



**COLLEGE OF HEALTH SCIENCE**

**SCHOOL OF PUBLIC HEALTH**

PREVALENCE OF OCCUPATIONAL ASTHMA AND ASSOCIATED FACTORS AMONG  
TANNERY WORKERS IN ADDIS ABABA, ETHIOPIA

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## TABLE OF CONTENTS

ACKNOWLEDGEMENTS .....	i
TABLE OF CONTENTS.....	ii
LIST OF TABLES .....	v
LIST OF FIGURES .....	vi
ACRONYMS .....	vii
ABSTRACT.....	viii
1. INTRODUCTION .....	1
1.1. Background .....	1
1.2. Statement of the problem .....	2
1.3. Significance of the Study .....	3
2. LITERATURE REVIEW .....	4
2.1. Prevalence of Occupational Asthma among Tannery Workers .....	4
2.2. Associated Factors and Occupational Asthma among Tannery Workers .....	5
2.2.1. Socio-demographic factors .....	5
2.2.2. Personal Factors and Occupational Asthma among tannery workers .....	6
2.2.3. Behavioral Factors and Occupational Asthma among tannery workers .....	6
2.2.4. Work Environment Factors and Occupational Asthma Prevalence among tannery workers .....	7
2.3. Research Questions .....	9
3. OBJECTIVE .....	10
3.1. General Objective.....	10
3.2. Specific objectives.....	10
4. METHODS AND MATERIALS.....	11
4.1. Study Area.....	11
4.2. Study Period .....	11
4.3. Study Design .....	12
4.4. Population.....	12
4.4.1. Source population .....	12
4.4.2. Study Population.....	12
4.5. Inclusion and Exclusion Criteria .....	12
4.5.1. Inclusion criteria .....	12

4.5.2. Exclusion criteria .....	12
4.6. Sample size determination and Sampling methods.....	12
4.6.1. Sample size determination .....	12
4.6.2. Sampling procedure .....	14
4.7. Study variables .....	16
4.7.1. Dependent variables.....	16
4.7.2. Independent variables .....	16
4.8. Study Tools and Data collection procedures.....	16
4.8.1. Study Tools .....	16
4.8.2. Data collection procedures.....	16
4.9. Data Management and Quality Assurance .....	16
4.10. Data processing and Analysis .....	17
4.11. Operational Definition.....	17
4.12. Ethical consideration .....	18
4.13. Dissemination and Utilization of the result.....	18
5. RESULT .....	19
5.1. Socio-demographic characteristics of the study population .....	19
5.2. Work Environment Factors.....	21
5.3. Personal and Behavioral Factors.....	23
5.4. Prevalence of Occupational Asthma in Tannery Industries of Addis Ababa .....	25
5.4.1. Prevalence of Occupational Asthma among socio-demographic characteristics of respondents.....	25
5.4.2. Prevalence of Occupational Asthma among work environment factors of respondents.....	26
5.5. Result of work place observation:.....	27
5.6. Factors associated with the occurrence of occupational asthma: Multivariate analysis .....	28
6. DISCUSSION .....	30
7. STRENGTH AND LIMITATION OF THE STUDY .....	33
7.1. Strengths of the study.....	33
7.2. Limitations of the study.....	33
8. CONCLUSION AND RECOMMENDATIONS .....	34
8.1. Conclusion.....	34

8.2. Recommendations .....	34
9. REFERENCES .....	35
10. ANNEXES.....	39
Annex I: Study Information Sheet in English.....	39
Annex II: Consent form in English .....	40
Annex III: English Version Questionnaire.....	41
Annex IV: Study Information Sheet in Amharic .....	45
Annex V: Informed Consent in Amharic .....	45
Annex VI: Amharic Version Questionnaire.....	46
Annex VII: Work place observation checklist .....	50
Annex VIII: Screening Questions for participants going to participate on the interview.....	51

## LIST OF TABLES

Table 1: Socio-demographic characteristics of study participants among tannery industry in Addis Ababa, Ethiopia, August 2018 .....	20
Table 2: Work Environment factors of the Selected Tanneries in Addis Ababa, Ethiopia, August, 2018.....	22
Table 3: Personal and behavioral factors of respondents working in tannery factory of Addis Ababa, Ethiopia, August, 2018.....	24
Table 4: Occupational Asthma Prevalence among some socio-demographic characteristics of respondents working in tannery factory of Addis Ababa, Ethiopia, August, 2018 .....	25
Table 5: Occupational Asthma Prevalence among some work environment factors of respondents working in tannery factory of Addis Ababa, Ethiopia, August, 2018 .....	26
Table 6: Multivariate logistic regression analysis of the relative effect of socio-demographic, work environment, personal, and behavioral factors on the prevalence of occupational asthma in tanneries of Addis Ababa, Ethiopia, August 2018.....	29

## LIST OF FIGURES

Figure 1: Conceptual framework for the study of occupational asthma and its associated factors among tannery workers in Addis Ababa, 2018.....	9
Figure 2: Sampling procedure and proportional sample size distribution diagram in selected tanneries of Addis Ababa, Ethiopia, August, 2018.....	15
Figure 3: Occupational Asthma prevalence among sections of tanneries in Addis Ababa, Ethiopia, August 2018 .....	27

## ACRONYMS

BMRC	British Medical Research Council Questionnaire
COPD	Chronic Obstructive Pulmonary Diseases
DALYs	Daily Adjusted Life Years
ELICO	Ethiopia Leather Industry Corporation
ELIDI	Ethiopia Leather Industry Development Institute
GDP	Growth Domestic Product
IHME	Institute for Health Metrics and Evaluation
ILO	International Labor Organization
MOH	Ministry of Health
MOLSA	Ministry of Labor and Social Affairs
MSDS	Material Safety Data Sheet
NGO	Non- Governmental Organization
OA	Occupational Asthma
PPE	Personal Protective Equipment
PPS	Probability Proportional to Size
RADS	Reactive Airway Dysfunction Syndrome
SPSS	Statistical Package for Social Science
URTI	Urinary Tract Infection
WHO	World Health Organization

## ABSTRACT

**Background:** Out of 334 million global prevalence of asthma, around 15% is attributable to occupational asthma. According to the 2014 WHO report, the disease affects about 5% of the global population, mainly in low and middle-income countries. Tannery workers perform many operations with different exposures to varieties of chemicals, which are harmful for their health through causing occupational diseases including asthma.

**Objectives:** To assess the prevalence of occupational asthma and associated factors among tannery industries workers in Addis Ababa, Ethiopia, 2017/18.

**Methods:** An institutional based cross-sectional study was conducted on the study participants of 348 tannery workers, which were selected by systematic random sampling in Addis Ababa from February to April 2018. Data collection performed by trained data collectors using pre-tested questionnaires and by work place observation. The collected data was analyzed by using IBM SPSS version 24. Descriptive statistics was done for all variables in the study and displayed as frequency, percentages, means and standard deviations. A bivariate and multivariate analysis was used to identify associated factors of occupational asthma with 95% CI and level of significant association (p-value of 0.05).

**Result:** A total of 348 (97.8%) respondents were included in the study. Out of these, occupational asthma prevalence was 35.3% (n=123). Out of the total respondents, 57.8% were males and 56.3% ages were less than 35 years and their mean age were 34.53 years. Only 17% of respondents had trained on PPE use. The odds of illiterate respondents were 2 times more likely to be asthmatic (AOR = 2.021; 95% CI: 0.645, 6.328) than respondents of educational level > grade 12. A work experience of > 20 years had 2 times more likely to be asthmatic than respondents of 1-5 experiences in years (AOR = 1.981; 95% CI: 1.008, 3.892).

**Conclusion and Recommendation:** The overall prevalence rate of occupational asthma in tanneries of Addis Ababa was 353 per 1000 exposed workers. MOLSA, AAU, MOH, and Ministry of Industry should give attention and enforce an integrated emphasis to establish and properly apply an active and functional health and safety programs through strengthen strict supervision of workplace and working conditions.

# 1. INTRODUCTION

## 1.1. Background

Occupational asthma (OA) is asthma caused by exposure to certain substances at workplace and characterized by variable airflow obstruction, airway hyper-responsiveness, and airway inflammation attributable to a particular exposure in the workplace and not due to stimuli encountered outside the workplace [1-5]. It is one of the major work-related diseases that leads to death of a large number of workers. There are two main classes of occupational asthma depending on the causative agents: OA induced by workplace sensitizers called allergic or immunological (with a latency period); and OA caused by irritants known as non-allergic or non-immunologic, irritant-induced asthma including reactive airways dysfunction syndrome (RADS). It starts during the time of adulthood and induced by exposure to certain immunologic or non-immunologic stimuli found in the workplace [1, 2, 4, 6].

Tanning industry is one of the work places where workers exposed to different chemicals and sensitizers. There are three major sections or stages in which the major processes of tanning take place and in which the majority of employees are working and exposed to chemicals: Preparatory stage called beam house is the section in which Soaking, Liming, De-fleshing, De-liming, Bating, and Pickling takes place. After preparatory phase, tanning stage gets start and there are different types of tanning applied including Vegetable tanning, Aldehyde tanning, Synthetic tanning and Chrome tanning. Tanning stage followed by Post tanning (Finishing) operations like Slamming, Splitting, Skiving, Neutralizing, Dyeing, Greasing, Drying and Finishing. Finally, the leather surface coated with dyes to remove scars or damages [7-9].

In the tanning industries more than 170 types of chemicals used in leather tanning process. Out of these, sulphuric acid, tri-chromium, chromium sulphate, ammonium sulphate, formaldehydes and different dyes are the main chemicals that cause occupational asthma [10-15]. This is not only because of the disagreeable odor emanating from the decomposition of proteinous waste materials and the presence of sulphide, ammonia and other volatile organic compounds associated with tanning activities but also caused by biological, toxics, and carcinogenic agents which are used in the process of tanning [16-18]. The exposure rate of tannery workers to these chemical compounds is increasing [18-20]. However, to the knowledge of the researcher, no

published data are available on prevalence and associated factors of occupational asthma in tannery workers of Addis Ababa, Ethiopia. Thus, this study aimed to estimate prevalence of occupational asthma and to identify risk factors associated with it in tannery workers of Addis Ababa, Ethiopia.

## **1.2. Statement of the problem**

Global asthma report of 2014 reported that, asthma is one of the major public health problems with a global prevalence of 334 million and an African prevalence of 50 million people [21] and current trends suggest that an additional 100 million people may be living with asthma by 2025 [22]. Out of these, around 15% is attributable to occupational asthma[6]. The World Health Organization(WHO) estimates about 250,000 deaths from asthma every year, mainly in low and middle-income countries [22].

In developing countries, the workforces probably have even more extensive occupational exposures than in high-income countries, but smaller figures of the occurrence of occupational asthma reported that there is likely to be a problem of under detection and that the methodology to assess the occurrence is not optimal [23].

According to a recent comparative risk assessment of occupational hazards conducted by World Health Organization, respiratory disease is the major occupational causes of death in developing countries [1, 24]. The specific diseases in the tannery industries are associated with exposure to causative agents in the industries and the extent to which the workers exposed to the agents [6]. Moreover, it is in turn dependent upon the job category of workers within the industry [25] and the condition worsened by socio-demographic factors, work environment factor, behavioral and Personal factors of workers on their work in the tanneries [4, 26, 27].

Some of the chemical compounds which are used in tanning industries of Addis Ababa and the unpleasant odors that is formed by the interaction with the proteinoous substances of the skin emanated from the industry can cause occupational asthma [28]. In addition, the work environment is one of the major contributors for the cause of occupational asthma as there is not enough space in the working sections, no proper windows for air movement and the workers are not regular use of PPE during work [5, 28].

### **1.3. Significance of the Study**

Occupational morbidity and death in most developing countries including Ethiopia are becoming a serious public health problem. Tanning industry has been identified as one of the most hazardous industries in many parts of the world. As there is growing activities and concerns of occupational health in an area regarded with protecting the safety, health and welfare of people engaged in work such as tannery industries, it is crucial to see the problem and perform study for better intervention. However, there is no study done on prevalence of occupational asthma and associated factors among tannery industry workers in Addis Ababa, Ethiopia. Therefore, this study will fill this gap by assessing the prevalence of occupational asthma and associated factors among tannery industry workers in Addis Ababa, Ethiopia.

The finding of this study will help for the development of effective preventive strategies and useful in the development of occupational asthma epidemiology. This study provided statistical evidences and it will serve as base line information to undertake studies on similar settings. In addition, it helps Ministry of Health (MOH), Ministry of Labor and Social Affairs (MOLSA), and other interested governmental and Non- Governmental Organizations (NGO) to improve occupational health and safety and occupational health services at the work place. Moreover, it will be used as baseline information for policy makers and other researchers.

## 2. LITERATURE REVIEW

### 2.1. Prevalence of Occupational Asthma among Tannery Workers

A study done in Karachi, Pakistan on adult male leather tannery workers showed that prevalence of adult asthma was 10.8% (69/641) and the prevalence of work-related asthma was 5.3% (34/641) [2]. As the study done in India and Sweden 2006 and 2009 respectively, there has been a varying prevalence of occupational asthma which was between 2.2% and 38% among leather tannery workers in India [2]. Likewise, a wide range of estimates between 2% to 45% in Sweden [18], with moderate to high exposures at workplace to be significantly associated with asthma [2]. According to the finding, whistling symptoms in 20% of the group, awakening from sleep due to a tightness of chest in 23%, difficulty in breathing in 24%, excessive coughing in 25%, and out of breath on a usual walk in 41% [12].

As a study done in Bangladesh, Dhaka on Disease and Health Condition of Tannery workers in 2015, Fish sellers, Mechanic workers and Cleaners in different areas of Dhaka City, Tannery workers showed a higher prevalence of respiratory symptoms (30%) compared to the control group (10%) [12, 26].

As the study done on prevalence of respiratory symptoms in Karachi, Pakistan found that only 11(7%) of tannery workers were diagnosed with asthma by a qualified physician. In the study, only 32(20%) had a history of whistling sound. In addition, 37(23%) were awoken from sleep due to tightness in the chest. About 39(24%) accepted that they were having a history of awakening from sleep due to difficulty in breathing. Similarly, 40(25%) were awoken from sleep due to excessive coughing. Also, 66(41%) had a shortness of breath during a usual walk, 52(33%) considered that symptoms were related to work, and 66(41%) had sneezing [12, 29].

Another study conducted on Prevalence of Health Diseases among Bangladeshi Tannery Workers and Associated Risk Factors revealed that the prevalence of occupational asthma was 50% [26, 30].

Results of questioning about asthma on respiratory problems in tannery workers of Istanbul in 2007 indicated that some 20.30% of the people who answered the questions about asthma had wheezing and a whistling sound while breathing. Half of the people with crackling respiration complaints also complained of shortness of breath (9.0%). Coughing attacks and a feeling of

pressure on their chest or discomfort on breathing lasting one year was 13.60% while those whose dyspnea made breathing an effort was almost 13.0% [11].

According to another study on Respiratory Problems in Tannery Workers in Istanbul 2007, the number of people with possible asthma diagnosed through questions during the interview was 263 (36.02%) of the total. In some of the cases with respiratory symptoms, problems were worse on the first workday of the week and after any day off. Respiratory symptoms appeared in 53 (20.2%) of the workers on their first weekday back at work [11]. On similar study on the study of clinical examination, symptoms of those workers given a physical examination wheeze and rhonchus, which is a sign of bronchial obstruction detected in 71 (9.72%) people. Complaints from those cases with suspected asthma disappeared in 81 of 263 (30.8%) workers but were unchanged in the remaining 182 (69.2%) during holidays [11].

Although, there is scarcity of study on prevalence asthma in some countries of Africa including Ethiopia, the study done in Congo, Kinshasa, on Prevalence and determinants of asthma among adults showed that in South Africa, Nigeria, Tanzania and Cameroon have reported prevalence of 3.8%, 2%, 3.3% and 2.7%, respectively [16].

## **2.2. Associated Factors and Occupational Asthma among Tannery Workers**

### **2.2.1. Socio-demographic factors**

The study on prevalence and determinants of asthma in adult male leather tannery workers in Karachi, Pakistan: a cross sectional study showed that, the living condition/residency of individuals are influenced by the level and the type of profession they have learnt as it has strong effect on attitude and awareness related to workplace and family health and hygiene [2]. Because low awareness of health and safety would make more vulnerable to illness including occupational asthma [2, 25]. Education is one of key determinants of lifestyle and provides people with the skill and knowledge that can lead to a better quality of life [2, 25, 30]. Illiterate men (2.6%) and women (2.1%) had a much higher prevalence of asthma than those with middle school or higher education [25]. Moreover, with multivariable logistic regression model showed that, after considering the literacy effects the leather tannery workers were more likely to be asthmatic, if they were illiterate (adjusted OR = 2.13), of Pathan ethnicity (adjusted OR = 2.69).

According to the study on Prevalence and risk factors for self-reported asthma in an adult Indian population: a cross-sectional survey in 2013, indicated that there are strong associations observed between age and asthma prevalence [25]. In addition, it associated with sex and marital status, men (5.6%) and women (2.9%) who were widowed/ divorced/separated/deserted were more likely to report asthma than those who were not married or were currently married.

## **2.2.2. Personal Factors and Occupational Asthma among tannery workers**

### **2.2.2.1. Personal Protective Devices Use**

Occupational health risks can be prevented by applying a hierarchy of occupational control measures [i.e. hazard elimination, substitution, engineering controls, safe work practices and, where these are not possible, personal protective equipment (PPE)] used [4, 10]. Personal protective equipment in combination with other control measures as mentioned above, if necessary, is important to protect workers from exposure.

A study conducted among tannery workers at Kasur, Pakistan in 2009 found that personal protective equipment has a definite role in prevention of disease at work. The tannery worker should use appropriate respiratory equipment for prevention of work-related asthma. It found that only 5.3% of the workers were using a facemask. The prevalence of bronchial asthma was 3.1% among those using a facemask as compared to 9.27% who were not using mask. It found that in those who diagnosed with bronchial asthma, 82% were not using facemask. This shows that facemask use can reduce the prevalence of bronchial asthma in tannery workers [18].

## **2.2.3. Behavioral Factors and Occupational Asthma among tannery workers**

Behavioral factors of an individual such as alcohol consumption, cigarette smoking, chat chewing and other similar characteristics have their own contribution in the development of respiratory problems.

### **2.2.3.1. Smoking and Occupational asthma**

A case-control study done on Prevalence of Respiratory Symptoms, Bronchial Asthma and Obstructive Lung Disease among Tannery Workers during 2010-2011 in Karachi, Pakistan found that smoking is a major risk factor for disease burden and with ever-smoked (adjusted OR = 2.22). According to the study on Disease and Health Condition of Tannery workers, Fish sellers,

Mechanic workers and Cleaners in different areas of Dhaka City on 25 to 34 of age respondents are addicted on smoking (25.64%)[26].

#### **2.2.3.2. Alcohol consumption and Occupational asthma**

In the study conducted on Prevalence of Respiratory Symptoms, Bronchial Asthma and Obstructive Lung Disease among Tannery Workers during 2010-2011 in Karachi, Pakistan, within this result some of respondents are addicted to Alcohol (23.7 %) [26]. It irritates bronchi, leads to bronchial hyper-responsiveness and sensitizes airways to occupational allergens. It is a significant predictor of wheezing and leads to a high prevalence rate of bronchial asthma [19].

#### **2.2.3.3. Chat chewing and Occupational asthma**

According to the study done on Chat chewing Practice and Associated Factors among Adults in Ethiopia in 2011, the overall prevalence of chat chewing was 15.3%, which is lower as compared to Yemen and Uganda and it has an impact on respiratory symptom [31]. A small-scale study conducted in Butajira, Ethiopia reported that lifetime experience of chat chewing was 55.7% and the prevalence of current use was 50%, which is higher than this national report. This large variation might be due to measurement and methodological differences [31].

#### **2.2.4. Work Environment Factors and Occupational Asthma Prevalence among tannery workers**

A study had done in Karachi, Pakistan with cross-sectional study design on prevalence and determinants of asthma in adult male leather tannery workers. According to this study, it showed a significant interaction between allergy and duration of work; those who have allergy were more likely to have asthma if their duration of work was 8 years (adjusted OR = 2.26) and this relationship was even stronger if duration was 13 years (adjusted OR = 3.67) [2].

According the study on Disease and Health Condition of Tannery workers, Fish sellers, Mechanic workers and Cleaners in different areas of Dhaka City showed that there is a problem in hygiene and ventilation status of tannery industries as many dusts and fumes make the lights dim. Furthermore, there is no chance of sun light on the ground floor to enter. On the ground floors, there are no windows or extra doors apart from the main gate. There are only two ventilators with adjuster fans; however, the adjuster fans do not work and over-sweating makes them tired, and creates breathing problems because of the scarcity of fresh air [26]. It was

explained that the factories are exposing huge amount of toxic substances and heavy metals that lead to many health problems including asthma [26]. The tanneries emit bad odor and pollute the air beyond tolerable limits. The tannery workers had mean duration of work at tanneries for  $6.99 \pm 4.86$  years [26].

In summary, the relation between independent variables used in this proposal such as socio-demographic factors, behavioral factors, personal factors and work environment factors expected to contribute and affect the prevalence of occupational asthma directly and/or indirectly. For instance, socio-demographic factors expected to influence behavioral and work environment factors and personal factors directly and indirectly, thereby resulting in a great deal of respiratory health symptoms. Personal factors, behavioral factors and work environment factors expected to affect each other. The brief summary charted in the figure one bellow as conceptual framework putting into consideration of factors.

## Conceptual Framework on Occupational Asthma and its associated factors

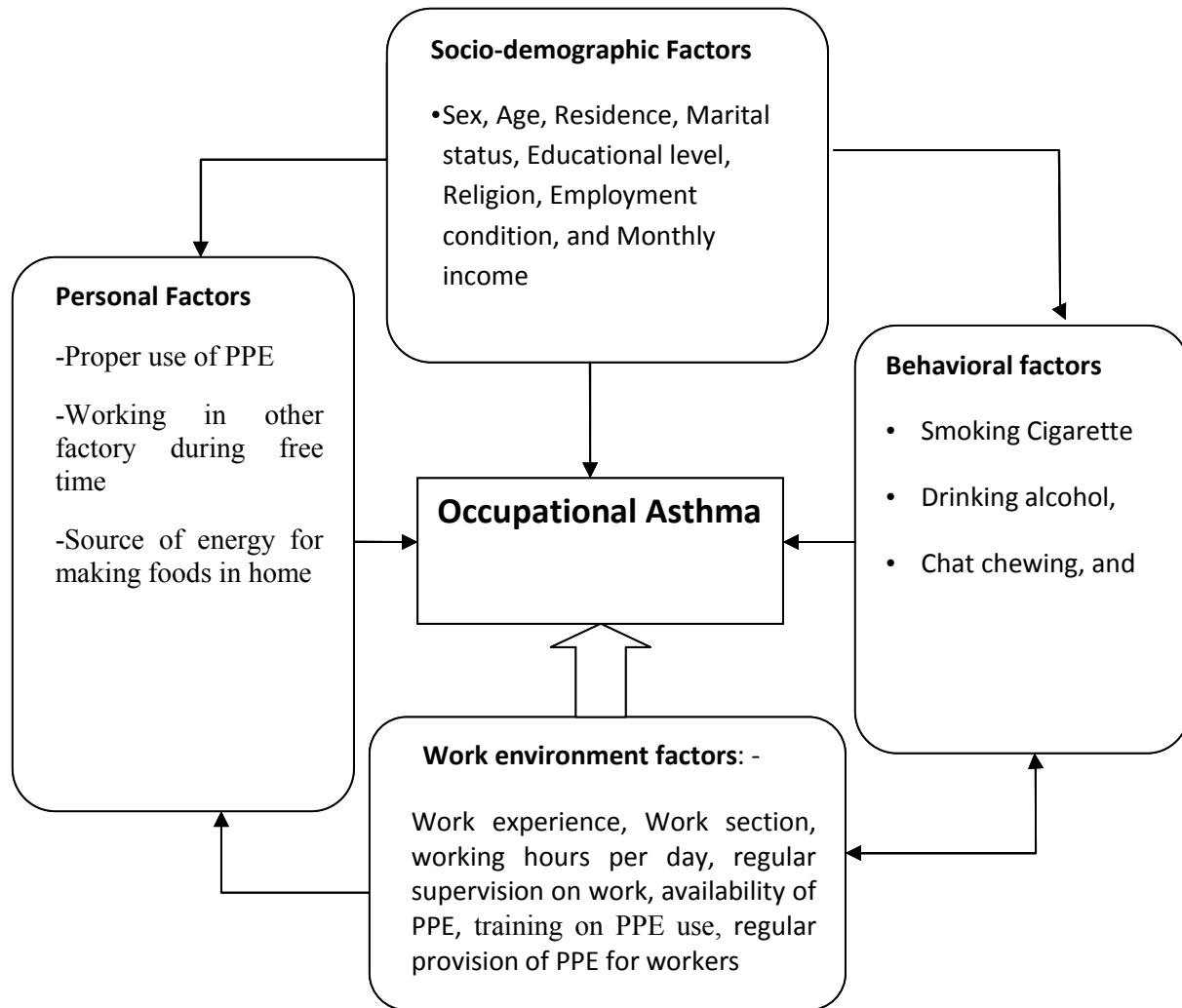


Figure 1: Conceptual framework for the study of occupational asthma and its associated factors among tannery workers

Source: Adopted by reviewing different literatures [28]

### 2.3. Research Questions

- ❖ What is the prevalence of occupational asthma among tannery industry workers in Addis Ababa?
- ❖ What are the associated factors for occupational asthma among tannery industry workers in Addis Ababa?

### **3. OBJECTIVE**

#### **3.1. General Objective**

To assess the magnitude of occupational asthma and associated factors among tannery workers of Addis Ababa, Ethiopia, 2017/18

#### **3.2. Specific objectives**

1. To determine the prevalence of occupational asthma among the tannery workers
2. To identify factors associated with occupational asthma among the tannery workers.

## 4. METHODS AND MATERIALS

### 4.1. Study Area

The study was conducted in Addis Ababa city. Addis Ababa is a capital city of Ethiopia and a seat of African Union with an area of 530 km<sup>2</sup> and a total population of around 4.3 Million. It has 10 sub- cities.

Addis Ababa found at latitude of 8° 58' N and longitude of 38° 47' E and with an elevation of 2324 m (7625 ft.). The city has a complex mix of highland climate zones, with temperature differences of up to 10 °C (18 °F), depending on elevation and prevailing wind patterns. The high elevation moderate temperatures year-round, and the city's position near the equator means that temperatures are very constant from month to month. As such, the climate would be maritime if its elevation was not taken into account, as no month is above 22 °C (72 °F) in mean temperatures.

Mid-November to January is a season for occasional rain. The highland climate regions characterized by dry winters, and this is the dry season in Addis Ababa. During this season, the daily maximum temperatures are usually not more than 23 °C (73 °F), and the nighttime minimum temperatures can drop to freezing. The short rainy season is from February to May. During this period, the difference between the daytime maximum temperatures and the nighttime minimum temperatures is not as great as during other times of the year, with minimum temperatures in the range of 10–15 °C (50–59 °F).

As the country, Ethiopia, is developing there are a large number of manufacturing industries including tannery industries. There are twenty-six tanneries in the country, twenty-two of which are private and four of them are government owned, and together they employ 4577 persons. Most of the tanneries found in different regions of the country were in Addis Ababa. Out of the six tanneries in Addis Ababa, four of the tanneries found in Akaki Kaliti areas and two of them found in Kolfe Keranio sub cities with a total employee of 2333 persons [32].

### 4.2. Study Period

Study was conducted from January to April 2018.

### **4.3. Study Design**

An institutional based cross-sectional study design was used to assess prevalence of occupational asthma and associated factors among tannery workers in Addis Ababa.

### **4.4. Population**

#### **4.4.1. Source population**

All workers of the tannery industries found in Addis Ababa are source population of the study.

#### **4.4.2. Study Population**

Selected participants from the selected sections of the selected tannery industries found in Addis Ababa.

### **4.5. Inclusion and Exclusion Criteria**

#### **4.5.1. Inclusion criteria**

Employees who are directly engaged in the three stages (Beam house (pre-tanning), tanning, and finishing sections) of tanning processes will be included in the study. In addition, employees who have been working at least for one year in the tannery were included in the study.

#### **4.5.2. Exclusion criteria**

- Workers who had been out of the selected sections for more than three months by some cases in study year,
- Employees who have a confirmed asthma and/or other respiratory symptoms by a doctor before joining the tannery,
- Employees who have confirmed respiratory problems other than asthma by a doctor after hired in this tannery, and employee who have family history of asthma were excluded from the study.

### **4.6. Sample size determination and Sampling methods**

#### **4.6.1. Sample size determination**

To determine the sample size, the formula for single population proportion and double population proportion for first and second specific objectives respectively used. Based on the reported health effects of occupational asthma prevalence in tanneries of Bangladesh, the prevalence in range of between 25% and 35% occupational asthma was used [18].

To determine the sample size for the first objective based on the reported health effects during tanning process, the prevalence of 30% occupational asthma among tannery workers was used [2, 12, 18, 26].  $Z_{\alpha/2}$  = the standard normal deviate corresponding to the confidence level of 95%, i.e., 1.96, with 5% degree of precision and 80% detection power was used and none response rate of 10% was added.

**Sample size for the first objective:**

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

$$n = \frac{(1.96)^2 * 0.3(1-0.3)}{(0.05)^2}$$

**n = 323**

P = 30%

d = 5%

Where:

P = prevalence of occupational asthma among workers in tannery industry

d = margin of error

n = sample size

$Z_{\alpha/2}$  = standard score corresponding to the confidence level of 95%, i.e., 1.96

The assumption, there was no national or local data on the prevalence of occupational asthma in tannery industry. Hence, prevalence of 30 % used in order to maximize the sample size.

Considering 10 % non-response rate, the sample size will be:

**n = 323 + (323 x 10%) = 356 respondents**

**Sample size for the second objective:**

The sample size for the 2<sup>nd</sup> objective was calculated using double population proportion formula based on the following assumptions: proportion of occupational asthma among PPE users assumed to be 50% [3, 11]. Assuming odds of respiratory symptoms among non-users is 2 times higher than PPE users.

$$n = \frac{(Z_{\alpha/2})^2 \sqrt{(1+1/r) p(1-p) + z\beta \sqrt{p_1(1-p_1) + p_2(1-p_2)^2}}}{(P_1 - P_2)^2}$$

Where

P1 = 50 % (proportion of occupational asthma among PPE users)

$P_2=67\%$  (proportion of occupational asthma among non-PPE users)

$P=\text{pooled proportion } (p_1+p_2/1+r) = 0.585$

$\alpha=0.05$  the probability of committing type one error =1.96

$\beta=20\%$  of rejecting a true difference

$r= 1$  since the proportion of  $n_1$  to  $n_2$  is 1 to 1  $n_1=148$ ;  $n_2 = 148$

By considering 10% none response rate  $n=326$

Therefore, the final sample size was **356**.

#### **4.6.2. Sampling procedure**

##### **4.6.2.1. Selection of Tannery Industries**

Out of the six tanneries found in Addis Ababa city, four of them were selected randomly by lottery method.

##### **4.6.2.2. Sampling**

First, the actual numbers of employees in the selected tanneries' and the three major tannery-processing sections of the selected tanneries identified. Then, sample size was calculated based on proportion to size of employees in each section of the selected tanneries (as shown on figure 2 below). Finally, after receiving list of employees from the selected tanneries' human resource departments, systematic random sampling on each selected section was used to get the desired sample size after assigning number to each employee on the sampling frame to minimize selection bias.

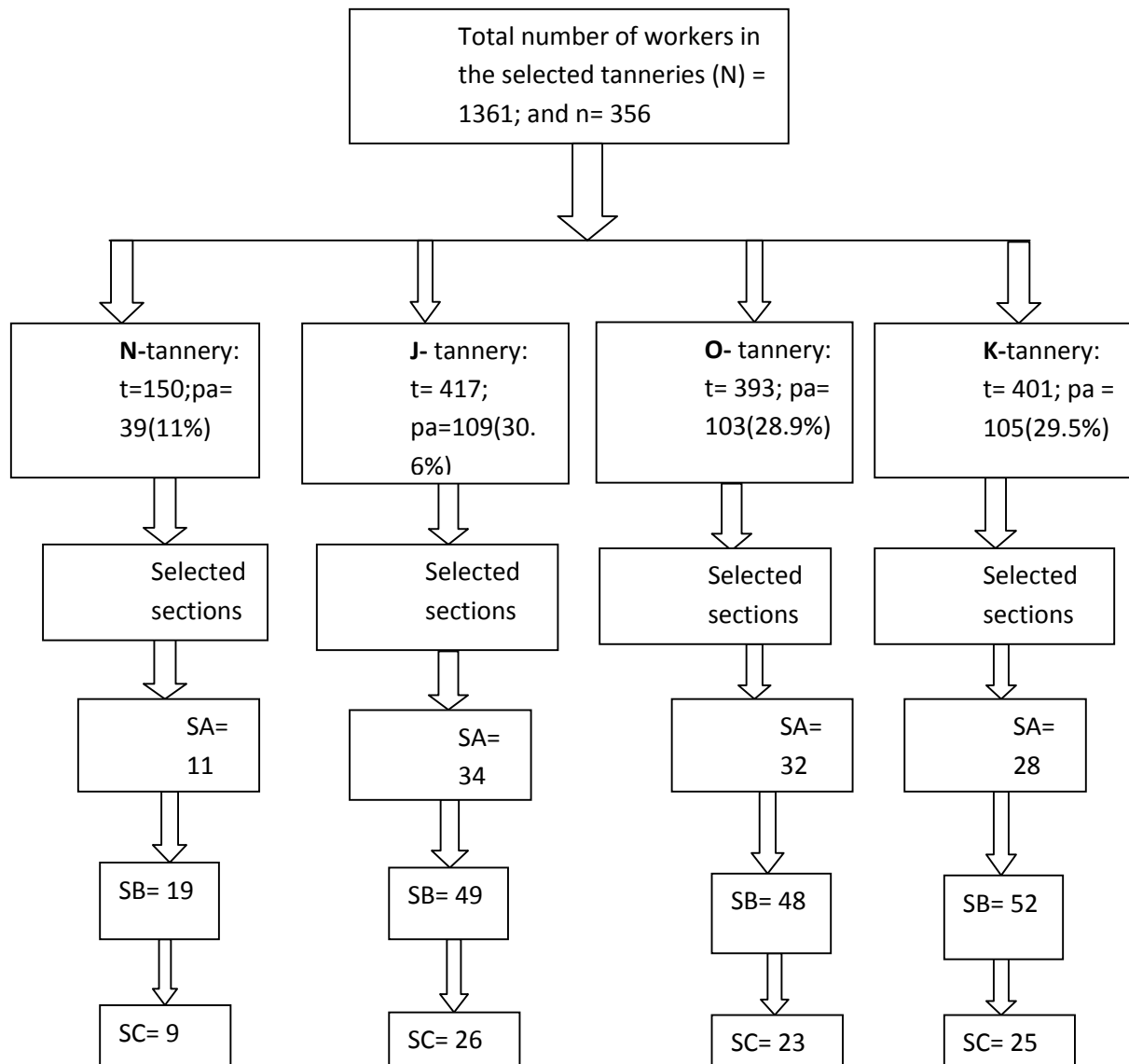


Figure 2: Sampling procedure and proportional sample size distribution diagram in selected tanneries of Addis Ababa, Ethiopia, August, 2018

Where:

- ▶  $N$  = Total number of workers in selected tanneries;  $t$  = total number of workers in each tannery,  $n$  = sample size
- ▶ Section A = Pre-tanning (Beam house), SB = Section B (Tanning), SC = Section C (Finishing)
- ▶  $P_a$  = proportional allocation to size, and
- ▶ Letters: N, J, O, and K are symbols to represent the tanneries in Addis Ababa.

## **4.7. Study variables**

### **4.7.1. Dependent variables**

The outcome or dependent variable of the study is occupational asthma.

### **4.7.2. Independent variables**

Such as training on PPE, proper PPE use, regular use of PPE, drinking alcohol, cigarette smoking, chat chewing, living conditions, working hours per week, and attitudes on PPE use.

## **4.8. Study Tools and Data collection procedures**

### **4.8.1. Study Tools**

A standard questionnaire was adopted from **British medical research council's questionnaire on respiratory symptoms; Asthma Screening Questionnaire adapted by** University of South Florida and published studies on other related titles [5, 33, 34]. The questionnaire is prepared in English, translated to Amharic, and later translated back to English by other person to check the consistency of translation and its meaning. The questionnaire has five parts: socio- demographic, environmental, and behavioral and personal factors.

### **4.8.2. Data collection procedures**

Three data collectors who have first degree in different fields including: Health Officer, Bachelor of Science in Nursing, Environmental and Occupational health professional who have an experience on research work and familiar with the study areas selected. Three days' training of the data collectors on the data collection processes performed.

Before the actual data collection, the adopted questionnaire pre-tested on 5% of employees of the other tannery industries that will not be included in the study two weeks before the starting date of data collection. Based on the pretested questionnaire some modification on the questions contents and correction was taken place on its structure. Then, trained data collectors through face-to-face interview of the study participants administered the questionnaire for data collection.

## **4.9. Data Management and Quality Assurance**

Every day, the completed questionnaires and checklists handled to the supervisors on each day of data collection. The supervisor checked the filled questionnaires randomly for correctness, completeness, and appropriateness. After checking for consistency and completeness, the

supervisors submitted the filled questionnaires to the principal investigator. Inappropriately, filled or missed ones sent back to data collectors for correction. Anything that was unclear and ambiguous had corrected on the next day of data collection.

After the completion of data collection, filled questionnaires checked again for completeness and any incomplete information excluded from the entry, and the raw data edited and entered in to a computer using Epi-Data, then it exported to SPSS version 24 for data clearance. Preliminary frequencies will run to identify missing variables. Data was backed-up by saving it in different folders of the computer, removable flash disk and email.

#### **4.10. Data processing and Analysis**

The collected data entered into Epi Data3.1 and analyzed by using SPSS version 24, and displayed by percentages, graphs and tables. Descriptive statistics of the collected data performed for all variables in the study using standard statistical parameters such as percentages. A bivariate and multivariate logistic regression analysis undergone to see if there was an association between dependent and independent variables and to determine the empirical relationship between the variables and among the variables.

#### **4.11. Operational Definition**

- **Occupational Asthma:** In this study, a respondent labeled as occupational asthmatic if he/she met one or more of the following criteria:
  - a. Diagnosed asthmatic by a physician or a nurse after hired in the tannery[5, 35]
  - b. Having the following symptoms/conditions:
    - i. Attacked with shortness of breath, wheezing/whistling with breathlessness, wheezing/whistling in absence of cold, attack of coughing (especially at night or early morning), and chest tightness in the past 12 months [33-35]
    - ii. A worker reporting improvement of asthma symptoms on going to leave or weekend/holidays and worsening of symptoms on coming back from short leave [36-38].
- **Respiratory symptoms:** The development of one or more of the symptom/s of cough, phlegm, breathlessness, wheezing, chest illness which last/s at least three months in one year [2, 19, 39].

- **Cough** Experience of cough on most days of the week (4 days) for at least three months in one year.
- **Phlegm:** Sputum expectoration on most days of the week (4 days) for at least three months in one year defined as phlegm. Characterized by yellowish-green, thick and tough, and may contain blood in the morning.
- **Breathlessness:** Was occurrence of shortness of breath when hurrying on level ground or walking up slight hill.
- **Wheezing:** A condition of causing a wheezy or whistling sound in the chest at any time in the last 12 months.
- **Chest illness:** In the past one year, chest pain that kept off work with phlegm.
- **Workers smoking status:** It categorized as current smokers, ex-smokers or non-smokers. If the worker started smoking before or after engaged to this job and smoking until the time of data collection of this study, then they classified as current smokers. If the worker stopped smoking for at least three months before data collection, they categorized as ex-smokers and if never smoked in his/her life classified as non-smoker.

#### **4.12. Ethical consideration**

Ethical clearance obtained from the Research and Publication Committee, School of Public Health, Addis Ababa University and official letters written from the School of Public Health to Federal Democratic Republic of Ethiopia Ministry of Industry. Moreover, the Ministry writes a letter to Ethiopia Leather Industry Development Institute (ELIDI), and finally the letter written to the respective tanneries. The purpose of study explained to the study subjects. Study subjects told that the information they provide kept confidential and that their identities not revealed in association with the information they provided. The respondents stop or skip to the next question when they were not interested to give response to the question. Informed verbal consent secured from each participant before starting to answer the questions on the questionnaire.

#### **4.13. Dissemination and Utilization of the result**

The result of this study presented to Addis Ababa University School of Public Health, Federal Democratic Republic of Ethiopia Ministry of Industry. In addition, it will be communicated to Ethiopian Leather Industry Development Institute and with its respective tannery industries from which the data had collected. The result also availed by publication.

## 5. RESULT

### 5.1. Socio-demographic characteristics of the study population

Totally 348 respondents were included in the study, which give the response rate of 97.8%. Out of the total respondents, 201(57.8%) were males and majority of the respondents 196 (56.3%) were less than 35 years old. Their mean age was 34.53, with the range of 20 – 61 years.

From the total respondents, 183 (52.6%) of them had an educational level of not more than grade eight. Majority of the respondents, 183 (52.6%) were married and 133(95.7%) of the study participants were living in Addis Ababa.

Regarding religious and employment status of respondents, 271 (77.9%) and 322 (92.5%) were Orthodox in religion and permanently employed respectively. Around two-third of study participants, 247 (71.0%) have monthly income of below 2350.00 Ethiopian Birr with the mean of 1969.13 and mode of 1200.00 Ethiopian birr (Table 1).

Table 1: Socio-demographic characteristics of study participants among tannery industry in Addis Ababa, Ethiopia, April 2018

Socio-demographic characteristics	<u>n = 348</u> Frequency	Percent
<b>Sex</b>		
Male	201	57.8
Female	147	42.2
<b>Age (in years)</b>		
20-24	42	12.1
25-30	77	22.1
30-34	77	22.1
>= 35	152	43.7
<b>Residence</b>		
Urban	333	95.7
Rural	15	4.3
<b>Marital Status</b>		
Single	99	28.4
Married	183	52.6
Divorced	47	13.5
Widowed	19	5.5
<b>Educational level</b>		
Uneducated	29	8.3
Grade 1-4	52	14.9
Grade 5-8	102	29.3
Grade 9-12	137	39.4
> grade 12	28	8.0
<b>Religion</b>		
Orthodox	271	77.9
Muslim	37	10.6
Protestant	39	11.2
Other	1	0.3
<b>Employment Condition</b>		
Permanent	322	92.5
Temporary	26	7.5
<b>Monthly Income (in Ethiopian Birr)</b>		
<1400.00	96	27.6

1400.00-2350.00	151	43.4
2350.01-3550.00	94	27.0
>3550.00	7	2.0
<b>Total for each variable</b>	<b>100</b>	<b>100.0</b>

## 5.2. Work Environment Factors

From the three major sections of tannery industries most of the respondents, 166 (47.7%) were working in tanning section and the greatest part, 233 (67.0%) of the total respondents were working >8 hours per day and the mean working hours per day of the study participants were 9.27 hours. Regarding work experience of tannery workers, 137 (39.4%) and 65 (18.7%) of the respondents had work experience of 11-20 and > 21 years respectively.

According to the responses given by the respondents, majority of them, 278 (79.9%) were no regular supervision in the work place. In similar condition, for 306 (87.9%) of the respondents there were no availability personal protective equipment, mouth and nose mask, in the tanneries. In addition, the regular provision of the available personal protective equipment (PPE) by the company for the workers on job was only 3.4% (Table 2).

Table 2: Work Environment factors of the Selected Tanneries in Addis Ababa, Ethiopia, April, 2018

<b>Work Environment Factors</b>	<b>n = 348</b> <b>Frequency</b>	<b>Percent</b>
<b>Work experience (in years)</b>		
1-10	146	42.0
11-20	137	39.4
>21	65	18.7
<b>Work Section</b>		
Beam house	90	25.9
Tanning	166	47.7
Finishing	92	26.4
<b>Working hours per day</b>		
<=8	115	33.0
>8	233	67.0
<b>Regular Supervision in the work place</b>		
No	278	79.9
Yes	70	20.1
<b>Availability of PPE in the work place</b>		
No	306	87.9
Yes	42	12.1
<b>Provision of the available PPE for workers on Job</b>		
No	336	96.6
Yes	12	3.4
<b>Total for each variable</b>	<b>348</b>	<b>100.0</b>

### **5.3. Personal and Behavioral Factors**

Out of the total, only 59 (17.0%) of respondents were trained on how to use personal protective equipment (PPE). From the total respondents, 48 (13.8%) were not properly used the available PPE. Out of this, 10 (20.83%) and 38 (79.17%) reasoned out that the size of the available PPE was not suitable and not clean respectively. Coal is the most commonly used, 144 (41.40%) followed by electricity, 87 (25%) as energy source for cooking foods in their home (Table 3).

Out of the total respondents participated on the study, 122 (35.1%) of them were consuming alcohol and 47 (13.5%) and only 7 (2.0%) were chew chat and smoke cigarette respectively. (Table 3).

Table 3: Personal and behavioral factors of respondents working in tannery factory of Addis Ababa, Ethiopia, April, 2018

<b>Personal and Behavioral Factors</b>	<b>n = <u>348</u></b> <b>Frequency</b>	<b>Percent</b>
<b>Training on PPE use</b>		
No	289	83.0
Yes	59	17.0
<b>Proper use of the available PPE</b>		
No	48	13.8
Yes	300	86.2
<b>Reason for not using the available PPE</b>		
Size not suitable	10	20.83
Not clean	38	79.17
<b>Source of energy for cooking food in home</b>		
Wood	50	14.4
Coal	144	41.4
Electricity	87	25
Petroleum gas	66	18.9
Other	1	0.3
<b>Cigarette smoking status</b>		
No		
Yes	341	98.0
	7	2.0
<b>Alcohol drinking status</b>		
No		
Yes	226	64.9
	122	35.1

<b>Chat chewing status</b>		
No		
Yes	300	86.2
	47	13.5
<b>Total for each variable</b>	<b>348</b>	<b>100.0</b>

#### **5.4. Prevalence of Occupational Asthma in Tannery Industries of Addis Ababa**

From the total respondents of the study, the total prevalence of Occupational Asthma in tannery industries of Addis Ababa, Ethiopia was 123 (35.3%).

##### **5.4.1. Prevalence of Occupational Asthma among socio-demographic characteristics of respondents**

Out of 123 respondents who have occupational asthma, 75(37.3%) were males and 15(35.7%) were in the age group of 20-24 (Table 4).

Table 4: Occupational Asthma Prevalence among some socio-demographic characteristics of respondents working in tannery factory of Addis Ababa, Ethiopia, April 2018

<b>Characteristics of respondents</b>	<b>Occupational Asthma Prevalence</b>		<b>Total</b>
	<b>No (%)</b>	<b>Yes (%)</b>	
<b>Sex</b>			
Male	126(62.7%)	75(37.3%)	201(57.8%)
Female	99(67.3%)	48(32.7%)	147(42.2%)
<b>Age category (in years)</b>			
20-24	27(64.3%)	15(35.7%)	42(12.0%)
25-29	51(66.2%)	26(33.8%)	77(22.13%)
30-34	47(61.0%)	30(39%)	77(22.13%)
>=35	100(65.8%)	52(34.2%)	152(43.68%)
<b>Residence</b>			
Urban	215(64.6%)	118(35.4%)	333(95.69%)
Rural	10(66.7%)	5(33.3%)	15(4.31%)

#### 5.4.2. Prevalence of Occupational Asthma among work environment factors of respondents

Out of the total reported occupational asthma, the majority, 52(38.0%) of the respondents had a work experience of 1-10 years and 51(44.3%) had been working for  $\leq 8$  hours per day respectively (Table 5).

Table 5: Occupational Asthma Prevalence among some work environment factors of respondents working in tannery factory of Addis Ababa, Ethiopia, April, 2018

Characteristics of respondents	Occupational Asthma Prevalence		Total
	No (%)	Yes (%)	
<b>Work experience (in years)</b>			
1-10	91(62.3%)	55(37.7%)	146(41.95%)
11-20	85(62.0%)	52(38.0%)	137(39.37%)
$\geq 21$	49(75.4%)	16(24.6%)	65(18.68%)
<b>Working hours per day</b>			
$\leq 8$	64(55.7%)	51(44.3%)	115(33.05%)
$> 8$	161(69.1%)	72(30.9%)	233(66.95%)

Out of the total reported prevalence of occupational asthma, 40 (44.4%) was in beam house section (Figure 3).

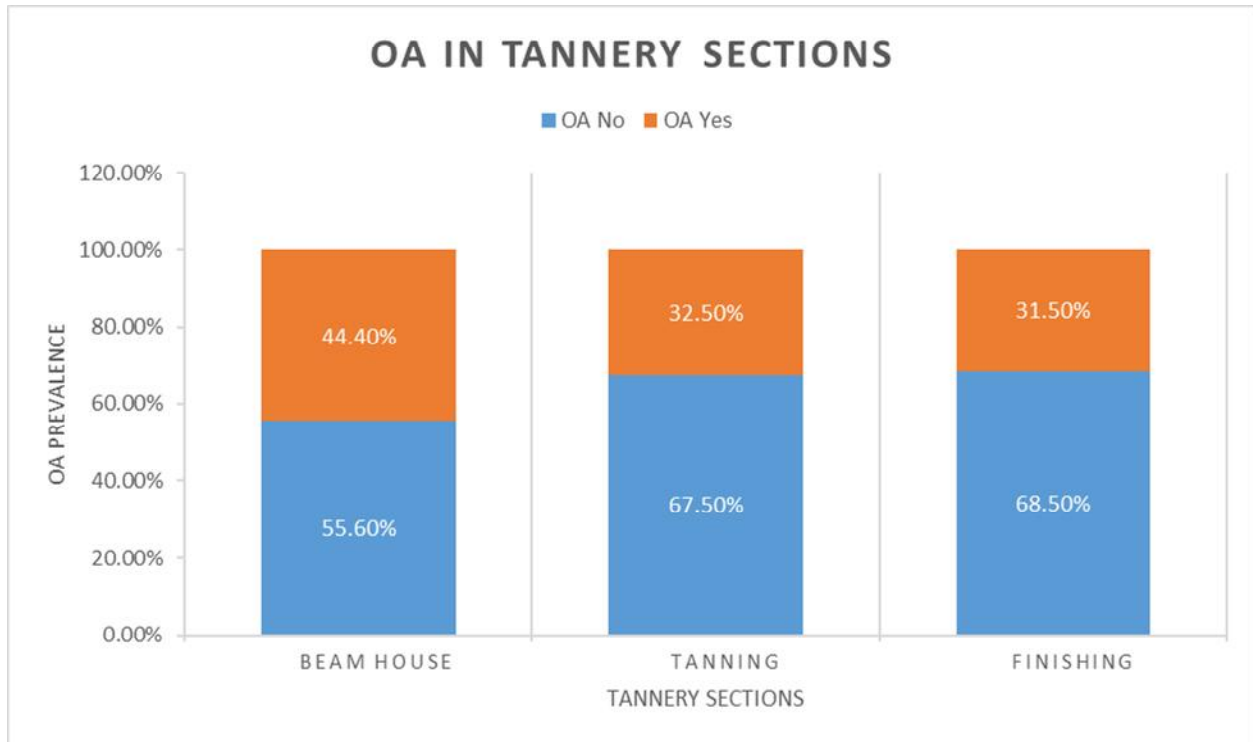


Figure 3: Occupational Asthma prevalence among sections of tanneries in Addis Ababa, Ethiopia, April 2018

### 5.5. Result of work place observation:

Observation was done in the four selected tanneries found in Addis Ababa, Ethiopia during data collection period. The observation mainly focused on system of handling chemicals by the workers, use of safety procedures, use of personal protective equipment, precautions, and availability of sanitation and ventilation.

#### A. Work place safety and personal protective equipment (PPE) using status of workers:

The result of the work places observation showed that there were few safety precautions, no material handling procedures, most of the tanneries were not get free air movement, the rooms were hot, workers at beam house and tanning sections exposed to chemicals during the whole process including cleaning and disposing chemical wastes.

Some of the workers perform their tasks in acid solution at pickling stage without wearing mask, gloves, and apron. Personal protective equipment required by the workers in this area is gown, glove, apron, boots, goggles and respirator. Almost all workers wore gown, only some workers wore a thin cloth like mask, which the workers bought it by themselves and used it repeatedly. From the study tanneries, only two of them have clinics but the clinics were used only for referring diseased workers to other health centers or clinics.

**B. Ventilation and Sanitation status:** The tanning houses have no appropriate windows available in addition has not proper ventilation system. The air inside the factories is with fume and heat. Dirty fluids released from the work sections mostly had no sewerage systems and were uncovered, very bad smells were also emitted.

#### **5.6. Factors associated with the occurrence of occupational asthma: Multivariate analysis**

Socio-demographic, work environment, personal and behavioral variables were assessed in the bivariate analysis to identify their association with occupational asthma, but only working hours per day (COR=0.561, 95% CI: 0.354-0.890) and work experience variables (COR=0.54; 95% CI: -1.370, 0.049) from work environment factors were found significantly associated with occupational asthma prevalence.

To avoid an excessive number of variables and unstable estimates in the subsequent model, only variables reached a p-value less than 0.3 were kept in the subsequent analyses. From socio-demographic factors analyzed in the multivariate analysis, no variable remained significantly associated with occupational asthma.

From work environment variables analyzed, hours worked per day and work experience were statistically significantly associated with occupational asthma. Respondents who have had a more work experience become more asthmatic from the work place than the less experienced workers do. The result showed that respondents who had a work experience of greater than 20 years had about 2 times more likely to be asthmatic from the work place than those who had work experience of 1-10 years (AOR = 1.981; 95% CI: 1.008, 3.892). Similarly, workers who had worked for more than 8 hours per day had odds of 1.8 times more likely to be affected by occupational asthma than respondents who worked for less than 8 hours per day (AOR = 1.795; 95% CI: 1.121, 2.877) (Table 6).

Table 6: Multivariate logistic regression analysis of the relative effect of socio-demographic, work environment, personal, and behavioral factors on the prevalence of occupational asthma in tanneries of Addis Ababa, Ethiopia, April 2018.

Variables	Occupational Asthma		COR (95% CI)	AOR (95% CI)	P-Value
	No (%)	Yes (%)			
<b>Educational level</b>					
No formal education	16(52.2)	13(44.8)	2.031(.677-6.096)	2.021(.645-6.328)	0.24
Grade 1-4	34(65.4)	18(34.6)	1.324(.487-3.595)	1.242(.435-3.550)	0.73
Grade 5-8	67(65.7)	35(34.3)	1.306(.522-3.264)	1.080(.415-2.810)	0.88
Grade 9-12	88(64.2)	49(35.8)	1.392(.5713-3.94)	1.270(.508-3.176)	0.64
> grade 12	20(71.4)	8(28.6)	1	1	
<b>Work experience (in years)</b>					
1-10	91(62.3)	55(37.7)	1	1	
11-20	85(62.0)	52(38.0)	1.012(.626-1.637)	1.901(.973-3.714)	0.06
>20	49(75.4)	16(24.6)	.540(0.37-0.049)	<b>1.981(1.008-3.892)</b>	0.04**
<b>Tannery Sections</b>					
Beam house	50(55.6%)	40(44.4%)	1	1	
Tanning	112(67.5%)	54(32.5%)	.61(.36-1.021)	1.790(.954-3.360)	0.05
Finishing	63(68.5%)	29(31.5%)	.58(.314-1.06)	1.038(.590-1.827)	0.92
<b>Working hours/day</b>					
<= 8	209(65.5%)	110(34.5%)	1	1	
>8	16(55.2%)	13(44.8%)	0.561(.3540-0.890)	<b>1.795(1.121-2.877)</b>	0.01**
<b>Regular supervision in the workplace</b>					
No	176(63.3%)	102(36.7)	1.35(.77-2.38)	1.419(.755-2.670)	0.31
Yes	49(70.0%)	21(30.0%)	1	1	
<b>Training on PPE use</b>					
No	189(61.0)	100(39.0)	.83(.465-1.474)	1.490(.790-2.810)	0.23
Yes	36(65.4)	23(34.6)	1	1	
<b>Proper use of PPE</b>					
No	33(64.0)	15(36.0)	.81(.42-1.56)	1.281(.648-2.533)	0.53
Yes	192(68.7)	108(31.3)	1	1	

Note: \*\*@p-value < 0.05; and 1 is constant used for comparison

## 6. DISCUSSION

This institution -based study attempted to assess the prevalence of occupational asthma in the last 12 months among tannery industry workers in Addis Ababa, Ethiopia. In addition, the study tried to investigate the associated factors for the occurrence of occupational asthma in these industries. So far, few studies were done on the title in different countries of Africa and Asia and no study done in Ethiopia.

Nearly, 123(35.3%) of tanneries respondents reported occupational asthma problems. The prevalence was relatively high compared with previous studies done in Karachi, Pakistan, 5.3% [2, 40] and India 2.2% [2]. Studies done in Congo, South Africa, Tanzania and Cameroon have reported prevalence of 3.8%, 2%, 3.3% and 2.7%, respectively [16, 41]. The difference could be due to sample size and the working area conditions that might not expose the workers to different determinant factors. Nevertheless, the prevalence was low relatively in comparison with some studies. For instance, study done in Bangladeshi and Istanbul tannery workers showed that prevalence of occupational asthma were 50% and (36.02%) [26, 30, 42].

According to the analysis, only work environment factors such as work experience and working hours per day were remained statistically significant. The analysis of the study showed that, those of respondents whose experience greater than 20 years were 1.98 times odds of developing occupational asthma than the less experienced workers of 1-10 years (AOR=1.981, 95% CI: 1.008-1.3.892). These results were similar to the study done in Pakistan [43, 44]. In similar condition, the odds of having occupational asthma in workers who had working for greater than 8 hours/day were 1.8 times higher than the odds of workers who had working less than or equal 8 hours/day at the time of survey (AOR=1.795, 95% CI:1.121-2.877). This showed that, the longer the exposed time at the workplace per day the higher chance of developing occupational asthma [45].

Although multivariate analysis did not show significant association between educational level and occurrence of occupational asthma; the study in Pakistan and Brazil showed that, education had strong effect on attitude and awareness related to workplace and family health and hygiene [2, 29]. Because low awareness of health and safety would make more vulnerable to illness including occupational asthma [2, 25, 29]. Education is one of key determinants of lifestyle and

provides people with the skill and knowledge that can lead to a better quality of life [2, 25, 30]. One of the reasons why this study didn't find significant association between educational level and prevalence of asthma, could be explained as education alone cannot eliminate occupational asthma when the level of hazards is high and when the use of adequate PPE and safe work organization are limited.

However, in this analysis occupational asthma was not significantly associated with work section, monthly salary, workplace supervision, health and safety training, alcohol use, chat chewing, and use of PPE of the respondents; some studies indicated the presence of association of some of these variables similar to the study conducted at Kasur, Pakistan [18, 46]. The probable reasons for the variables were not significantly associated might be due to most workers spent short duration on one section of the tanneries and they always shift to the new environment. In addition, the other probable reason might be the difference in study settings. During this time those variables may not be an important pre-requisite for the occurrences of occupational asthma.

There was a problem in hygiene and ventilation status of tannery industries as many dusts and fumes make the lights dim. Furthermore, there is no chance of sun light on the ground floor to enter. On the ground floors, there are no windows or extra doors apart from the main gate. There are only two ventilators with adjuster fans; however, the adjuster fans do not work and over-sweating makes them tired, and creates breathing problems because of the scarcity of fresh air. The ventilation and sanitation status of the place has its own effect on the prevalence of occupational asthma. This narrative result was similar to the study of Dhaka City [26]. It was explained that the factories are exposing huge amount of toxic substances and heavy metals that lead to many health problems including asthma [26]. The tanneries emit bad odor and pollute the air beyond tolerable limits.

Occupational asthma risk in tanneries mainly related to the frequent and prolonged exposure of the workers to chemical substances, to hot and humid environmental conditions and to unventilated and suffocated work areas. This was because workers exposed to hazardous chemicals through skin absorption, inhalation and ingestion. Workers at beam house and tanning area exposed to chemicals during the whole process including cleaning and disposing chemical wastes as these rooms are humid, had no ventilation system and had high temperature. Some of the workers perform their tasks

in acid solution at pickling stage without wearing mask, gloves, and apron. Personal protective equipment required by the workers in this area is gown, glove, apron, boots, goggles and respirator. Only some workers wore a thin cloth like mask, which the workers bought it by themselves. As the mask is bought and used by themselves the workers used it repeatedly without replacement for at least 3-6 months and the masks became perforated and dirtied that make users un interested to use as a result make them exposed to chemicals used at the work place. From this observation, I noticed because of this that most workers were reluctance against the use of personal protective devices.

## **7. STRENGTH AND LIMITATION OF THE STUDY**

### **7.1. Strengths of the study**

1. The study covers large tanneries and the response rate was high (97.7%).
2. Use of multiple methods of data collection like face-to-face interview and work place observation to validate the self -reported information regarding work related conditions and work processes.
3. Use of face-to-face interview during data collection reduce non-response rate, permit clarification of questionnaires and addressing all participants who differ in educational status.

### **7.2. Limitations of the study**

1. The study was a one -year cross sectional study. The possibility of recall biases resulting in under or over reporting and misreporting of events was likely.
2. There could be social desirability bias that might relate to compensation and leadership or organization structure of sampled industries. This may result in over reporting of occupational asthma.
3. Shortage of measurement tools such as spirometry in the university.
4. There is shortage of studies with similar methodological approach on subjects with similar background and characteristics particularly in Ethiopia to compare results.

## **8. CONCLUSION AND RECOMMENDATIONS**

### **8.1. Conclusion**

It concluded that the prevalence of occupational asthma in this population of tannery workers is high. The study reveals that having long experience in the tanneries and working longer hours in the tanneries had shown a significant association with an increased prevalence of occupational asthma. Workers working in Beam house followed by finishing section had shown increased prevalence of occupational asthma. The results of this study found high rates of occupational asthma among tannery industrial workers of Addis Ababa, Ethiopia.

Similar to other studies, the work environment inspection revealed that in all industries, workers were highly exposed to occupational health and safety hazards. Moreover, there was inadequate provision of health and safety services to workers.

### **8.2. Recommendations**

Based on the above findings and conclusions for sustained prevention and control of occupational asthma, the following recommendations made for the concerned bodies:

1. AAU, MOLSA, MOH and Ministry of Industry should have an integrated emphasis to reduce occupational asthma by identifying the root cause.
2. Long exposure for the work place in terms of working hours per day and stay on the jobs should be solved by taking corrective action such as job rotation for employees.
3. The tanning industries provide appropriate health and safety training for workers beginning with the first day of their employment, strengthen strict supervision of workplace and working conditions, and establish active and functional health and safety programs.
4. Further studies need to be conducted by AAU, MOH, and tannery industry through other additional study designs to investigate the occupational asthma prevalence and associated factors.

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## 10. ANNEXES

### **Annex I: Study Information Sheet in English**

Good Morning/ Good after- noon, my name is \_\_\_\_\_. I am working as data collector in a study conducted by **Fetene Merga**, a postgraduate student at Addis Ababa University, College of Health Sciences, School of Public Health, Department of Preventive Medicine, Environmental and Occupational Health track. He is conducting research on the Prevalence of Occupational Asthma and Associated Factors among Tannery workers, Addis Ababa, Ethiopia. He has got permission to do this research from Addis Ababa University, School of Public Health research ethics Committee, Industry Minister and Ethiopia Leather Industry Development Institute as well as management bodies of the Tannery Industries. You are selected to participate in the study from tannery workers. If you are willing to participate, I will ask you some questions to assess the health problems encountered here to know the prevalence of occupational induced health problems and the causes the health problems. To get this information, I am caring out interview in this tannery. The interview will last no more than 20 minutes and your participation is voluntary. You can stop the participation, ask questions and skip questions at any time you want. Your participation in the study will not have any risk on you other than your time. There will no financial benefits for you in participating in this research project. However, the information you provide will be very helpful for prevention of the disease in the future. In addition, the result from this project will be used to help policy makers and other responsible bodies to improve occupational safety and health service in this organization. The information you provided will be kept confidential and your name will not be revealed in the study. The collected data will not be used for other purposes other than the study.

Do you have any question?

If you want to ask the principal investigator about the research at any time, you can contact him through: [fetenemer@gmail.com](mailto:fetenemer@gmail.com) or mobile: +251-911-93-81-65

## **Annex II: Consent form in English**

I understand that **Fetene Merga**, a graduate student from School of Public Health, Addis Ababa University in Environmental and Occupational Health want to assess the prevalence of occupational asthma and associated factors among tannery workers in Addis Ababa. I fully understand that, they are going to ask me about socio-demographic factors, behavioral factors, work related factors and personal factors. The research will take place at tannery industries, Addis Ababa, which will not take more than 20 minutes of my time. I want to take part in the study because I have been told that; I can stop participation at any time, skip any question if I do not like to answer. No one will know my answers other than investigators and the information will not be used for other purposes other than this study.

**Are you willing to participate in the study?**

Yes             No       Acknowledge and go to the next participants

**Annex III: English Version Questionnaire**

**Addis Ababa University College of Health Science, School of Public Health, Department of Preventive Medicine.**

**A questionnaire designed to assess the prevalence of Occupational Asthma and its Associated Factors among tannery workers in Addis Ababa, Ethiopia.**

Respondents' ID No \_\_\_\_\_

Factory code: \_\_\_\_\_

**Encircle your choice**

Sr. No	Questions	Possible answers	skip	Code
<b>Part I: Socio-demographic characteristics</b>				
101	Gender?	1. Male 2. Female		
102	How old are you?	_____years		
103	Where is your residence?	1. Urban 2. Rural		
104	What is your marital status?	1. Single 2. Married 3. Divorced 4. Widowed		
105	What is your educational level?	1. Uneducated 2. Grade 1-4 3. Grade 5-8 4. Grade 9-12 5. > grade 12		
106	What is your religion?	1. Orthodox 2. Muslim 3. Protestant 4. Other, (specify)___		
107	What is your employment condition?	1. Permanent 2. Temporary		
108	How much is your monthly income?	_____(EBr)		
109	What is your total services year in the tannery?	_____years		
<b>Part II: Work environment factors</b>				

201	Where is your work section?	1. Beam house 2. Tanning 3. Finishing		
202	How many hours/day you work in the factory?	_____ hours		
203	Is there regular supervision in the workplace?	0. No    1. Yes		
204	Is personal protective equipment (PPE), <b>facemask</b> , available in the tannery?	0. No    1. Yes	If <b>No</b> go to Q <b>301</b>	
205	If " <b>YES</b> " for Q 204, does the company regularly provide the PPE for the workers on job?	0. No    1. Yes		
<b>Part III: Personal Factors</b>				
301	Are you trained on how to use the PPE in the last 12 months?	0. No    1. Yes		
302	Do you use the available PPE properly?	0. No    1. Yes	If your answer is <b>Yes</b> , go to Q <b>304</b>	
303	If " <b>No</b> " for Q 302, why not?	1. Size not suitable 2. Not clean 3. Other (List)_____		
304	Are you working in other factory or institution during your free time?	0. No    1. Yes		
305	If Yes for question 304, list	1_____		
305	What is the source of energy that you use for making foods in your home?	1. Wood    2. Coal 3. Electricity 4. Stove 5. Other (specify)___		
<b>Part IV: Occupational Asthma Screening Questions</b>				
401	Have you had wheezing or whistling in your chest at any time in the last 12 months?	0. No    1. Yes	If your answer is <b>No</b> , go to	

				<b>Q 404</b>	
402	If “ <b>Yes</b> ” for question 401, have you been at all breathless when the wheezing noise was present?	0. No	1. Yes		
403	If “ <b>Yes</b> ” for question 401, have you had this wheezing or whistling when you did not have a cold?	0. No	1. Yes		
404	Have you woken up with a feeling of tightness in your chest at any time in the last 12 months?	0. No	1. Yes		
405	Have you woken up by an attack of shortness of breath especially at night in the last 12 months?	0. No	1. Yes		
406	Have you woken up by an attack of coughing in the last 12 months?	0. No	1. Yes		
407	Have you had an attack of asthma in the last 12 months?	0. No	1. Yes		
408	Have you had asthma confirmed by doctor after joining the tannery?	0. No	1. Yes	If <b>No</b> go to Q <b>410</b> .	
409	If “ <b>Yes</b> ” for Q 408, are you receiving asthma medication?	0. No	1. Yes		
410	When you are at work, have you had been coughing?	0. No	1. Yes		
411	When you are at work, have you had been wheezing?	0. No	1. Yes		
412	When you are at work, have you had been feeling short of breath or get chest tightness?	0. No	1. Yes		
413	If “ <b>Yes</b> ” to one of the statements of 410, do these problems have related to your work?	0. No	1. Yes		
414	Were there changes in the work processes in the period preceding the onset of symptoms?	0. No	1. Yes		
415	Was there unusual work exposure within 24-hours before the onset of initial asthma symptoms?	0. No	1. Yes		
416	Do asthma symptoms differ during times away from work such as weekends or holidays?	0. No	1. Yes		
<b>Other possible accompanying signs and symptoms:</b>					

<b>Phlegm Related</b>				
417	Do you usually bring up any phlegm from your chest?	0. No	1. Yes	If your answer is <b>No</b> , go to <b>Q 501</b>
418	Have you ever coughed up phlegm with yellow-green thick and sticky?	0. No	1. Yes	
419	Is the phlegm continuous for at least 4 days per week?	0. No	1. Yes	
420	Is the phlegm continuous for at least 3 months per year?	0. No	1. Yes	
421	In the past three years, have you had a period of increased cough and phlegm lasting for three months or more?	0. No	1. Yes	
<b>Part V: Behavioral related factors</b>				
501	What is your cigarette smoking status?	1. Never smoked 2. Current smoker		
502	What is your current alcohol drinking status?	1. Never 2. Current drinker		
503	What is your current Chat chewing status?	1. Never 2. Current chat chewer		

This is the end of our questionnaire. Thank you very much for taking time to answer these questions!

**Result of the questionnaire (to be confirmed by the supervisor)**

Completely filled       Opposed

Partially filled (missing)       Respondent absent

Interviewer Name: \_\_\_\_\_ signature \_\_\_\_\_ date \_\_\_\_\_

Supervisor Name: \_\_\_\_\_ signature \_\_\_\_\_ date \_\_\_\_\_

**Annex IV: Study Information Sheet in Amharic**

**መጠይቁን ስመሙሳት ከመጸመድ በፊት የተሳታፍውን ፈቃደኝነት መጠየቂያ ቅጽ፤**

ሰላም! ስንደምን ስት? ስኔ \_\_\_\_\_ ስባሳሰቡ። ፈጠነ መርጋ፤ በአድስ ስባባ ዩኒቨርሲቲ የጤና ኮሌጅ የህብረተሰብ ጤና ትምህርት ቤት የፕሮጀክቲቭ መድሰን ትምህርት ክፍል የሆነ የማስተርስ ተማሪ በሚሰራው ጥናት ሳይ መረጃ በማሰባሰብ ሳይ ነኝ። ተማሪው ጥናቱን የሚያካሄድበት ስድስት ስባባ ወሰን የሚገኙ የቆዳ ፍብረትዎች ውስጥ የሚሰሩ ሰራተኞች የአስም ስርጭት መጠን ምን ያህል ስንደሆነ የዳሰሳ ጥናት ስማካሄድ ስና ሰበሽታው መነሻ ምክንያት/ተባባሪ የሆኑ ሁኔታዎችን ስመለየት ነው። በመሆኑም ደህን መረጃ ስማግኘት በዚህ ድርጅት ውስጥ ደህን መጠይቅ በማካሄድ ሳይ ስገኛለሁ። የዚህ ጥናት ውጤት በሀገራችንና በዚህ ድርጅት ውስጥ የሚደረገውን የሙያ ደህንነትና ጤናነት ስገልግሎት ስማሻሻል ከፍተኛ ስገዳ ደኖረዋል። ስለሆነም ከስራዎ ጋር በተያያዘ ሳስፍት ስመታት ስዚህ ከመጡ ጸምር የተከሰቱ የጤና ችግሮችን በተመለከተ የተወሰኑ ጥያቄዎችን ስማግኛት ስወዳለሁ። በአጠቃላይ መጠይቅ ከ15-20 ደቂቃ ያህል ደፈጃል። የሚሰጡት መረጃም ስማግኘም ተሳስፎ ስይሰጥም። በተጨማሪም በተቃራኒ መሰከር ፈልጎ ስይተረጎምም። ስምዎን መመዝገብ ስያስፈልገኝም። ተሳትፎዎ ሙሉ በሙሉ በፈቃደኝነት ሳይ የተመሰረተ ስደመሆኑ መጠን ስንዲመሰሰሱ ብዬ በምንም ስይነት መሰከር ስስገፋፋዎትም። መመሰስ በማድረግ-በት ሰዓት መጠይቁን የማቋረጥ ወይም የመዘሰስ መብት ስስዎት።

ስለዚህ ስመቀጠል ፈቃደኛ ነዎት? 1. ስዎ  2. ስይደሰቱም

ፈቃደኛ ከሆኑ ወደምቀጥሰሁ ስምዎን ስንጠራ

ስማግኛውም ችግር ስና ግልጽ ሳልሆነ ነገር ክታች ባለው ስድራሻ ማነጋገር ደችሳሁ።

ዋና የጥናቱ ተጠሪ፡ ፈጠነ መርጋ

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**Annex V: Informed Consent in Amharic**

**የፈቃድ መጠየቂያ ፎርም**

ፈጠነ መርጋ፤ በአድስ ስባባ ዩኒቨርሲቲ የጤና ኮሌጅ የህብረተሰብ ጤና ትምህርት ክፍል የፕሮጀክቲቭ መድሰን ድጋግተኛነት የሆነ የማስተርስ ተማሪ በአድስ ስባባ ወሰን የሚገኙ የቆዳ ፍብረትዎች ውስጥ የሚሰሩ ሰራተኞች የአስም ስርጭት መጠን ምን ያህል ስንደሆነ የዳሰሳ ጥናት ስማካሄድ ስና ሰበሽታው መነሻ ምክንያት የሆኑ ሁኔታዎችን ስመለየት ስንደሆነ ተረድቻለሁ። ጥናቱን ስማካሄድ በማህበራዊና ስነ-ህዝባዊ ገደቦችን ፤ የሥራ ቦታ ፤ የሰው ጤና ፤ የግል ሁኔታ ፤ የሰራተኛው ስነ-ባህሪ ፤ ስና የመተንፈሻ ስካል የጤና ችግሮች ሳይ የሚያተኩር ጥያቄዎችን ስጠይቁኝ ስንደሆነ በሚገባ ተረድቻለሁ። ጥናቱ የሚካሄደው አድስ ስባባ ወሰን የሚገኙ የቆዳ ፍብረትዎች ስንደሆነና ሰዓቱን ከመወሰድ ሴሳ በስኔ ሳይ በምንም መሰከር ጉዳት ስንደማደመጣ በደንብ ተረድቻለሁ። በጥናቱ መሳተፍ ደፈሳጋሰቡ ምክንያቱም በፈሰሱት ሰዓት መሳተፍን

ማቅም ስንደሚችሉና ግልፅ ያልሆነሰነግን ጥያቄ የማሰፍ መብት ስንደሰኝ ተነግሮኛለሁ። በተጨማሪም የሚሰጣቸው መረጃ ሰጥኖቱ ከማዋሰ ውጪ የስነ ምግባር የሚያወጡ ማንም ስንደሰሰና መረጃው ከጥናቱ ውጭ ስምንም ስይወጣም።

የተጠያቂው መስያ ቁጥር: \_\_\_\_\_ የድርጅቱ ኮድ: \_\_\_\_\_  
 መጠይቁ የተሞላበት ቀን \_\_\_\_\_ የተጠያቂው ፊርማ \_\_\_\_\_

**Annex VI: Amharic Version Questionnaire**

**በአድስ አባባ ዩኒቨርሲቲ የጤና ሳይንስ ኮሌጅ የህብረተሰብ ጤና ትምህርት ቤት**

አድስ አባባ ውስጥ ሰሚገኙ የቆዳ ፍብረቱዎች ውስጥ ሰሚሰሩ ስራተኞች የቀረበ መጠይቅ ቅዳ ፍብረቱዎች ሳይ ተቀጥረው በሚሰሩ ስራተኞች ሳይ ከሰሩቸው ጋር በተያያዘ የሚደርሰባቸውን የጤና ችግር ሰማጥናት የተዘጋጀ መጠይቅ፤

**የተጠያቂው ሀሳብ ብቻ ይክበብ**

ተ.ቁ	ጥያቄ	ስማራጭ መሰብ	(ደስፍ)	ኮድ
<b>ክፍል 1: ማህበራዊና ስነ-ሕዝባዊ ገጽታዎችን በተመለከተ</b>				
101	ደታ?	1. ወንድ 2. ሴት		
102	ሰድሚያ/ሽ ስንት ነው?	_____ ዓመት		
103	የመኖሪያ ቦታ የት ነው?	1. ከተማ 2. ገጠር		
104	የጋብቻ ሁኔታ?	1. ያገባ/ች 2. ያላገባ/ች 3. የፎታ/ች 4. የሞተበት/ባት		
105	የትምህርት ደረጃ?	1. ያስተማሪ/ች 2. ማንበብና መጻፍ 3. የተማሪ/ች(የትምህርት ደረጃ ይጠቀሱ---)		
106	ሀይማኖት?	1. ኦርቶዶክስ 2. ሙስሊም 3. ንግሥታዊ 4. ሌላ (ይጥቁሱ)...		
107	የቅጥር ሁኔታ?	1. ቋሚ 2. ኮንትራት		

108	የወር ገቢ/ሽ ምን ያህል ነው?	_____ ብር		
109	በፍብረት ወይም ምን ያህል ስገራ/ሰዓት/ሻል?	_____ ሰዓት		
<b>ክፍል 2: የሥራ ቦታን በተመለከተ</b>				
201	የሥራ መደብ/Work section/?	1. ቤም ሀወስ 2. ታኒንግ 3. ፍንሽንግ		
202	በፍብረት ወይም በቀን ምን ያህል ሰዓት ትሰራህ/ሽ?	_____ ሰዓት		
203	በስራ ቦታ ቀጣይነት ያሰኙ ክትትል ስለ	0. የሰም 1. ስም		
204	ከስደጋ የመከላከያ ቁሳቁስ ስም ላይ የሰጡ ስራዎች መሸፈኛ በመ/ቤቱ ስለ?	0. የሰም 1. ስም		
205	ስተ.ቁ 204 መሰረት ስም ከሆኑ ከስደጋ የመከላከያ ቁሳቁስ በመ/ቤቱ በቀጣይነት ስራዎች የቀርቧል?	0. የሰም 1. ስም		
<b>ክፍል 3: የሠራተኛ የግብር ሁኔታን በተመለከተ</b>				
301	ባለፉት 12 ወራት ውስጥ በሰውነት መከላከያ መሳሪያ ስጠቀም ይሰጡ ስለሆነ ወስደሃል/ሻል?	0. የሰም 1. ስም		
302	በመስሪያ ቤቱ ያሰጡ የሰውነት መከላከያ መሳሪያ በስግባቡ ትጠቀማለህ/ ትጠቀሟል/ሻል?	0. የሰም 1. ስም	ስተ.ቁ ቁጥር 302 መሰረት ስም ከሆነ ወደ ተ.ቁ 304 ሂዱ	
303	ስተ.ቁ ቁጥር 302 መሰረት ስም ከሆነ ስምን?	1. መጠኑ ምን ስም ስም 2. ንግድ የሰጡም 3. ሴላ (ደግሞ)		
304	በትርፍ ሰዓት ሲላ ቦታ ትሰራህ/ሽ	0. የሰም 1. ስም	ስተ. ቁ. 304 መሰረት የሰም ከሆነ ወደ ተ.ቁ 401 ሂዱ	
305	ስተ.ቁ ቁጥር 304 መሰረት ስም ከሆነ ደግሞ	_____		
306	በትህ/ሽ ውስጥ ምን ያህል ሰዓት የሚጠቀሙ/ሚወጡ	1. ማገድ 2. ክስል		

	የሀይደል ምንጭ ምንጭን ነጠ.	3. መብራት4. ስቶቭ 5. ሴሳ (ደግሞ)		
<b>ክፍል 4: ከስራ ቦታ ጋር ተያይዞ የመተንፈሻ ስኬት የጤና ችግሮች ሳይ የሚያተኩሩ ጥያቄዎች</b>				
401	እዝህ መ/ቤት ዉስጥ ከተቀጠረ ዉድህ የሚንኮራፍት ሁኔታ ስጋጥሞት ያቀጠ?	0. የሰሞ 1. ስሞ		
402	ስተ.ቁ. 401 መሰሪ ስሞ ከሆነ ከዝግጁ ጋር ተያይዞ የተንፋሽ እጥረት ይሰማዎታል	0. የሰሞ 1. ስሞ		
403	ስተ.ቁ. 401 መሰሪ ስሞ ከሆነ ጉንፍን በሰሰበት ወክት ነጠ.	0. የሰሞ 1. ስሞ		
404	እዝህ መ/ቤት ዉስጥ ከተቀጠረ ዉድህ የደረት ዉጋት ስጋጥሞት ከእንቅስፍ ብን ብሱ ተነስቶ ያወቃሉ	0. የሰሞ 1. ስሞ		
405	እዝህ መ/ቤት ዉስጥ ከተቀጠረ ዉድህ የተንፋሽ እጥረት ስጋጥሞት ከእንቅስፍ ብን ብሱ ተነስቶ ያወቃሉ	0. የሰሞ 1. ስሞ		
406	እዝህ መ/ቤት ዉስጥ ከተቀጠረ ዉድህ ሀይደል ሳይ ስጋጥሞት ከእንቅስፍ ብን ብሱ ተነስቶ ያወቃሉ	0. የሰሞ 1. ስሞ		
407	እዝህ መ/ቤት ዉስጥ ከተቀጠረ ዉድህ የስሞ ችግር ስጋጥሞት ከእንቅስፍ ብን ብሱ ተነስቶ ያወቃሉ	0. የሰሞ 1. ስሞ		
408	እዝህ መ/ቤት ዉስጥ ከተቀጠረ ዉድህ በሀኪም የተረጋገጠ ስሞ ስሰብህ	0. የሰሞ 1. ስሞ		
409	ስተ.ቁ. 408 መሰሪ ስሞ ከሆነ መድሀኒቱን እየወሰድክ/ሽ ነጠ.	0. የሰሞ 1. ስሞ		
410	ስራ ቦታ ስዎሰህ/ሽ በሳይ ትቸገራለህ	0. የሰሞ 1. ስሞ		
411	ስራ ቦታ ስዎሰህ/ሽ በማቃተት ትቸገራለህ/ሽ	0. የሰሞ 1. ስሞ		
412	ስራ ቦታ ስዎሰህ/ሽ ትንፋሽ የማጠር ችግር ተሰሞቶህ/ሽ ያወቃል	0. የሰሞ 1. ስሞ		
413	ስተ.ቁ. 410 መሰሪ ስሞ ከሆነ ደህ ችግር ከስራህ ጋር ግንኙነት ስለሁ	0. የሰሞ 1. ስሞ		
414	ስተ.ቁ. 410 መሰሪ ስሞ ከሆነ ምስክቱ ከመጀመሩ በፊት በስራዎ ሁኔታ ዙርያ የተሰጠህ ነገር ስለ	0. የሰሞ 1. ስሞ		
415	ስተ.ቁ. 410 መሰሪ ስሞ ከሆነ ምስክቱ ከመጀመሩ በፊት	0. የሰሞ 1. ስሞ		

	በስራዎ ባስተሰመዱ ሁኔታ የመጋቢት 17 ስድስት			
416	የስራዎ ምዕራፍ ካሉበት ምዕራፍ በስራዎ ቀናት የተሸለጠ ይሆናል	0. የስም	1. አዎ	
<b>IV. ስራዎን በተመለከተ</b>				
417	አደራት የሚወጡ ስራዎን ተፎቅ ያወጡታል?	0. የስም	1. አዎ	ስተ. ቁ 417 መሰረት የስም ክፍን ወደ ተ.ቁ 501 ሂ.ድ
418	የሚወጡ ስራዎ ስንደ ብጫ ነገር ስና ወፍራም ነዉ?	0. የስም	1. አዎ	
419	የሚወጡ ስራዎ ብድን በሳምንት ስራት ግዜ ነዉ?	0. የስም	1. አዎ	
420	የሚወጡ ስራዎ ብድን በዓመት ስተክታታዩ 3 ወራት ነዉ?	0. የስም	1. አዎ	
421	ሳስፍት 3 ዓመታት የሚሳሰ ወደም ስራዎን የሚወጡት መጠን ስተክታታዩ 3 ሳምንታት ስና ክዛ በሳዩ ወምሯል?	0. የስም	1. አዎ	
<b>ክፍል 5: የስራዎ ስነ-ባህሪን በተመለከተ</b>				
501	ሲጋራ ታጠላሰህ?	1. አዎ	2. አሳጠሰም	
502	ስሰኮስ መጠጥ ትጠላሰህ/ሽ?	1. አዎ	2. አስጠላም	
503	ጫት ትቅማሰህ/ሽ?	1. አዎ	2. አስቅምም	

የመጠደቁ ግምገማ: 1. ተሟሰቷል  2. ተቃውመዋል   
3. ተጠያቂው ስስተገኛም  4. በክፍል

ያረጋገጠው ሱፐርቫይዘር ስም: \_\_\_\_\_ ፊርማ \_\_\_\_\_  
ቀን \_\_\_\_\_

**Annex VII: Work place observation checklist**

- i. List hazards in working environment \_\_\_\_\_
- ii. Do the work has excessive heating? 1. Yes -----2. No -----  
a yes requires that a worker is found sweating when naked or with light clothing if investigator feels as sudden heat wave when entering in to the industry.
- iii. Is there excessive dust in the work place? 1. Yes -----2. No -----  
a yes requires if the investigator experience sudden sneezing up on entering the industry or if the workers eyebrows, hair, nostrils, and clothes is observed by investigator to be covered with dust particles.
- iv. Is there working sing and safety rules in the work place? 1. Yes -----2. No -----  
----a yes require no lack?
- v. Do the employees use the necessary personal protective equipment? 1. Yes -----2. No -----
- vi. Were there any preventive measures implemented for hazards in the working environment? 1. Yes -----2. No -----a yes requires specification of and preventive measures
- vii. Does the industry have copy of most important health regulation?
- viii. Does the industry follow writer safety and health plan of action in the workplaces?
- ix. Does the working section have first aid equipment? 1. Yes -----2. No -----
- x. Is there any health service near to the industry? [47, 48]

**Annex VIII: Screening Questions for participants going to participate on the interview**

**Employee excluded from the interview if he/she fulfills one or more of the following criteria**

Sr. No	Screening Questions	Response		Remark
		Yes	No	
1	Have you had worked more than one year in this tannery?			
2	Is your present work section from one of the following? I. Beam house    II. Tanning    III. Finishing			
3	Have you had out of one of the work sections in the tannery for more than 3 months?			
4	Have you had asthma and other respiratory symptoms confirmed by a doctor before joining this tannery?			
5	Do you have history of asthma in your family?			
6	Do you have confirmed respiratory problems other than asthma by a doctor after hired in this tannery?			

**Note:** Answering “No” for one or both of Questions 1 & 2 and/or “Yes” for one or more of Questions 3-6 exclude the employee from participating on the interview[33].