 1.361, 95% CI, (0.428, 4.333)), (AOR: 0.611, 95% CI, (0.221, 1.693)) and (AOR: 1.228, 95% CI, (0.306, 4.939)) respectively.

Likewise, no relationship was observed between asthma and pet ownership after adjusted for covariates (AOR: 1.971, 95% CI, (0.864, 4.493)) though statistically significant was not found in the conditional bi-variable analysis. This finding is comparable with a study conducted in united kingdom (25). Nevertheless , the finding of our study is in contrast to the study in united kingdom (65). The possible explanation could be due to difference in method of assessment of pet contact, genetically and environmental factor.

On the contrary , such variables, among socio demographic characteristics age (41), sex (44), residences , marital status, educational status (46), occupational status (49), monthly income (9) and religion) , among housing characteristics (number of rooms, household crowding index, lighting source , cooking area, cooking house floor material, cooking house wall material, cooking house roof martial, smoke extraction (46),), among stove type (shielded mud stove (46), wood burning metal stove (27), improved charcoal stove (27), solar cooker, grid powered electric stove), among current household fuel type (charcoal (27), solar, grid electricity), among life time household fuel type (solar, grid electricity), among life style characteristics (alcohol drinking status, chat chewing status, shisha smoking status, drug using status, physical activity) (48), among nutritional status (weight, height, body mass index) (15) , among chronic medical condition (cardiac problem, hypertension, diabetes mellitus, chronic kidney disease, chronic liver disease, cancer disease, HIV, neurologic problem) were not significantly associated with asthma in the conditional bi-variable analysis. Because of this these variables were not selected as a candidate for the final model however significant associations were reported in previous studies.

Most of the studies on asthma and its risk factors employed by cross sectional method, which has a limitation of statistical power by comparing the groups internally. When we compare the introduction of bias, matched case control study design has lower bias than cross sectional study. Because of this it is assumed that to generate valid data among main exposure variables.

7. Strengths and limitations of the study

7.1. Strengths

- ✓ Cases included in the study were selected based on spirometry results. This may reduce wrong diagnosis of the asthma.
- ✓ Using trained nurses who work in the selected hospitals as data collectors helped to keep the privacy of the respondents because of this they can provide the required information comfortably.
- ✓ Investigating the effect of multiple risk factors of Asthma simultaneously could be the strength of the study.
- ✓ Cases and controls were recruited at the same facility, to control for the context difference in the study participants.
- ✓ To control the influence of using matched design, matched analysis (conditional logistic regression analysis) was employed which is one of the strengths of the study.
- ✓ Representative sample size was taken.

7.2 Limitations

- ✓ Assessment of housing characteristics information was obtained by interview, but it would be better if we obtain it through direct physical observation.
- ✓ Since the study was done in institutions, it might not be generalized to the general population with asthma.

8. Conclusions and recommendations

8.1 Conclusions

This study demonstrated some of the factors associated with asthma. For instance, using wood and agricultural residues for cooking purpose in their life time were found to be significant risk factors for asthma. Tobacco smoking was also considered to be another risk for asthma. On the other hand, opening door while cooking was found to be preventive for asthma. Family history of asthma was noted to have its own contribution for the development of asthma.

8.2 Recommendations

Based on factors identified in the study we provide the following recommendations

For the public

- ✓ It will be better if the people avoid using wood and agricultural residues as household fuel for cooking or other purposes.
- ✓ It will be of great help in order to prevent asthma by practicing door open practice while cooking for better ventilation.
- ✓ People should avoid tobacco smoking in order to prevent asthma development.

For FMHACA

- ✓ Prepare trainings for health professionals, who work in, to widen their understanding about factors associated with asthma special reference to household fuel exposure and housing characteristics.
- ✓ FMHACA should include door open practice in the checklist, which they use to control food and drink establishment institutes, as mandatory /critical requirement in order to provide a licence.

For health care providers

- ✓ Health professionals should counsel patients by providing risk and preventive factors that are associated with asthma.

For the researcher

- ✓ It would be great if a study is conducted by direct observation in the house of the patient to check the exact housing characteristics and different observation may they hide in interview.
- ✓ Further study shall be conducted in cohort study design to show a cause and effect relationship between asthma and its risk factor.

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ANNEXES

Annex 1- Information sheet (English version)

Background

Good morning / good afternoon

My name is _____ i am data collector for master of public health student project in Addis Ababa University. We are conducting a research about “Assessment of the role of household fuel exposure and housing characteristics on asthma in selected public hospitals of Addis Ababa, Ethiopia; unmatched Case control study design.” Respiratory disease is the commonest public health burden across the globe. Among them asthma is a widely spread chronic condition. Today more than 200 million people worldwide are experiencing asthmatic attack resulting in more than 0.18 million people death per year. A worldwide prevalence study on asthma and allergies indicates that prevalence rate in Ethiopia 9.1%.Among the top 50 cause of death in Ethiopia asthma is 24th by the 11.98 age standardized death rate per 100,000 population. It imposes a global burden of impaired quality of life and health care costs. Individual susceptibility to asthma is likely to be determined by interacting heritable and environmental risk factors. Studies that have been investigated on this area suppose environmental exposure have generated inconsistent and inconclusive finding. This study is designed to fill the gap on the investigation of indoor cooking, housing characteristics and pet ownership association with asthma among women. This study will examine the relationship between housing characteristics and indoor cooking on asthma at public hospitals in Addis Ababa, Ethiopia. The information I collect will help in implementing possible and important intervention and to plan better supportive care provision system for patients. Now you are chosen by chance to participate for the survey. The benefits, procedure and what is expected from you will be explained in the following sections.

Objective

Aim of the study is to investigate whether household fuel exposure and housing characteristics are associated with asthma or not at public hospitals in Addis Ababa, Ethiopia.

Study procedures

The study involves a face-to-face interview. You will be asked set of questions using a structured questionnaire. After signing the consent form, you will then be asked relevant questions and your responses will be written on the questionnaire. The interview will take about 20 minutes.

Benefit of the study

The study will have important value to determine the association between selected factors (i.e. housing characteristics and indoor cooking) and asthma and also it has contribution to take appropriate intervention towards the establishment of prevention and control strategy of asthma. There will not be any incentives that will be given. But when you participate in this study you will have long and short term benefits. The long term benefit would be, the result of the study will be useful to expand and implement a good health control and prevention method towards asthma and your response will be used as baseline data to develop and implement new strategies. This could be very beneficiary for the patients and also for the overall community.

Harm/risks of the study

You might feel discomfort able talking about your personal information and part of your time (average of 20 minutes) will be consumed to answer the questions.

Rights of Participants

You have full right either to participate or refuse as well as to quit at the middle or at any time you want after you start participation in this study. You may respond to all the questions or you may not answer questions you don't want to answer. You can ask any question which is not clear for you.

Protection of privacy during data collection and analysis

Any data with personal information will be handled with confidentiality, and the privacy of subjects respected at all stages of the project. Respondents' privacy will be respected through the

informed consent process and the procedures during the data collection. Personal identifiers (including name) will not be recorded. Primary data will be handled only by the researchers, and the database will be password protected. During data analysis, again data will be stored through a password protected system and data is analyzed using codes, without personal identifiers.

Data Sharing:

During the study only the study PIs will have access to the study data including consent documents. If you have any question about all things I explained to you now please forward it before we proceed to the next step?

Are you willing to participate in the study?

1- Yes —————> (take informed consent)



2- No I don't want to participate in the study (Thank you)

If you want to ask the principal investigator about the research at any time, you can contact through:

Email: yonasabebe3367@gmail.com

phone number: +251 944162181

If you want to ask the primary advisor about the research at any time, you can contact through:

Email : ahmedaa5050@yahoo.com

Phone number: +251911684399

If you want to ask the co-advisor about the research at any time, you can contact through:

Email : adamuaddissie@gmail.com

Phone number: +251911404954

Annex 2- Informed consent (English version)

Centre Number: :_____

Subject identification Number for this trial:_____

I agree to take part in the above study by considering the following statement.

1. I confirm that I have received and understand the information sheet detail for the above study and have had the opportunity to ask question.
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.
3. I understand that the information I give may be looked at by responsible individuals from the research team or from regulatory authorities where it is relevant.

What does your signature on this consent form mean?

Your signature on this form means:

- You have been informed about this study’s purpose, procedures, and possible benefits.
- You have been given the chance to ask questions before you sign.
- You have voluntarily agreed to be in this study.

Signature of the Participant _____

Name of the interviewer _____ Signature_____

Date of interview _____

Annex 3- Screening questionnaire for control (English version)

1. Have you had wheezing or whistling in your chest at any time in the last 12 months?
 - A. No
 - B. Yes
2. Have you woken up with a feeling of tightness in your chest at any time in the last 12 months?
 - A. No
 - B. Yes
3. Have you had an attack of shortness of breath that came on during the day when you were at rest or following strenuous activity at any time in the last 12 months?
 - A. No
 - B. Yes
4. Have you been woken by an attack of coughing at any time in the last 12 months?
 - A. No
 - B. Yes

Annex 4- Survey questionnaire (English version)

Thank you for your willingness to participate, you were selected by a scientific sampling procedure, and your cooperation is very important to the success of the study. This is a questionnaire you are asked to answer, please answer the questions as frankly and accurately as possible. All information obtained in the study will be kept confidential and used for public health research only.

"Assessment of the role of indoor fuel exposure and housing characteristics on asthma in selected public hospitals of Addis Ababa, Ethiopia"

Center _____

Card number _____

Code _____

Address _____

Telephone number _____

Date _____

PART I: Demographic and socioeconomic characteristics			
SN	Question	Option	Skip pattern
101	How old are you?	_____ years	
102	Where do you live?	A. Rural B. Urban	
103	sex?	A. Male B. Female	
104	What is your marital status?	A. Single B. Married C. Widowed D. Separated /divorced	
105	What is your educational status?	A. Unable to read and write B. Primary (1-8) C. Secondary (9-10) D. Preparatory (11-12) E. Diploma and above	
106	What is your occupational status?	A. Unemployed B. Employed (government, private, self) C. Retired D. Student	

107	How much is your household income per month?	_____ Ethiopian birrs	
108	What is your religion?	A. orthodox B. Muslim C. protestant D. catholic E. others specify_____	
PART II: Household air pollution exposure characteristics			
201	How many rooms do you have in your house?	_____ No of rooms	
202	How many peoples live in the house?	_____ No of person	
203	Household crowding index	A. Less than 1 B. 1-2 C. Greater than 2	
204	What is the source of lighting used in the house?	A. Lanterns/gas B. Electricity C. Other, specify_____	
205	Where do you cook your food?	A. Enclosed area (Kitchen) B. Semi-open area C. Part of main living area D. Outside of main living area E. Other	
206	What types of ventilation / smoke extraction do you use?	A. Permanent holes in roof B. Eaves spaces C. Chimney D. Windows/openings in area used for cooking E. fan or air-condition F. door opening G . door and window opening H . open area I . others	
207	Time spent for cooking?	Mints _____	
PART III: cooking room characteristics			
301	What is the material of the floor?	A. Clay/mud B. Cement C. ceramic D. wood E. other	
302	What is the material of the wall?	A. Adobe/earth blocks B. Wattle and daub C. Iron sheets D. Burned bricks	

		E. Concrete blocks F. Dung G. plastic H. others	
303	What is the material of the roof?	A. Thatch B. Tiles C. Iron sheets D. Other N	
304	Do you have windows in the kitchen?	A. No B. Yes	
305	Do you open the windows during cooking?	A. No B. Yes	
306	Do you open the door during cooking?	A. No B. Yes	
PART IV: pet characteristics			
401	Section 1 stove type		
A	Three-stone fire	A. No B. Yes	
B	Shielded mud stove	A. No B. Yes	
C	Wood-burning metal stove	A. No B. Yes	
D	Improved charcoal stove	A. No B. Yes	
E	Kerosene stove	A. No B. Yes	
F	LPG (Gas) stove	A. No B. Yes	
G	Solar cooker	A. No B. Yes	
H	Grid powered electric stove	A. No B. Yes	
I	Other	SPECIFY	
402	Section 2 current household fuel		
A	Wood	A. No B. Yes	
B	Charcoal	A. No B. Yes	
C	Kerosene (Paraffin)	A. No B. Yes	
D	LPG (Gas)	A. No B. Yes	
E	Dung	A. No B. Yes	
F	Agricultural residues	A. No B. Yes	

G	Solar	A. No B. Yes	
H	Grid electricity	A. No B. Yes	
I	Batteries	A. No B. Yes	
J	Wax candle	A. No B. Yes	
K	Other	SPECIFY	
403	Section 3 life time household fuel		
A	Wood	A. No B. Yes	
B	Charcoal	A. No B. Yes	
C	Kerosene (Paraffin)	A. No B. Yes	
D	LPG (Gas)	A. No B. Yes	
E	Dung	A. No B. Yes	
F	Agricultural residues	A. No B. Yes	
G	Solar	A. No B. Yes	
H	Grid electricity	A. No B. Yes	
I	Batteries	A. No B. Yes	
J	Wax candle	A. No B. Yes	
K	Other	SPECIFY	
PART V: pet characteristics			
501	Do you keep a pet?	A. No B. Yes	If No`, go to 601
502	if 'Yes' which one?	A. Cat B. Dog C. Bird D. Cat and dog E. Dog and bird F. Cat and bird G. Cat, dog and bird H. If other	
503	Do pets have contact with inhabitants?	A. No B. Yes	If No` skip 601

504	What type of contact do you have with your pet? ?	A. Regular contact B. Some contact	
PART VI: Life style			
601	Have you ever smoked? ['YES' means at least 20 packs of cigarettes or 12 oz (360 grams) of tobacco in a lifetime, or at least one cigarette per day or one cigar a week for one year]	A. No B. Yes	If No` skip up to 607
602	if 'Yes' How old were you when you started smoking?	Years _____	
603	Do you now smoke, as of one month ago?	A. No B. Yes	If No` go to 605 ,
604	if 'Yes' ? How many cigarettes per day do you now smoke on average?	Numbers per day _____ Number per week _____	
605	Have you stopped or cut down smoking?	A. No B. Yes	
606	Have you been regularly exposed to tobacco smoke in the last 12 Months? ['Regularly' means on most days or nights]	A. No B. Yes	
607	What is your alcohol drinking status?	A. Current- drinker B. Ex – drinker C. Non – drinker	If No` skip 609
608	If you currently drink alcohol, how frequent	A. daily B. weekly C. Monthly D. rarely	
609	Have you ever chewed khat?	A. No B. Yes C. Ex-chewer	If No` skip 611
610	If you chew Khat, how frequently?	A. daily B. weekly C. Monthly D. rarely	
611	Have you ever used shisha?	A. No B. Yes C. Ex-smoker	If No` skip 613
612	If you smoke shisha, how frequently?	A. daily B. weekly C. Monthly D. rarely	
613	Have you ever used any drugs like cannabis, heroin, pethidine, cocaine, etc.?	A. No B. Yes C. Ex-user	If No` skip 615

614	If you use any of the drugs, how often do you use?	A. daily B. weekly C. Monthly D. rarely	
615	Do you engage in physical activity?	A. No B. Yes	
PART VII: Nutritional status			
701	what is your body weight?		
702	what is your body height?		
703	Body mass index,	No response needed	
PART VIII: Medical condition			
801	Do you have any family history of asthma?	A. No B. Yes	If no skip 802
802	If yes, who is affected by Asthma in the family?	A. Mother B. Father C. Sister/Brother	
803	Do you have any of the following known medical conditions?		
A	Cardiac problem	A. No B. Yes	
B	Hypertension	A. No B. Yes	
C	Diabetics	A. No B. Yes	
D	Chronic kidney disease	A. No B. Yes	
E	Chronic liver disease	A. No B. Yes	
F	Cancer disease	A. No B. Yes	
G	HIV	A. No B. Yes	
H	Neurologic problem		
I	Other	Specify	

Annex5- Information sheet (Amharic version)

መረጃ መግለጫ

እንደምን አደሩ/ዋሉ

ስሜ..... እባላለሁ። በአዲስ አበባ ዩኒቨርሲቲ በሕብረተሰብ ጤና ትምህርት ለድህረ ምረቃ ፕሮግራም ተማሪ መረጃ ሰብሳቢ ስሆን የምርምር ጥናቱ በቤት ውስጥ ማብሰል፣የቤታችን ና ምግብ ማዘጋጃ ቦታችን ገጽታ ሁኔታ ከአስም በሽታ ጋር ያላቸው ግንኙነት የሚያመጣውን ለውጥ ለመገንዘብ የሚደረግ ጥናት ነው። በአለም ላይ የመተንፈሻ አካላት ህመም የተስፋፋ በሽታ ሲሆን ከነዚህም ውስጥ አስም አንዱ ነው። በአሁን ሰዓት በአለም ላይ ወደ 200 ሚሊዮን የሚሆን የአስም ህመምተኛ ሲሆር ከነዚህም ውስጥ 180 ሺ የሚሆን ሰው በየአመቱ ይሞታሉ። በኢትዮጵያ ውስጥ 50 ገዳይ ከሚባሉ በሽታዎች ውስጥ አስም 24ኛ ላይ ይገኛል ከዚህም በተጨማሪ በህይወት ደህንነት ና ለጤና በሚወጣ ወጪ ላይ ከፍተኛ የሆነ ጉዳት እያስከተለ ይገኛል። በዚህ ዙሪያ የተሰሩ ጥናቶች እንደሚያሳዩት አካባቢያዊ ተጽእኖ ከአስም ጋር ያለው ግንኙነት የተለያዩ ምልክታዎች አሉ። ይህ ጥናት የተዘጋጀው እነዚህን ምልክታዎች ለማጥራት ማለትም በቤት ውስጥ ማብሰል፣የቤታችን ና ምግብ ማዘጋጃ ቦታችን ገጽታ ከአስም በሽታ ጋር ያላቸው ግንኙነት ሆኖ የጥናቱም ቦታ አዲስ አበባ ውስጥ በሚገኙ የህዝብ ሆስፒታሎች ላይ ይሆናል ማለት ነው። የሚሰበሰቡ መረጃ ጠቃሚነቱ ለእርስዎ ፣ለመንግስት አካላትና ለሌሎች ታማሚዎች አስም በሽታን በተመለከተ ለመከላከል ና ለመቆጣጠር የተሻለ እቅድ እንዲታወቅና ትኩረት እዲሰጥ ፤ እርስዎ ለዚህ ጥናት በ እድል የተመረጡ ነዎት። የጥናቱ ቅደም ተከተል፣የጥናቱ ጠቀሜታ፤ እንዲሁም ከእርስዎ የሚጠበቀውን እንደሚከተለው ይገለጻል።

የጥናቱ ዋና አላማ

በቤት ውስጥ ማብሰል፣የቤታችን ና ምግብ ማዘጋጃ ቦታችን ገጽታ ከአስም በሽታ ጋር ያላቸው ግንኙነት ና የሚያመጣውን ለውጥ ለመገንዘብ የሚደረግ ጥናት ነው።

የጥናቱ ቅደም ተከተል

ይህ ጥናት እርስዎ የፈቃደኝነት ፈርማዎችን ካስቀመጡ በኋላ በፊትለፊት በሚደረግ ቃለ-መጠይቅ ለ 20 ደቂቃ የሚካሄድ ሲሆን እኔ አንዳንድ ጥያቄዎች እጠይቅዎታለሁ የሚመልሱት መልስም በቅፁ ላይ በፅሁፍ የሚቀመጥ ይሆናል።

የጥናቱ ጠቀሜታ

ጥናቱ በቤት ውስጥ ማብሰል፣የቤታችን ና ምግብ ማዘጋጃ ቦታችን ገጽታ ሁኔታ ከአስም በሽታ ጋር ያላቸው ግንኙነት የሚያመጣውን ለውጥ ለመገንዘብ የሚደረግ ጥናት ነው። በዚህ ላይ በመሰተፍዎ ምንም አይነት የሚሰጥ ገንዘብ የለም። ነገር ግን በዚህ ጥናት ላይ ሲሳተፉ የአጭር እና የረጅም ጊዜ ጠቀሜታ ያገኛሉ። የሰጡትን መልስ እንደ መነሻ መረጃ በመጠቀም በአብዛኛው በአስም በሽታ ላይ በሚደረግ የመከላከል ና የመቆጣጠር አገልግሎት ላይ ለመስራት እንዲሁም አዳዲስ አቅዶችን በመቅረፅ እና በመተግበር ለሕብረተሰቡ ድጋፍ ለማድረግ እንደመረጃነት የሚያገለግል ይሆናል፤ ይህ የረጅም ጊዜ የጥናቱ ጠቀሜታዎች ነው።

የጥናቱ ጉዳዮች

የሰአትዎን በአማካኝ 20 ደቂቃ በጥናቱ ላይ ያሳልፋሉ። እንዲሁም ስለ ግል ህይወትዎ በሚወሰኑ ሰአት ምናልባት የመረጠሽ ስሜት ሊኖርዎት ይችላል።

የተሳታፊዎች ሙብት

በጥናቱ ላይ የመሳተፍም ሆነ ያለመሳተፍ ሙሉ ሙብት አልዎት፤ ጥናቱ ውስጥ ተሳታፊ ሆነው ቢሆን እንኳን አቋርጦ መውጣት ይችላሉ ፣ ሁሉንም ጥያቄዎች መመለስ አሊያም አለመመለስ ይችላሉ ። ያልገባዎትን ማንኛውንም ጥያቄ መጠየቅ ይችላሉ።

ሚስጥር ጠባቂነት በመረጃ አሰባሰብ እና ትንተና ወቅት

ከዝህ ጥናት የሚሰበሰበው መረጃ በጥናቱ አጥኝ የሚያዝ ሲሆን መረጃውም በ ሚስጥር ቁጥር የሚዘጋ ይሆናል። የግለሰቦች መግለጫ (ስም) አይመዘገብም በተመሳሳይ ጥናቱ ባለቀ ወቅትም የግለሰቦች ማንነት(ስም) በሪፖርት ላይ ማይገለጽና ማጠቃለያ ጽሁፉም በሚስጥር ቁጥር የሚዘጋ ይሆናል።

መረጃ ክፍፍል

በጥናቱ ወቅት የተሰበሰበው መረጃ የጥናቱ ባለቤት ብቻ ይኖርዋል። ይህ የፈቃደኝነት መግለጫውንም ያካትታል። እባክዎ ከላይ ስለተዘረዘረው ነገር ወደቀጣዩ ክፍል ሳንገባ ማንኛውም ጥያቄ ካልዎት? በጥናቱ ለመሳተፍ ፈቃደኛ ነዎት ?

- 1- አዎ (በመረጃ ላይ የተደገፈ የፈቃደኝነት ቅጽ ይውሰዱ)
- 2- በጥናቱ ለመሳተፍ ፈቃደኛ ካልሆኑ (እናመሰግናለን)

ጥናቱን በተመለከተ ሊብራራልዎት የሚፈልጉት ነገር ካለ መጠየቅ ይችላሉ። ለበለጠ መረጃ የጥናቱን ዋና አጥኝ በሚከተለው አድራሻ ማግኘት ይችላሉ።

እሜል: yonasabebe3367@gmail.com ወይም ሞባይል ስልክ ቁጥር +251 944162181.

Annex 6- Informed consent Amharic version

የማዕከሉ ቁጥር : _____

የተሳታፊው የጥናት መለያ ቁጥር: _____

1. የሚከተሉትን ሀሳቦች ግንዛቤ ውስጥ በማስገባት የጥናቱ ተሳታፊ ለመሆን ተስማምቻለው።
ስለጥናቱ በጥልቀት በተሰጠኝ መረጃ ግንዛቤ ማግኘቴን እና ያልገቡኝ ነገሮች ካሉም ጥያቄ እንድተይቅ እድል መሰጠቴን አረጋገጣለው
2. በፍቃደኝነት ላይ የተመሰረተ ተሳተፎ እንዳለኝ እና በዚህ ጥናት ውስጥ መቀጠልም ሆነ በማንኛውም ሰዓት ማቋረጥ እንደምችል ተነግሮኛል ።
3. በዚህ ጥናት ውስጥ በተሰጠው መረጃ በጥናቱ አጥኒዎች ለጥናቱ ግብዓትነት እንደሚያገለግል ተገልጿልኛል።

በዚህ ጥናት ላይ የእርስዎ ፊርማ ምን ማለት ነው ?

የእርስዎ ፊርማ ማለት

- የዚህ ጥናት አላማ ፣ ጥቅም ፣ ቅደም ተከተል በተገቢው ሁኔታ አውቀዋል
- ከመፈረምዎ በፊት ማንኛውንም ጥያቄ ለመጠየቅ እድል ተሰጥቷል
- በዚህ ጥናት ለመሳተፍ ፈቃደኛ ነዎት

የተሳታፊው: ፊርማ (የግራ እጅ አውራ ጣት አሻራ) _____

የጠያቂው ሙሉ ስም _____

የጠያቂው ፊርማ _____

ቀን _____

Annex 7- Screening questionnaire for control (Amharic version)

ጥ1. ባለፉት 12 ወራት የማፍጨት ወይም የማንከራፋት አይነት ድምጽ በደረት አካባቢ ስምተው ያውቃሉ?

- A. አይ አላቅም
- B. አዎ አቃለው

ጥ2. ባለፉት 12 ወራት በማንኛውም ሰዓት ከእንቅልፍ ሲነቁ ደረት አካባቢ የህመም ስሜት ይሰማዎታል?

- A. አይ አይሰማኝም
- B. አዎ ይሰማኛል

ጥ3. ባለፉት 12 ወራት በማንኛውም ሰዓት የሰውነት እንቅስቃሴ ካደረጉ በኋላ ወይም አረፍ ብለው ሳለ ትንፋሽ አጥሮት ያውቃል?

- A. አይ አያቅም
- B. አዎ ያውቃል

ጥ4. ባለፉት 12 ወራት በማንኛውም ሰዓት በሰፊ ምክንያት ከእንቅልፍ ነቅተው ያውቃሉ?

- A. አይ አላቅም
- B. አዎ አቃለው

Annex 8 - Survey questionnaire (Amharic version)

በቅድሚያ ይህን መጠይቅ ለመመለስ ፈቃደኛ ስለሆኑ እናመሰግናለን በዚህ ጥናት ላይ ለመሳተፍ እርስዎ የተመረጡት በሳይንሳዊ ዘዴ ነው በመሆኑም የእርስዎ ትብብር ለጥናቱ ውጤታማነት አስፈላጊ ነው። በዚህ መጠይቅ ላይ የሚሞሉት መረጃ ሚስጥራዊነቱ የተጠበቀ መሆኑንና አገልግሎቱም ለጥናቱ ብቻ መሆኑን እየገለጹን ጥያቄዎቹን በታማኝነትና በሀቀኝነት እንዲመልሱ እንጠይቃለን።

ማእከል _____
 የካርድ ቁጥር _____
 መለያ ቁጥር _____
 አድራሻ _____
 ስልክ ቁጥር _____
 ቀን _____

ክፍል 1: ህዝቡ-ነክ፣ ማህበራዊና እኩልሚያዊ ሁኔታ			
ቁ	ጥያቄ	ምርጫ	እለፍ
101	ስንት አመትህ/ሽ ነው?	_____ አመት	
102	የት ነው የምትኖረው/ሪው?	ሀ. ገጠር ለ. ከተማ	
103	ጾታህ/ሽ ምንድነው?	ሀ. ወንድ ለ. ሴት	
104	የሚገኙበት የጋብቻ ሁኔታ?	ሀ. ያላገባ ለ. ያገባ ሐ. የሞተበት / የሞተችበት መ. የፈታ / የፈታች	
105	የሚገኙበት የትምህርት ሁኔታ?	ሀ. መጻፍ ና ማንበብ የማይችል ለ. የመጀመሪያ ደረጃ ትምህርት ሐ. ሁለተኛ ደረጃ ትምህርት መ. መሰናዶ ትምህርት ሠ. ዲፕሎማ ና ከዘበላይ	
106	የሚገኙበት የስራ ሁኔታ?	ሀ. ስራ የሌለው ለ. ስራ ያለው (የመንግስት፣ የግል፣ የራስ) ሐ. ጡረታ የወጣ መ. ተማሪ	
107	ምን ያህል የወር ገቢ አላቸው?	_____ ብር	
108	እምነትህ/ሽ ምንድና?	ሀ. አርቶዶክስ ለ. ሙስሊም ሐ. ፕሮቴስታንት መ. ካቶሊክ ሠ. ሌላ ካለ ይግለጹ _____	

ክፍል 2: የመኖሪያ ቤቱ የቤት ውስጥ ጭስ ሁኔታ			
201	በቤት ውስጥ ስንት ክፍል አለ?	_____ ክፍል በቁጥር	
202	በቤት ውስጥ ምን ያህል ሰው ይኖራል?	_____ ሰው በቁጥር	
203	አማካኝ ምን ያህል ሰው በአንድ ክፍል ውስጥ ይኖራል?	ሀ. ከ አንድ በታች ለ. ከአንድ -ሁለት ሐ. ከሁለት በላይ	
204	በቤት ውስጥ ለመብራትነት የምትጠቀሙበት የሀይል ምንጭ?	ሀ. ፋኖስ / ጋዝ ለ. ኤሌክትሪክ ሐ..ሌሎች ይግለጹ	
205	ምግብ የምታበስሉት የት ነው?	ሀ. ከዋናው ክፍል ጋር ያልተገናኘ ማብሰያ ውስጥ (ኩሽና) ለ. በከፊል ክፍት የሆነ ቦታላይ ሐ. መኖሪያ ቤት ውስጥ መ. ከመኖሪያ ቤት ውጭ ሠ. ሌላ ካለ፣ይግለጹ	ኩሽናን ከመረጣች(If ከ306-3011 ስለዚህ ኩሽና ይሆናል)
206	ምን አይነት የማናፈሻ ስርዓት ትጠቀማላች?	ሀ. ጣሪያውን በመቅደድ ክፍተት በመፍጠር ለ. ከጣሪያው በታች ግንቡን በመብሰት ክፍተት በመፍጠር ሐ. ጭስ ማውጫ በመጠቀም መ. በምናበስልበት ሰዓት መስኮት በመክፈት ሠ. አየር ማቀዝቀዢያ በመጠቀም ረ. ሌላ ካለ ፣ይግለጹ	
207	ምግብ ለማብሰል ምን ያህል ሰዓት ታሰልፋላች?	ደቂቃ _____	
ክፍል 3: የማብሰያ ክፍሉ ገዕታ ሁኔታ			
301	ወለሉ የተሰራው ከምንድነው?	ሀ. ሸክላ አፈር / ጭቃ ለ. ሲሚንት / ሴራሚክ ሐ. ሌላ ካለ፣ይግለጹ	
302	ግድግዳው የተሰራው ከምንድነው?	ሀ. ከጡብ ለ. ከጭቃ ወይም ሸክላ ሐ. ቆርቆሮ መ. ብሎኬት ሠ. ከንክሪት ረ. ፍግ ሰ. ሌላ ካለ፣ይግለጹ	
303	ጣሪያው የተሰራው ከምንድነው?	ሀ. ከሳር ለ. ከፕላስቲክ ሐ. ከቆርቆሮ መ.ሌላ ካለ፣ይግለጹ	
304	ኩሽናው መስኮት አለው?	ሀ. አይ	

		ለ. አዎ	
305	ምግብ በምታዘጋጁ ግዜ መስኮት ይከፈታል?	ሀ. አይ ለ. አዎ	
306	ምግብ በምታዘጋጁ ግዜ በር ይከፈታል?	ሀ. አይ ለ. አዎ	

ክፍል 4 ፤ የጭስ ተጋላጭነትን በተመለከተ

401	1 - ምን አይነት የማብሰያ ምድጃ ነው ያላቹ?		
ሀ.	ባለ ሰዎች ጉልቻ ምድጃ	ሀ. አይ ለ. አዎ	
ለ	ዙሪያውን በጭቃ የተለሰነ ምድጃ	ሀ. አይ ለ. አዎ	
ሐ	አንጭት በማንደድ የሚሰራ የብረት ምድጃ	ሀ. አይ ለ. አዎ	
መ	የተሻሻለው የከሰል ምድጃ	ሀ. አይ ለ. አዎ	
ሠ.	ቡታ ጋዝ ምድጃ	ሀ. አይ ለ. አዎ	
ረ.	ቤንዚን ምድጃ	ሀ. አይ ለ. አዎ	
ሰ.	በጸሀይ በርሃን የሚሰራ ምድጃ	ሀ. አይ ለ. አዎ	
ሸ.	በኤሌክትሪክ የሚሰራ ምድጃ	በኤሌክትሪክ የሚሰራ ምድጃ	
ቀ.	ሌላ ካለ፣	ይግለጹ_	
402	2- በአሁን ሰዓት ለምግብ ማብሰያነት በመጀመሪያ ደረጃ የምትጠቀሙበት የነዳጅ አይነት		
ሀ.	እንጭት	ሀ. አይ ለ. አዎ	
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ሐ	ነጭ ጋዝ	ሀ. አይ ለ. አዎ	
መ	ቤንዚን	ሀ. አይ ለ. አዎ	
ሠ.	ፍግ	ሀ. አይ ለ. አዎ	
ረ.	ሰብላ-ቀር	ሀ. አይ ለ. አዎ	
ሰ.	የጸሀይ ብርሀን ሀይል	ሀ. አይ ለ. አዎ	
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ቀ.	ባትሪ	ሀ. አይ	

		ለ. አዎ	
በ.	የሰም ሻማ	ሀ. አይ ለ. አዎ	
ተ	ሌላ ካለ፤_	ይግለጹ_	
403	3- በህይወት ዘመንዎ ለምግብ ማብሰያነት በመጀመሪያ ደረጃ የምትጠቀሙበት የነዳጅ አይነት		
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ለ	ከሰል	ሀ. አይ ለ. አዎ	
ሐ	ነጭ ጋዝ	ሀ. አይ ለ. አዎ	
መ	ቤንዚን	ሀ. አይ ለ. አዎ	
ሠ.	ፍግ	ሀ. አይ ለ. አዎ	
ረ.	ሰብለ-ቀር	ሀ. አይ ለ. አዎ	
ሰ.	የጸሀይ ብርሀን ሀይል	ሀ. አይ ለ. አዎ	
ሸ.	የኤሌክትሪክ ሀይል	ሀ. አይ ለ. አዎ	
ቀ.	ባትሪ	ሀ. አይ ለ. አዎ	
በ.	የሰም ሻማ	ሀ. አይ ለ. አዎ	
ተ	ሌላ ካለ፤_	ይግለጹ_	
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501	በቤታችሁ ውስጥ ለማዳ እንስሳ አለ?	ሀ. አይ ለ. አዎ	አይ ካሉ ወደ 601 ይለፉ
502	'አዎ' ከሆነ ? የቱ?	ሀ. ድመት ለ. ውሻ ሐ. ወፍ መ. ድመት ና ውሻ ሠ. ድመት ና ወፍ ረ. ውሻ ና ወፍ ሰ. ድመት፣ውሻ ና ወፍ ሸ. ሌሎች	
503	ከለማዳ እንስሳቶቹ ጋ ንክኪ አላችሁ?	ሀ. አይ ለ. አዎ	አይ ካሉ ወደ 601 ይለፉ
504	'አዎ' ከሆነ ለምን ያህል ግዜ?	ሀ. ሁል ግዜ ለ. አልፎ አልፎ	

ክፍል 6፣ የአኗኗር ዘይቤ			
601	በህይወት ዘመንህ/ሽ አጭሰህ/ሽ ታቃለህ/ሽ? ['አዎ' ማለት በያንስ 20 እሽግ ሲጃራ ወይም (360 ግ.ም) የሚመዝን ቶባኮ በህይወት ዘመን ወይም ቢያንስ አንድ ሲጃራ በቀን ወይም አንድ ሰጃራ በሰዓት ለአመት]	ሀ. አይ ለ. አዎ	አይ ካሉ 607ን ይለፉ
602	ማጨስ ስትጀምር ስንት አመትህ/ሽ ነበር?	እድሜ _____	
603	በአንድ ወር ገዜ ውስጥ አጭሰህ ታቃለህ/ሽ?	ሀ. አይ ለ. አዎ	
604	በአማካኝ ምን ያህል ሲጃራ በቀን ያጨሳሉ?	ቁጥር በቀን _____ ቁጥር በሰዓት _____	
605	ሲጃራ ማጨስ አቁመህ ወይም ቀንሰህ ታቃለህ/ሽ?	ሀ. አይ ለ. አዎ	
606	ለሌሎች 12 ወራት ለትንባሆ ጭስ በየጊዜው ተጋላጭ ሆነው ያውቃሉ? ['በየጊዜው' ማለት በአብዛኛው ቀን ና ማታ ማለት ነው]	ሀ. አይ ለ. አዎ	
607	የአልኮል መጠጥ የመጠጣት ሁኔታ?	ሀ. አሁንም እጠጣለው ለ. በፊት እጠጣ ነበር ሐ. ጠጥኜ አለቅም	አይ ካሉ 608ን ይለፉ
608	አሁን የሚጠጡ ከሆን መቼ መቼ?	ሀ. በቀን ለ. በሰዓት ሐ. በወር መ. አልፎ አልፎ	
609	ጭት ቅመው ያውቃሉ?	ሀ. አይ ለ. አዎ ሐ. በፊት	አይ ካሉ 610ን ይለፉ
610	አሁን የሚቅሙ ከሆን መቼ መቼ?	ሀ. በቀን ለ. በሰዓት ሐ. በወር መ. አልፎ አልፎ	
611	ሺሽ አጭሰው ያውቃሉ?	ሀ. አይ ለ. አዎ ሐ. በፊት	አይ ካሉ 612ን ይለፉ
612	አሁን የሚያጨሱ ከሆን መቼ መቼ?	ሀ. በቀን ለ. በሰዓት ሐ. በወር መ. አልፎ አልፎ	
613	እንደ ካናቢስ፣ ሄሮኒን፣ ፔቲዲን፣ ኮኬን የመሳሰሉ መድሀኒቶችን ተጠቅመው ያውቃሉ?	ሀ. አይ ለ. አዎ ሐ. በፊት	አይ ካሉ 614ን ይለፉ
614	የሚጠቀሙ ከሆነ በምን ያህል ግዜ?	ሀ. በቀን ለ. በሰዓት	

		ሐ. በወር መ. አልፎ አልፎ	
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701	ክብደትህ/ሽ ስንት ነው?		
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703	የሰውነት ክብደት ጠቋሚ	ምላሽ አያስፈልገውም	
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801	በቤተሰብ ውስጥ አስም የሚያመው ሰው አለ?	ሀ. አይ ለ. አዎ	አይ ካሉ 803ን ይለፉ
802	አዎ ካላቹ ማን ነው የታመመው?	ሀ. እናት ለ. አባት ሐ. እህት/ ወንድም	
803	የሚከተሉት የህመም አይነቶች አሉባቸው?		
ሀ.	የልብ ህመም	ሀ. አይ ለ. አዎ	
ለ	ግፊት	ሀ. አይ ለ. አዎ	
ሐ	ስኳር	ሀ. አይ ለ. አዎ	
መ	ኩላሊት	ሀ. አይ ለ. አዎ	
ሠ.	ጉቦት	ሀ. አይ ለ. አዎ	
ረ.	ካንሰር	ሀ. አይ ለ. አዎ	
ሰ.	ኤች አይ ቪ	ሀ. አይ ለ. አዎ	
ሸ.	የነርቭ ህመም	ሀ. አይ ለ. አዎ	
ቀ.	ሌላ ካለ	ይግለጹ_	

Annex 9: A manual for training data collectors and supervisors



ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

SCHOOL OF PUBLIC HEALTH

Data collectors and supervisors training manual

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February 2020

Addis Ababa, Ethiopia

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3. Method of the training
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1. Introduction

Asthma is a chronic inflammatory disorder characterized by airway obstruction and hyperresponsiveness. Studies have suggested that household fuel exposure; either biomass or fossil fuel and housing characteristics have been associated with allergy. Recent analysis has also shown an increase in asthma among residential determinants of allergy. But there remains considerable uncertainty about whether this reflects an association with asthma.

2. Objective of the training

The main objective of this training is to provide basic information about the research and data collection process basically how to select the study unit and interview participants with the exact and appropriate way.

3. Method of the training

- Participatory presentation
- Group discussion
- Practical training

4. Training schedule

	Activity	Time
1	Introduction	20 mint
2	Description for data collection procedure	40 mint
3	Description for cases and controls	40 mint
4	Description for questionnaire	20 mint

5. Equipment for data collection procedure

- Information sheet
- Informed consent
- Questionnaire
- Patient card
- Pen
- Pencil
- Summary sheet

6. Payment

- Data collectors and supervisors in the study have payment per questionnaire. The payment is done after the data collection process is completed. The payment is paid by the principal investigator.

7. Responsibility for participants in the data collection process

A. Data collectors responsibility

- Before data collection process data collectors should take training.
- Identify cases and controls based on selection criterias.
- Informed consent should sign based on the informed information sheet.
- Doing interview for study participants based on questionnaire.
- Take basic information of the participant from system card or patient card.

B. Supervisor responsibility

- Before data collection process supervisors should take training.
- Help data collectors if needed.
- Follow data collection process
- Check completeness of the questionnaire and if there is a problem aware the data collectors to solve it.
- Provide materials for data collectors in order to perform the data collection process.

8. Description for selection of cases and controls

- Cases in this study took based on medical history, physical examination and pulmonary function test

1. Medical history

- ✓ Cough (worse at night)
- ✓ Chest tightness
- ✓ Wheezing
- ✓ Difficulty breathing

2. Physical examination finding

- ✓ Thoracic hyper expansion
- ✓ Wheezing during normal breathing
- ✓ Prolonged phase of forced exhalation

- ✓ Rhinorrhea
- ✓ Nasal polyps
- ✓ Atopic dermatitis

3. Pulmonary function test (spirometry)

- ✓ Spirometry is an instrument used to demonstrate obstruction and assess reversibility.
- ✓ Reversibility is determined by
 - A. An increase in forced expiratory volume in one second (FEV1) of greater than or equal to 12% from baseline OR
 - B. An increase greater than or equal to 10% of predicted (FEV1) after inhalation of a short acting B2-agonist.

So the cases are selected especially based on pulmonary function test result.

➤ Controls in this study are patients who are not suffering from asthma and chronic respiratory disease like COPD, lung cancer, PTB and pneumonia based on their medical diagnosis report and screening questioner. The screening questioner basically contains four questions. The answers must be no for all.

- I. Have you had wheezing or whistling in your chest at any time in the last 12 months?
- II. Have you woken up with a feeling of tightness in your chest at any time in the last 12 months?
- III. Have you had an attack of shortness of breath that came on during the day when you were at rest or following strenuous activity at any time in the last 12 months?
- IV. Have you been woken by an attack of coughing at any time in the last 12 months?

NO	Age group	Cases	Controls
1	≤20	≤20- Male ≤20- Female	≤20 ± 2- Male ≤20 ± 2- Female
2	21-40	21-40- Male 21-40- Female	21-40 ± 2- Male 21-40 ± 2- Female
3	41-60	41-60- Male 41-60- Female	41-60 ± 2- Male 41-60 ± 2- Female
4	61-79	61-79- Male	61-79 ± 2- Male

		61-79- Female	61-79 ± 2- Female
5	≥80	≥80- Male ≥80- Female	≥80 ± 2- Male ≥80 ± 2- Female

9. Description for questionnaire

The questionnaire has 5 sub sections these are

- A. Sub-section 1- Demographic and socio economic characteristics**
- B. Sub-section 2- Housing characteristics**
- C. Sub-section 3- House hold fuel exposure characteristics**
- D. Sub-section 4- Pet characteristics**
- E. Sub-section 5-Life style**
- F. Sub-section 6- Medical condition**

Question description

- ✓ Based on our data collection procedure we categorize household fuel in to three
 1. Biomass fuel- which include wood, charcoal, agricultural residues and dung.
 2. Fossil fuel- which include kerosene(paraffin), LPG
 3. Cleaner fuel- which include grid electricity, batteries and solar

And if there is the use of such fuel with in the last 12 months considered like current user . on the other hand if there is the use of such fuel previously in their life time considered like life time user.

- ✓ Age is considered like as right censored i.e. we count in years when the month is completed. For example, if an individual whose age was 20 years with six month we took it like 20 year.
- ✓ Time spent for cooking present approximately in minute.
- ✓ Pet contact categorized in to two regular and some contact.
 1. Regular contact – a contact with a pet at least once a day and five times per week.
 2. Some contact- a contact with a pet less than once a day and five times per week.
- ✓ Alcohol drinking status categorized in to three
 1. Ever drinker – a person who had ever drink alcoholic beverage during his/her life.
 2. Ex-drinker- an ever drinker who had not drink alcohol with in the last 12 months.
 3. Current drinker- an ever drinker who had drunk alcohol with in the last 12 months.

- ✓ Physical activity categorized in to two
 1. Physically active – a person who engage in moderate physical activity for at least 30 minute per day , 5 or more days per week or vigorous physical activity for at least 20 minute per day 3 or more days per week.
 2. Physically inactive – a person who didn't engage in moderate physical activity for at least 30 minute per day , 5 or more days per week or vigorous physical activity for at least 20 minute per day 3 or more days per week.
- ✓ Smoking in this study categorized in to three.
 1. Ever smoker - A person who had smoked at least 20 packs of cigarettes or 12 oz (360 grams) of tobacco in a lifetime, or at least one cigarette per day or one cigar a week for one year was called an ever smoker.
 2. Ex-smoker - An ever smoker who had not smoked with in the last 12 months or with in the last 6 months.
 3. Current smoker- An ever smoker who had smoked with in the past 30 days.
- ✓ Weight of an individual in this study is expressed in a unit called kilogram.
- ✓ Height of an individual in this study is expressed in a unit called centimeter.

10. Data collection procedure

- ❖ Introduce yourself to participants after greetings
- ❖ Read the information sheet for participants
- ❖ Ensure participants understanding about research and data collection process.
- ❖ Answering politely if there is any question which participants want to elaborate.
- ❖ Ask their permission to engage in the study without any enforcement.
- ❖ If they are agree to participate in the study , then we will sign them on the informed consent form.
- ❖ Finally start the interview

Thank you

CURRICULUM VITAE 1

1. GENERAL INFORMATION

- FULL NAME- YONAS ABEBE MEZEMIR
- SEX- MALE
- DATE OF BIRTH- 19/03/1987 EC
- MARITAL STATES- SINGLE
- NATIONALITY- ETHIOPIAN
- ADDRESSES- E-MAIL- YONASABEBE3367@GMAIL.COM

MOBILE- 0944162181

ADDIS ABABA, ETHIOPIA

2. EDUCATIONAL BACKGROUND

Education	Study Area	Obtain From	Points	Graduation year
Certificate	Primary education	Mesrak Jegnoch primary school Dire Dawa	97.9%	2000 E.C
Certificate	Secondary education	Sabeyan secondary school Dire Dawa	3.8	2002 E.C
Preparatory education	Natural science	Sabeyan preparatory school Dire Dawa	461	2004 E.C
Bachelor of science	Public health officer	Addis Ababa university	3.61	2008 E.C

3. LANGUAGE ABILITY

language	Reading	Writing	Speaking	Understanding
Amharic	Fluent	Fluent	Fluent	fluent
English	Very good	Very good	Very good	Very good

4. TRAINING

- 1 .Basic computer skill (EXCEL, WORD, POWER POINT,)
2. Basic journalism and communication skill

5. WORK EXPERIENCE

NO	POSTION	PLACE OF WORK	DATE OF WORK
1	Junior public health professional	Arsi zone, munesa woreda, kenchere health center	25/01/2009-25/09/2009
2	Junior food , health related and health facilities inspection and licencing officer	Arada subcity woreda 09 Food, Medicine, Health Care Administration and Control Authority (FMHACA)	15/09/2009-27/09/2010
3	Assistance lecturer (part-timer)	Alkan health science , business and technology college	1/10/2010-1/2/2011

1. Arsi zone, munesa woreda, kenchere health center , Junior public health professional.

- The main duties and responsibility is
- ✓ Work in both OPD and IPD (i.e treatment of patients and decision on referral)
- ✓ Work in emergency (trauma management, drainage...)
- ✓ Provide health education (communicable disease, personal and environmental hygiene, STI, and first aid)
- ✓ Organize and document different patient data for different purpose.

2. Arada subcity woreda 09 Food, Medicine, Health Care Administration and Control Authority (FMHACA), Junior food , health related and health facilities inspection and licencing officer

- The main activities and responsibility is
- ✓ Provide technical support and health education in different areas for example hygienic, standard operating procedure, solid and liquid waste management ,food handling, medicine preservation....)
- ✓ Monitor and evaluate institutions then issue, renew, suspend and revoke certificate of competence for health, health related and food processing institutes.
- ✓ Design and develop different plans, programs, strategies, techniques...in order to create awareness in food and health related institutions.
- ✓ Ensure proper disposal of expired medicine and foods and their raw material.
- ✓ Ensure that handling and disposal of solid and liquid wastes from different institutions are not harmful to public health.
- ✓ Control illegal food, medicine and health services and take appropriate measure.
- ✓ Ensure the availability of necessary hygienic requirement in controllable health related institution.

- ✓ Serve as medicine, food, health professional and health and controllable health related institutions information center.

3. Alkan health science , business and technology college, Assistance lecturer (part-timer)

- The main activities and responsibility is
 - ✓ Teaching different subjects like environmental health, health promotion.
 - ✓ Assist other instructors in different activities.
 - ✓ Coordinate college activities.

6. REFERENCE

No	NAME	JOB	TELL NO
1	Mr. Werissaw h/Selassie	Head, under graduate department of public health officer, AAU	+251912005718
2	Mr. Debebe Yosef	Kenchere health center manager	+251904115919
3	Mr. Kumela Fufi	Arada subcity woreda 9 FMHACA Manger	+251910393505
4	Mr Dawit Tadesse	AHSBTC Community health faculty dean	+251911466091

Annex 11: Assurance of principal investigator

ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ethical and technical Conduct of the research project and for provision of required progress reports as Per terms and conditions of the Research Publications Office in effect at the time of Grant is forwarded as the result of this application.

Name of the student: _____

Date. _____ Signature _____

Approval of the primary Advisor

Name of the primary advisor : _____

Date. _____ Signature _____