DUST EXPOSURE AND BYSSINOSIS AMONG COTTON TEXTILE WORKERS IN DAR ES SALAAM

Luco Patson Mwelange (BSc.EHS)

Master of Science in Environmental and Occupational Health Dissertation

Muhimbili University of Health and Allied Sciences

October 2019

Muhimbili University of Health and Allied Sciences
Department of Environmental and Occupational Health

DUST EXPOSURE AND BYSSINOSIS AMONG COTTON TEXTILE WORKERS IN DAR ES SALAAM

By

Luco Patson Mwelange

A Dissertation Submitted in (Partial) Fulfilment of the Requirements for the Degreeof Master of Science in Environmental and Occupational Health of Muhimbili University of Health and Allied Sciences

October, 2019

CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation titled "**Dust Exposure and Byssinosis among Cotton Textile Workers in Dar Es Salaam. ",** in partial fulfilment of the requirements for the degree of Master of Environmental and Occupational Health of the Muhimbili University of Health and Allied Sciences.

_____

Dr. Simon Mamuya, PhD

(Supervisor)

_____

Date

DECLARATION AND COPYRIGHT

I, **Luco Patson Mwelange**, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature_____ Date_____

This dissertation is a copyright material protected under the Berne Convention, the Copyright Act 1999 and other international and national enactments, in that behalf, on intellectual property. It may not be reproduced by any means, in full or in part, except for short extracts in fair dealing, for research or private study, critical scholarly review or discourse with an acknowledgement, without the written permission of the Directorate of Postgraduate Studies, on behalf of both the author and the Muhimbili University of Health and Allied Sciences.

ACKNOWLEDGEMENT

I, would like to thank the Almighty for giving me energy, wisdom, passion and keeping me healthy throughout the whole process of preparing this work and be able to accomplish the two years of my post-graduate studies. I extend my sincere gratitude to my supervisor Dr. Simon Mamuya for his time and expertise in grooming me to accomplish this work.

Secondly, I would also like to express my gratitude to MUHAS, academic staff of the department of Environmental and Occupational Health, in particular, the Head of the department Dr. Jane Mlimbila and all the others from the School of Public Health and Social Sciences for their teaching, constructive criticism, and guidance that has enhanced the accomplishment of this work.

I am most grateful to NORAD through the NORHED-programme (Norwegian Programme for Capacity Development in Higher Education and Research for Development) via Norhed Project Tan:1300646-12 (North- South-South collaboration for funding the work.

Also, I would like to acknowledge my study participants and research assistants for their time and willingness to participate. Industrial management as well, for giving me permission to conduct the study. Dr.G. Sakwari for her great support, my colleagues MSc. EOH class of 2017/19 who offered their academic support throughout my studies, laboratory technicians at Muhimbili University's Physiology Laboratory Mr. Kapinda for his contribution to dust samples analysis.

The accomplishment of this study required the involvement of many individuals, whom I may not mention all of them here, but I am really grateful to you all

Last but not the least, Special thanks go to my wife, Consolata Ndakidemi and my children Ivan, Ivana, and Ian for their prayers during my studies, I always trust in your good wishes for me.

May God bless you all.

DEDICATION

I dedicate this work to my family starting with my wife Consolatha Ndakidemi and my beloved children; Ivan, Ivana, and Ian. My mother Apia Lilawiya, and father Patson Mwelange, my sisters Yezabel and Atu Mwelange My brother Nelson and my late brother Willy Mwelange.

ABSTRACT

Background: The Magnitude of byssinosis is significantly decreasing in developed countries with a current prevalence of 3% (1). Previous studies have reported an increase in prevalence (45%) of in developing countries (1–3). In Tanzania, there is little scientific information known about the prevalence of byssinosis. It is also not clear which risk factors are associated with because the last study in Tanzania was done almost 40 years ago in 1979 (4).

Therefore, the aim of this study was to determine the magnitude and risk factors associated with byssinosis among textile workers, so as to develop effective control measures.

Study objective: To assess dust exposure, the prevalence of byssinosis**,** factors associated with it, and lung function among cotton textile workers in Dar es Salaam

Method: The study deployed a cross-sectional comparative study design. The study involved 325 participants 164 were from cotton textile industry (exposed) and 161 from drinking water bottling industry (unexposed). The questionnaire was used to assess byssinosis and respiratory symptoms.. EasyOne spirometer and personal sampling pump (SKC Sidekick pump) were used for lung function and dust data collection respectively.

Results: The overall prevalence of byssinosis in the study population was 18.9% in the exposed group and 6.2% in the unexposed group. The department of weaving had higher dust level of arithmetic mean of 2.20 mg/m3 (SD =0.32) and geometric mean 2.14 mg/m3 (GSD=0.25) (mg/m3).

The study showed that expected FEV% in normal, mild to moderate and severe were high proportion in exposed group compared to unexposed group and the difference was significant with p-value < 0.001.In assessing the risk factors working experience, previously respiratory symptoms and personal protective equipment had a statistically significant associated with byssinosis.

Conclusion: In conclusion, this study found out that the prevalence of byssinosis and other respiratory symptoms were high among the exposed group (18.9%) compared to (6.2%) of unexposed group. Therefore, cotton dust level, should be reduced by improving the ventilation system of the industry and ensure the provision and use of appropriate personal protective equipment, this is best way to reduce the effect to workers.

.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
BMRC	British medical research council
COPD	Chronic Obstructive Pulmonary Disease
FEV1	Forced Expiratory Volume in one second
FVC	Forced Vital Capacity
LFT	Lung Function Test
MUHAS	Muhimbili University of Health and Allied Science
NIOSH	National Institute for Occupational Safety and Health
PEFR	Peak Expiratory Flow Rate

DEFINITION OF TERMS

Breathlessness	Refers to difficulty in breathing
Cough	Involve expelling air from lung suddenly with sharp, short noise usually in a series of efforts.
Phlegm	Refer to an abnormal amount of mucus especially as expectorated from mouth
Sneezing	Is the reaction of the body to inflammation inside the nose and respiratory tract
Total dust	Is the fraction of airborne material which enters the nose and mouth during breathing and is therefore liable to deposition anywhere in the respiratory tract.
Wheezing	Is a whistling sound that can be made while breathing that may be a symptom of respiratory illness

CHAPTER ONE

1. INTRODUCTION

1.1. Background Information

A cotton textile manufacturing industry is among the industries that employ many workers. It is estimated that more than 60 million people globally work in the cotton textile industry (5). Tanzania is among the country in Africa which manufacturer's textile products and employ a lot of workers. Report on textile industries status of 2004 shows that 50 textile industries were established by the year 2002(6). Cotton dust exposure has a significant contribution to the increase in the occupational burden of diseases globally (7).

Cotton processing involves several stages, such as spinning, knitting, weaving, dyeing, and garment (1,8). The spinning section involves subsection, such as bale opening, blowing, and carding. Previous studies show that the spinning section has higher dust compared with other sections. The cotton dust may contain a mixture of many substances which are harmful to human health. The cotton dust particles enter into the respiratory system to the alveoli zone hence causing the narrowing of the airways, reducing the capacity to retain oxygen (9).

Byssinosis occurs in workers, with exposure to cotton dust. It is characterized by chest tightness; the condition is worse on Monday or the first day of the working week. It improves as the days progress but the symptoms are usually more pronounced when returning to work after a weekend, holiday or vacation (3,10).

Literature review shows that the intervention has reduced the prevalence of byssinosis in developed countries. But in developing countries, the intervention is yet to be implemented hence the prevalence is increasing. Tanzania likes any other developing countries has the same situation (1,3).

There are several factors known to be associated with byssinosis as shown on the conceptual framework (Figure 1) (1,3,7). But studies in byssinosis have been carried out among the male workers, although the number of women working in the textile industry are increasing.

In Tanzania, there is little scientific information known about the prevalence and it is not clear which risk factors are associated with byssinosis because the last study in Tanzania was done almost 40 years ago 1979 (4).

In order to develop effective control measures, it is important to understand the magnitude of the problem and risk factors associated with byssinosis among textile workers. The current study assessed the cotton dust exposure, prevalence of byssinosis and associated factors so as to portray the clear health status of workers in textile industries.

1.2. Problem Statement

A number of researchers have reported that byssinosis and other related respiratory abnormalities are well-known occupational respiratory diseases among the workers in textile industries (11). The Magnitude of byssinosis is significantly decreasing in developed countries with a current prevalence of 3% (1).Previous studies have reported an increase in prevalence (45%) in the developing countries (1–3).

Factors found to be influencing byssinosis have been investigated in several studies. A study done in Turkey indicated that age, sex, smoking status, working history in a dusty place, working in divisions with the high risk of dust exposure were not associated (12). Another study done in Ethiopia showed that byssinosis is associated with employment duration, working department, and work unit ventilation (13). Also, other findings suggest that byssinosis is associated with a reduction in lung function indices especially forced vital capacity and FEV1 characteristically seen on the day of return to work after an absence (10,12).

Most studies which assessed the prevalence, lacked important measurements such as lung function test and dust level, which are important parameters in assessing byssinosis.

In Tanzania, the prevalence of byssinosis was 13% according to a study done by Mustafa at el almost 40 years ago (4). Hence, in Tanzania, little scientific information is known about the magnitude of byssinosis and its associated risk factors.

Therefore, the current study assessed the cotton dust exposure, prevalence of byssinosis and associated factors among textile workers so as to portray clear health status of cotton textile workers.

1.3. The rationale of the Study

This study provides information on employee dust exposure level and the prevalence of byssinosis among cotton textile workers. At this age of industrialization knowing the status of workers will help the stakeholders to take necessary measures to achieve SDGs number 8 of decent work and economic growth.

The recommendation from this study can be used by different stakeholders for example Workers Compensation Fund because according to ILO byssinosis is among the occupational diseases that require to be compensated. Therefore, knowing the current situation is very important.

The study adds up to the body of knowledge on the scientific community on understanding the magnitude and factors associated among cotton textile workers in Tanzania. Also, it can be used by other researchers in formulating the basis for other research on byssinosis.

The results of this study provide information that may help to address some of the challenges addressed by National Occupational Health and Safety policy, for example, inadequate Occupational Health and Safety information in working places.

The study is used as part of fulfillment for the Master of Science in Environmental and Occupational Health

1.4. Main research question

What are, the level of dust, the prevalence of byssinosis**,** factors associated with, and lung function status among cotton textile workers in Dar es Salaam?

1.5. Research Questions

1. What is the proportional of byssinosis among cotton textile workers in Dar es Salaam?
2. What are the factors associated with byssinosis among cotton textile workers?
3. What is lung function status among cotton textile workers in Dar es Salaam?
4. What level of cotton textile dust in the production sections has workers in Dar es Salaam are exposed?

1.6. Broad Objective

To assess dust exposure, the prevalence of byssinosis**,** factors associated with, and lung function among cotton textile workers in Dar es Salaam.

1.6.1. Specific Objectives

1. To determine the magnitude of byssinosis among cotton textile workers in Dar es Salaam.
2. To determine factors associated with the development of byssinosis among cotton textile workers in Dar es Salaam.
3. To determine lung function status among cotton textile workers in Dar es Salaam.
4. To determine cotton dust exposure levels among workers in textile factory production sections in Dar es Salaam

1.7. Study hypothesis

Null hypothesis

It was hypothesized that ‘there is no significant difference between cotton dust exposure and the increase in prevalence of byssinosis among cotton textile workers

Alternative Hypothesis

It was hypothesized that ‘there is significant difference between cotton dust exposure and the increase in prevalence of byssinosis among cotton textile workers.

1.8. Conceptual Framework

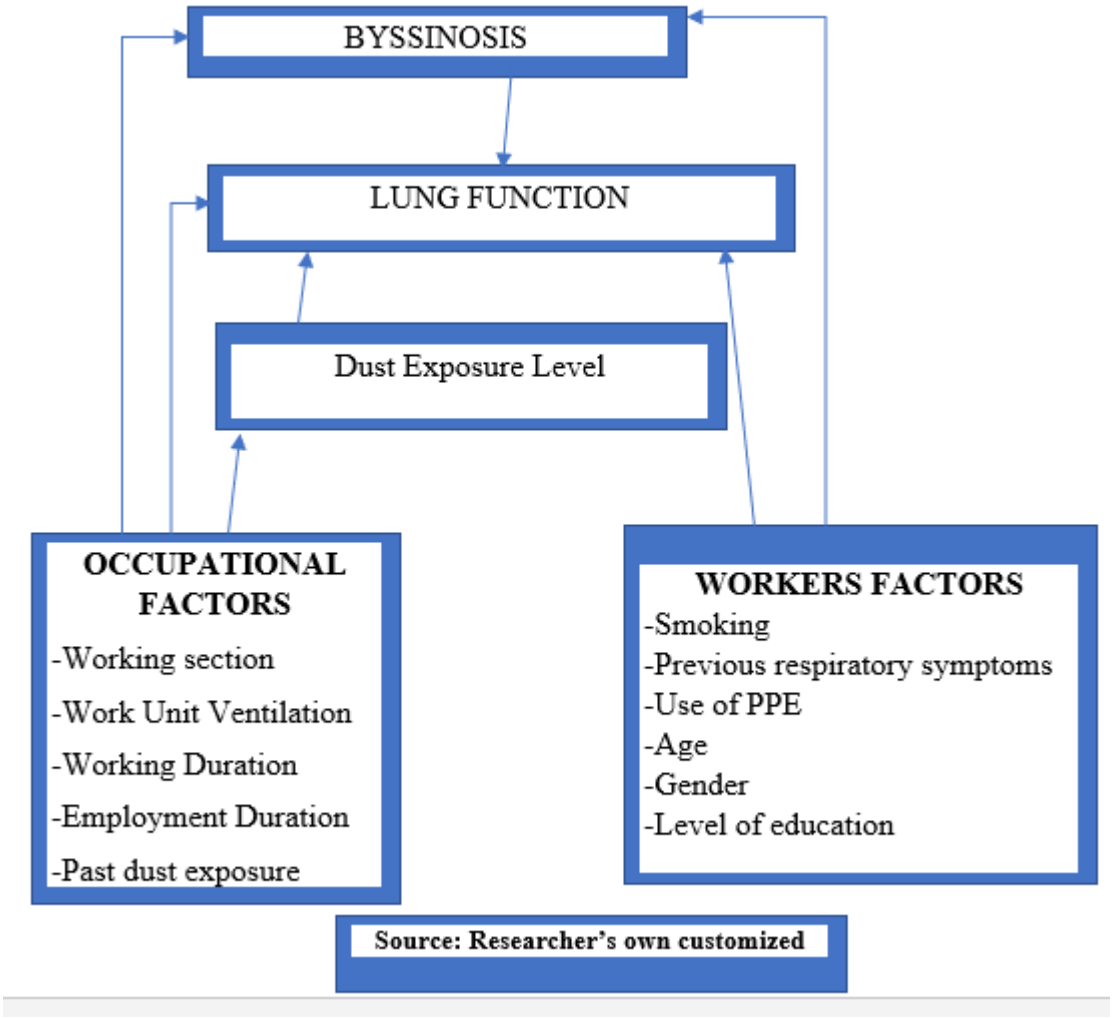

Figure 1-1: Conceptual Framework

The conceptual framework explains the relationship between dependent and independent variables. The byssinosis as outcome variable which is dependent on various factors. The predictors are the independent variables which are, grouped into occupational factors and workers factors. (Figure 1-1)

Workers factors

They include factors such as age, education level, and use of personal protective equipment gender previous respiratory symptoms and smoking that may influence byssinosis. For example, elderly people are more prone to acquire byssinosis than young. Workers with the low level of education are more at risk to get exposure to dust because they are working in dust areas for a long time compared to those with high education who normally play a role of supervision Proper use of PPEs reduce dust exposure and smokers have a chance of developing byssinosis compare to non-smokers.

Occupational factors

These are factors that can predispose worker into danger while at work. They include the working section, those who work in section with high dust have a high chance of developing byssinosis. Adequate ventilation in working place reduce exposure to dust, other occupational factors that influence byssinosis is past dust exposure and employment duration.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Prevalence of Byssinosis

Byssinosis is a respiratory disease associated with exposure to cotton dust. Some of its symptoms are feeling of chest tightness that is worst for being out of work for 48 hours and on the first day of the working week. Although it improves when you are on holiday, this differentiates byssinosis from occupational asthma (2,7).

Several studies have investigated the prevalence of byssinosis and respiratory symptoms among cotton textile workers. The study was done in Pakistan, among healthy individuals showed that the prevalence of Byssinosis is observed on the first day of the week, (3).

Exposure to cotton dust significant induces chest tightness, where studies show that the exposed group has four times risk than the non-exposed group (14). A study done in India among women has shown that women are more affected and have a high prevalence of byssinosis compared to men due to the combination of pollutants (9).

In Africa, few types of research have investigated the prevalence of byssinosis. A study done in Ethiopia showed that the prevalence was high in spinning and weaving section (2). The study done in Benin has described that prevalence was high among the exposed group compared to the unexposed group (15).

In Tanzania there is only one study which describes the byssinosis, it shows that the prevalence of byssinosis is high among cotton textile worker. However, these results are based upon data from over 40 years ago and it is unclear if the condition is still the same (4).

While these studies report in detail the prevalence of byssinosis, it provides the basis for understanding how big a problem is and the importance of taking action. However, the studies have some limitation, since they only involved male workers.

The studies also lack Lung function test and measurement of cotton dust level. Lack of current data because the study done in Tanzania has almost forty years now which its information may be irrelevant. Therefore, this objective intended to fill the knowledge gap by providing current data.

2.2. Factors associated with Byssinosis

It is clear that exposure to cotton dust significantly is associated with byssinosis. It is necessary but not sufficient factor, therefore it is important to determine the other risk factors associated (9). Factors thought to be influencing have been explored in several studies. Numerous studies have attempted to explain the increase of age and duration of employment as the significant determinant for byssinosis (8,10,11). The study done in Pakistan showed that the duration of employment has no significant effect (3).

A recent studies showed that education level is associated with byssinosis (3,7), while a study by Mansouri et al showed that education level is not associate with (16). Other studies have considered the relationship between the working section and byssinosis whereby working in spinning and weaving section is also significantly associated (7,11). A number of studies show that smoking is a factor associated (3,7,17,18), while other studies show that smoking is not associated with (19–21).

In Africa the studies done in Benin and Ethiopia shows, the employment duration is the factor thought to be influencing byssinosis that has been explored in several studies (13,15,18). Other factors are sex, factory ventilation, working department/section (13).

In Tanzania, there is a lack of recent study that assesses the factors associated with byssinosis (4). Previous research findings into factors have been inconsistent and contradictory. Therefore, this objective addressed the knowledge gap.

2.3. Lung Function Test

The pulmonary functions test is very important test in assessing the byssinosis. The lung function test includes the use of spirometry. The spirometry includes the following indices Forced expiratory volume in the first second (FEV1), forced vital capacity (FVC) and FEV1/FVC ratio (11,22).

In a prospective cohort study, done in China showed that FV1 declined observed among those who had a history working in the textile industry (23). In India significant fall in FEV1, FVC and PEFR are shown among individual exposed to cotton dust and biomass users (9).

Another study marked the value of FEV1, FVC and PEFR to be lower among exposed than the unexposed group. Also, the increase of duration of employment associated with a decrease in mean of lung function indices (24).

Spirometry parameters also decrease by working section unit where a significant decrease is seen in cotton mills than other section (25). The study done in India suggests that smokers have a lower value for FEV1, FVC, and PEFR (26).

In Africa, several studies have revealed a decline in spirometry value due to exposure to cotton dust. A study done in Nigeria shows that smoking and duration of exposure contribute to declining in spirometry values although the cross-shift change was insignificant (27). Another study done in Egypt show statistical differences on comparing FEV1 and FVC between weaving, spinning and carding sections but there is no statistical decline of spirometry value and duration of employment(18). In Tanzania recent, information on cotton dust exposure levels and lung function test in textile industries are not available.

The above studies provide the basis for understanding the effect of exposure to cotton dust. Although there is a limitation because most of the studies involved only men and the few that involved women, did not have Lung function test and dust level measurement. Therefore, this objective filled the knowledge gap.

2.4. Cotton dust exposure

In Tanzania, the textile cotton industry drives the economy and provide employment, although the workers are at risk of getting byssinosis. (13). During the handling and final processing of cotton, it generates a lot of dust. Cotton dust polluted working areas are reported as significant risk factors for Byssinosis (3,14). The concentration of respirable cotton dust differ from section to section and is higher in the first initial processing sections (10,12).

In Africa there are few study that reported effect related to cotton dust, Hinson et al reported that breathing discomfort was frequently reported in a section that generates dust in cotton textile (21). The results are contrary to the study done in Zimbabwe which showed that working in the weaving section showed dust as protective against the respiratory problem (28).

Measurement of dust should account for variability between the sections and workers, but most of the previous studies did not take account of variability in their measurement. Therefore, the current study addressed the gap.

Table 2-1: Review of studies on Cotton Dust Byssinosis and respiratory symptoms among textile workers

Study	**Country**	**Refer No.**	**n**	**Study design**	**Average Dust level $mg.m^{-3}$**	**Decline FEV_1/FVC**	**%Predictive value FEV1, FVC**	**Symptoms**
Global Studies								
Lai, P. S. et al. (2014)	USA	1		Review		≤ 0.7,		
Nafees, A. A. et al. (2013)	Pakistan	3	372	Cross-sectional survey				BS10.5%, CC7.5%, SB22.3%, W22.3%CT 33.3%
Abbas, A. H. (2015)	Iraq	4	75	Cross-sectional study				CC 1.3, SB 45.3, W22.3%
Suneeta.M, Kumar. (2015)	India	6	315	Cross-sectional study			FEV1/FVC % Mean 93.46	BS41%, CC 24% SB 18%, W22.3%, CT 17%
Ghasemkhani, M. et al. (2006) ‘	Iran	7	880	Cross-sectional study				CC 20.7%, P 41.6% SB 18%, W22.3%, CT 27.4%7%
Ismail at el. (2017)	Pakistan	8	362	Cross-sectional study				BS 56.6%, SB 18% CT 10.1%
J. V. Jannet, G. P. J. (2006)	India	10	104	Cross-sectional study		3.36	FEV_1 77.59% FVC 80.74%	BS65.7%, CC 23.7%, SB22.3%, W22.3%CT 33.3%
Sevincc at el (2002)	Turkey	12	223	Cross-sectional study	0.413	FEV_1 0.1021		BS14.2%, CC 14.3% SB22.3%, W 11.5%, CT 20.3%
Dube, K. J., and Ingle, S. T. (2013)	India	14	188		4.2		FEV_1 60% FVC 80.74%	CC 42% SB 55%,CT 71%, , P 62%
Lai, P. S. et al. (2014)	China	22	919	Cohort study		0·83		
Dangi, B. and Bhise, A. (2017)	India	25	100	Cross-sectional observati			FEV1/FVC 85.11%	C 65%, SB 85%, CT 30%

				onal study				
Africa Regional studies								
Study	**Country**	**Refer No**	**n**	**Study design**	**Average Dust level**	**Decline FEV_1/FV**	**%Predictive value FEV1, FVC**	**Symptoms**
Hinson, A. V. et al. (2016)	Benin	21	656	Cross-sectional study				BS44%, CC 16.8%,.9%, SB22.3%, W 17.3% CT 30%
Awad, M. et al. (2017)	Egypt	18	115	prospective study				CC 20%, W 12% CT 33.3%, P 32%
Wami, et al. (2018)	Ethiopia	13	413	Cross-sectional study				CC 28.1%, SB22.3%, W27.1% CT 33.3%, P 19.6%
Hinson, A. (2014)	Benin	5	216	Cross-sectional study			FEV1, 74.12% FVC, 130.92%	BS 21.1%, CC 22.0.9%, SB22.3%, W17.3% CT 27.5%), P 13.8%
Alemu at el. (2010)	Ethiopia	11	417	Cross-sectional study	32.2			BS 38% CC 32 SB 17.4.3%, W 62%, CT 46%, P 62%
Nagoda, at el(2012)	Nigeria	27	400	Cross-sectional study				SB 11.9%, W 13.5%, CT 22%, P 41%, C 43%, W 32.5%
Mberikunashe, J. et al. (2006)	Zimbabwe	28	194	Cross-sectional study				SB 24% P 41%C 43%
Tanzania Local studies								
Mustafa, K. Y., Bos, W. and Lakha, A. S. (1979)	Tanzania	9	216	Cross-sectional study		0.06		BS 13% ,CC 3.6% SB 17.4.3%, W 62% ,CT 46%, P 14%

SB: shortness of breath. BS: Byssinosis. W: Wheezing. P: phlegm. CC: chronic cough. C: Coughing. CT: chest tightness

CHAPTER THREE

3. METHODOLOGY

3.1. Study Area

The study was conducted in the cotton textile industry located in Dar es Salaam where workers from cotton textile industry (exposed) and workers from the water bottling company comparative group (unexposed) were recruited.

3.1.1 Study setting

The cotton textile industry had three major departments, which are spinning department, weaving department and the final processing department.

The spinning department is the first department in the cotton textile industry, it makes cotton into thread. Spinning produces cotton threads of required size from raw cotton, ready to be used by machines in the weaving department.

The weaving department consisted of more than 200 machines in one big room. It receives materials from the spinning department, which are close to each other, and workers move from one department to another. Weaving department has two functions, first is winding, which consists of unrolling the chain threads to roll them up on the large pools done by winding machine. The second function is making cloths obtained from the chain threads placed vertically and the weft placed horizontally. After verification, the clothes are taken to the final processing department.

The final processing department is divided into different subsection but located in one place and workers move from one section to another. It involves hand sewing, bleaching, dyeing, printing, and packaging sections.

There are several chemicals used in this section including Enzyme, Acetic Acid, Bleaching powder, Sodium hyposulfite, Caustic Soda, Soda Ash, and Sodium Bicarbonate which are mixed with raw materials coming from weaving section

3.2. Study Design

The study deployed a cross-sectional comparative study design. The study design was considered suitable for assessing the magnitude and associated factors of byssinosis.

3.3. Study Population

The source population of this study was workers in cotton textile industries for exposed participants and drinking water bottling plant participants for the unexposed. The study population involved male and female workers.

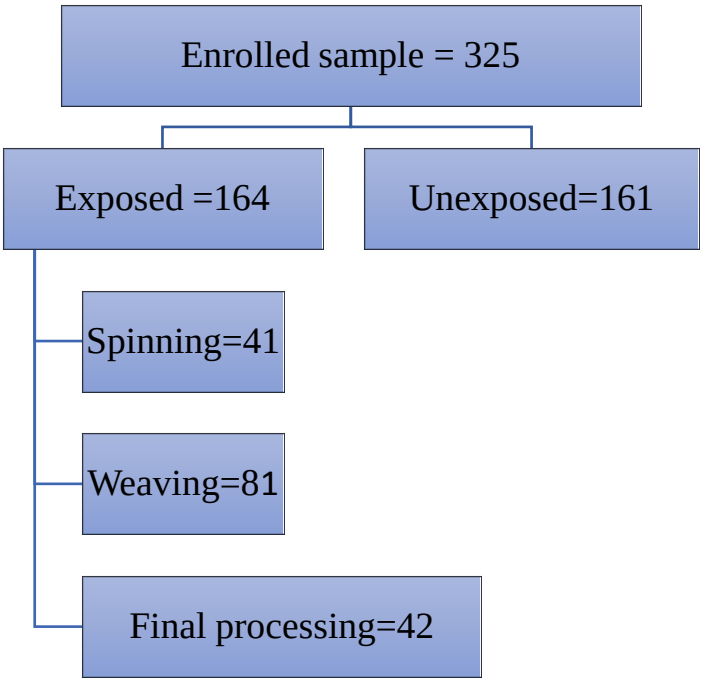

Figure 3-1: Distribution of study participants

3.4. Sample Size

The sample size was determined using Open Epi software.

The following assumptions was considered:

P= Proportion of Byssinosis among exposed group (44%) (21)

Proportion of Byssinosis among unexposed group (13%) (21)

95% confidence interval, 80% power,

d= Margin of error 5% (0.05)

Z= Confidence level (Z = 1.96 for 95%)

DEFF =Design effect

α = 0.05

Np =Product of sample size and probability *p* of the event

N* = [DEFF*Np(1-p)]/ [(d^2/$Z^2_{1-\alpha/2}$*(N-1) + p*(1-p)] (*Source Open Epi)

***N* =** 300

Adjusting for non-response rate

$$N'' = \frac{N}{(1 - q)}$$

Where,

N'' = Adjusted sample size

N= Initial sample size

q= proportion is expected to refuse to participate assumed 10%

N'' =320 participants

The sample size of the study was 320 participants

The ration of exposed: Unexposed = 1:1

Therefore, it was planned that exposed should consist of 160 participants and unexposed consist of 160 participants

3.5. Sampling procedure

A list of the cotton textile industries found in Dar es Salaam were obtained from Tanzania cotton Board's Textile sector development unit. Then a simple random technique used to select the textile industry. In selecting the study participant, the names of study participants from Human resources officer register were taken. Then a walkthrough survey was done to establish similar exposure (SEG). Then Stratified sampling technique was used to select study participants from each department. The industry had only one shift. The industry had three main departments, the first department was spinning the second was weaving and the third was final processing department.

Inclusion and exclusion criteria

Inclusion Criteria: -

The study deployed employees who were directly involved in the production of cotton textile. These were workers that were daily working in production sections such as bale opening, blowing, and carding of the textile industry in all time of their working shift.

Exclusion Criteria

Workers with less than one year of working experiences were excluded.

Study Variables

Objectives 1: Prevalence of Byssinosis

Independent variables

Working Duration

Employment Duration

Age

Working section

Work Unit Ventilation

Dependent variables

Byssinosis

Objectives 2: Factors associated with Byssinosis

Independent variables

Working section

Work Unit Ventilation

Working Duration

Employment Duration

Use of PPE

Smoking

Previous respiratory symptoms

Past dust exposure

Age

Gender

Level of Education

Dust Exposure Level

Dependent variable

Byssinosis

Objectives 3: Determine Lung Function Test

Independent variables

Smoking

Age

Gender

Height

Dependent variable

Lung function status

Objectives 4: Determine the cotton dust exposure level

Independent variables

Working section

Work Unit Ventilation

Working Duration

Employment Duration

Dependent variables

Dust levels

3.6. Recruitment and training of research assistants.

The study recruited five research assistants with an environmental health background and one Laboratory technician. The training was provided to research assistants on data collection, data quality assurance, data management.

3.7. Data Collection Procedures

A stratification sampling technique was used to select participants from the industries. The workers were grouped into the strata (department). In the textile industry, they had only one shift, and all workers who were present during the study period were recruited. Participants for a personal total dust sample were selected from similar exposure groups (SEGs) where workers were assumed to have similar exposures. Questionnaire in Swahili version was pre-tested before data collection.

3.7.1. Questionnaire

A standardized British medical research council (BMRC) questionnaire modified to suit the Tanzanian environment was used (29). The questionnaire included questions on coughing, wheezing, chest tightness, breathlessness, and chronic bronchitis, whether they ever had previous respiratory diseases, smoking habits, and industrial ventilation. The questionnaire

was translated into Swahili language and administered to all comparative group and exposed respondents. Then translated back to English language and crosschecked by different people so that the meaning was not distorted.

3.7.2. Lung Function Measurements.

Spirometry assessment was done in both comparative and exposed subjects. Prior to conducting the actual procedure of the test, the spirometer was calibrated as per the instruction manual and clear demonstration was done to respondents. Anthropometric measurements of height and weight without shoes were taken, measured to the nearest one kilogram and to the nearest one centimeter, respectively.

History of Asthma and smoking status were recorded. Lung function tests were done by using EasyOne spirometer, the tests were performed in standing position. Each respondent was asked to take deep breaths, put into mouth spirette connected to spirometry. The participant was instructed to blow out as hard and fast as possible, without interruption, and completely as possible for three times. For each respondent, forced vital capacity (FVC), forced expiratory volume in 1 sec (FEV1), and the ratio of forced expiratory volume in 1 sec to forced vital capacity (FEV1/FVC) was recorded. The best of the three results were recorded (20). Peak expiratory flow (PEF) was studied for each respondent.

3.7.3. Cotton dust exposure measurements

Air sampling of the workplace was sampled by using Side Kick Casella (SKC) pumps operated at a flow rate of 2.0 L/minutes attached to closed cassettes fitted with PVC Filters, 5.0 µm, 37 mm throughout the work shift. The pump was attached around the breathing zone of the worker for the whole working shift. Dust collection form was used to collect information such as section name, date, pump number, the filter number, total time sampled and pre-and post-calibration.

The filter paper was inserted in the desiccator for removing the humidity for 72 hours before going to the field. Then, pre-weighed, then it was inserted into the cassettes marked the code ready to be taken to the field. During these processes, the temperatures were maintained between 24^0C to 25^0C and relative humidity maintained between 50 to 51%.

Prior to air sampling, pumps were calibrated to the flow rates 2.0L/min. Post-calibration was done after sampling.at the end of the working shift the deviation of more than ±5% between pre-calibration and post-calibration was the criteria to discard the sample. Personal samples were taken under normal work conditions to obtain the concentration of airborne contaminants which will be equivalent to what would be taken within the breathing zone of the employees.

To ensure quality control and monitoring any contamination and change in weight, field blank was used, this was clean unexposed filters that were used to determine whether contamination occurred during sample transport, setup and recovery. Field blanks were transported to the sampling site, removed and stored in containers inside the sampler's case at the sampling site until the exposed filters were retrieved for post-sampling weighing.

After taking the samples, the sampling train was disconnected. The cassette was sealed with plugs on both ends for transportation. The sample was taken to the laboratory and inserted in the desiccator to remove the humidity before post-weight measurement for each filter, including field blanks.

The mass concentration was calculated using GRAVIMETRIC (FILTER WEIGHT) method using the formula.

$$C = \frac{(W_2 - W_1) - (B_2 - B_1)}{V} \times 10^3, \text{ mg/m}^3,$$

Where:

W_1= tare weight of filter before sampling (mg),

W_2= post-sampling weight of sample-containing filter (mg),

B_1= mean tare weight of blank filters (mg),

B_2= mean post-sampling weight of blank filters (mg).

The exposure level (concentration) was compared with the threshold limit value for total dust.

The sampling procedure and number of dust samples for personal dust sampling followed the NIOSH guideline.

3.8. Ethical issues and consideration

Ethical clearance was provided by the Muhimbili University of Health and Allied Sciences (MUHAS) Ethical Committee, issued on 9th May 2019. Permission to conduct the study at the field was requested and provided by Industrial Management, letters issued on 28th June 2019 for the comparative group. The permission to conduct a study for the exposed group was issued on 2nd July 2019 for the exposed group. Informed consents were obtained from study respondents after being informed on the operation and application of the study findings. Confidentiality of the respondents was ensured at all stages of the study.

3.9. Data Management and Analysis.

3.9.1. Data Management.

All filled questionnaires on the day were checked for completeness and collected by the principal investigator from research assistants every evening.

3.9.2. Data Analysis

SPSS version 23 was used to analyze the data. Both descriptive and inferential statistics, the continuous variables were checked for normality by using the histogram with a normal curve in order to determine the suitable statistical test to be used. The significance level was set to $p < 0.05$. Data were presented in tables, frequencies, and percentages. Continuous variables were compared by using Mean, standard deviation, median, independent t-test, and one-way analysis of variance (ANOVA), for skewed data, they were log-transformed before statistical analysis. Categorical responses were tested by using Chi-square test; for an expected number less than 5 Fisher's exact test was used. Univariable and multivariable binary logistics regression analyses were done to examine factors associated with byssinosis. All independent variables and other variables with P value < 0.25 at bivariate analysis, were taken into the binary logistics regression analysis. The measure of statistical association was the odds ratio, and the measure of statistical significance was 95% confidence level expressed in P-value < 0.05.

3.10. Data Analysis techniques by Objective

Objective 1: To determine the prevalence of Byssinosis among cotton textile workers

The prevalence was analyzed in order to show the frequency and percentage of variables. (χ^2) test was used to determine the association of Byssinosis and predictors variables. In assessing the Byssinosis, presence of one or more of the following respiratory symptoms were used.

Byssinosis: was defined by Schilling's grading

Grade 0: no symptoms of chest tightness or breathlessness on Monday

Grade ½: occasional chest tightness or breathing difficulty on the first day of the working week

Grade 1: chest tightness and/or breathlessness on Monday only.

Grade 2: chest tightness and/or breathlessness on Monday and other weekdays.

Objective 2: To determine factors associated with Byssinosis among cotton textile workers

The multivariable binary logistic regression was performed to determine predictor variables (13). Univariable logistic regression analysis was performed primarily to select variables for the final model on the basis of p-value < 0.2. Cramer's V test was used to observe for Multicollinearity between variables. Outliers were checked by using a scutter plot. A p-value of less than .05 was considered significant**.** Assumption for logistic regression were checked Predictors that did not meet the criteria were omitted in this study. Education level and past dust exposure were omitted because they did not meet the criteria of having count more than five.

Objective 3: To determine lung function test among cotton textile workers

Independent t-test and one-way analysis of variance (ANOVA) were used to check the significant differences in lung functions of the exposed subject's value of FEV1 and FVC and the predicted FEV1 and FVC. Therefore, a p-value of < 0.05 was considered significant in showing the statistical difference among the groups

Objective 4: To determine the level of dust exposure in the cotton

Gravimetric (Filter Weight) method in the laboratory used to get the concentration of the dust, then independent t-test was used to determine the geometric means between different departments of the cotton textile industry.

3.11. Dissemination of the research findings

The finding of this study will be disseminated to different stakeholders the study participants, the industry management, OSHA, Tanzania Cotton Board, and Workers Compensation Fund and to local and international conferences. The study manuscript will be prepared and submitted for publication in a reputable journal.

CHAPTER FOUR

4. RESULTS

4.0.Demographic characteristics of the study participants

Table 4-1: Demographic characteristics of the study participants (N=325)

Variables	Exposed n (%)	Unexposed n (%)	Total n (%)
Sex			
Male	103 **(62.8**)	130 (**80.7**)	233 (71.7)
Female	61 (37.2)	31 (19.3)	92 (28.3)
Age (years)			
18 - 27	8 (4.9)	98 **(60.9)**	106 (32.6)
28 - 37	15 (9.1)	47 (29.2)	62 (19.1)
38 - 47	22 (13.4)	12 (7.5)	34 (10.5)
48 - 57	73 **(44.5)**	3 (1.9)	76 (23.4)
Above 58	46 (28.0)	1 (0.6)	47 (14.5)
Mean Age	51(SD 11.4)	27.9 (SD 7.2)	
Education level			
Informal education	0 (0.0)	4 (**2.5**)	4 (1.2)
Primary school	142 (**86.6**)	51 (31.7)	193 (59.4)
Secondary school	21 (12.8)	92 **(57.1**)	113 (34.8)
Diploma College	0 (0.0)	7 (4.3)	7 (2.2)
University	1 (0.6)	7 (4.3)	8 (2.5)
Marital status			
Single	27 (16.5)	106 (65.8)	133 (40.9)
Married	119 (72.6)	49 (30.4)	168 (51.7)
Cohabiting	5 (3.0)	4 (2.5)	9 (2.8)
Separated	7 (4.3)	2 (1.2)	9 (2.8)
Widowed	6 (3.7)	0 (0.0)	6 (1.8)
Work experience(years)			
Below 5	20 (12.2)	131 **(81.4**)	151 (46.5)
5 - 10	7 (4.3)	27 (16.8)	34 (10.5)
11- 20	11 (6.7)	1 (0.6)	12 (3.7)
Above 20	126 **(76.8**)	2 (1.2)	128 (39.4)

The study involved 325 participants, 164 were exposed group and 161 were unexposed. Exposed group had mean age of 50.96 (SD 11.42) and unexposed group had mean age of 27.88 (SD 7.17) Most of the study participants were males 103 (62.8%) of exposed and 130 (80.7%) of unexposed. Half of the study participants had attended primary school education

followed by secondary school (34%). Majority of the study participants (32%) had the age group between 18 – 27 years, (Table 4-1).

The exposed group had higher proportional of ever smoked compare to unexposed group.

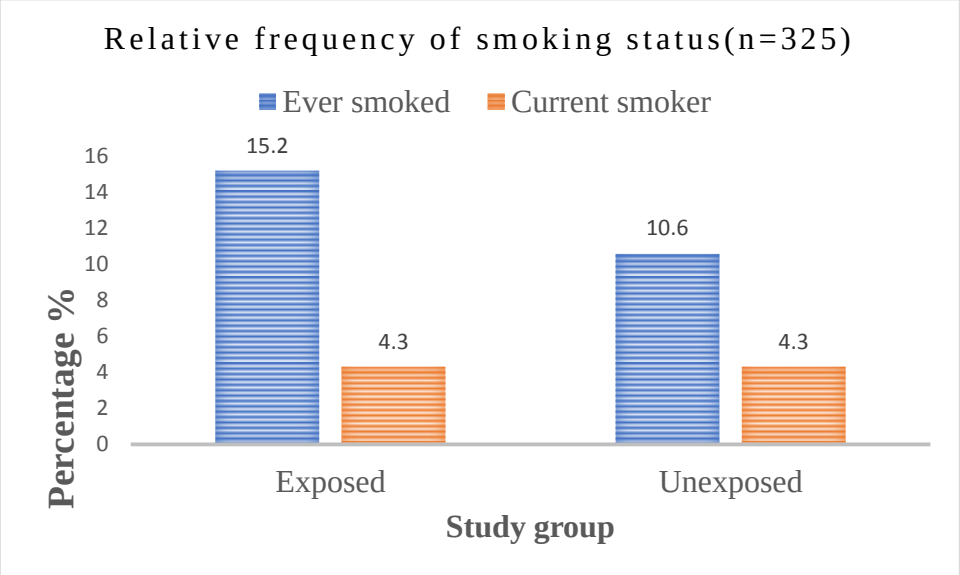

Figure 4-1: Showing the percentage of ever smoked and current smoker among exposed and unexposed

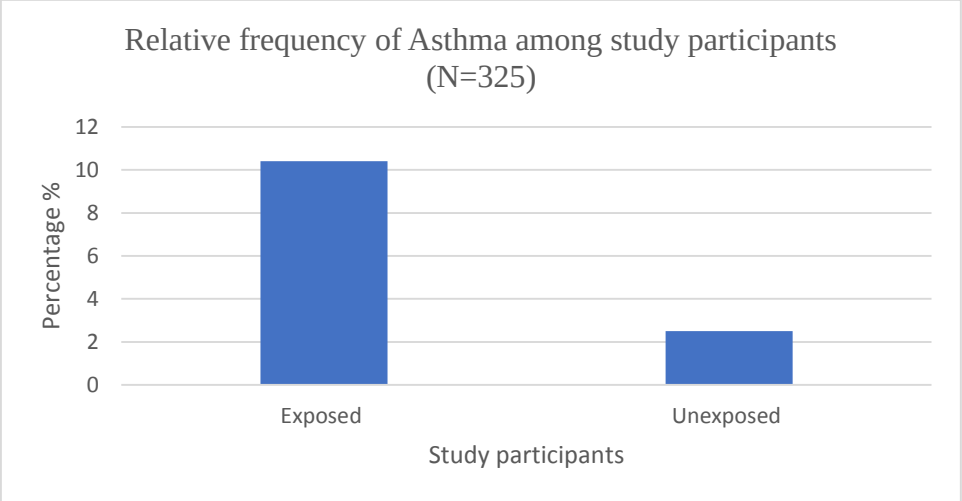

Figure 4-2: Percentage of Asthma among exposed and unexposed

Asthma prevalence was higher in exposed group compared to unexposed group, this show that byssinosis is also aggravate by the occurrence of asthma

4.2 Prevalence of Byssinosis

The overall prevalence of byssinosis in the study population was 18.9% in the exposed group and 6.2% in the unexposed group. Among the exposed group it was observed that the prevalence of byssinosis was higher in final processing department (26.2%) than those in spinning and weaving departments in which their prevalence was 19.5% and 14.8% respectively.

Table 4-2: Prevalence of byssinosis among study participants

Byssinosis Grade	Exposed n (%) n=164	Unexposed n (%) n=161	P-value
Grade 0	133 (81.1)	151 (93.8)	0.001
Grade 1/2	22 (13.4)	10 (6.2)	0.039
Grade 1	31 (18.9)	10 (6.2)	0.001
Grade 2	23 (14.)	11 (6.8)	0.034

Byssinosis Grade 1 was higher among the exposed group followed by Grade 2 in the unexposed group. The prevalence was almost similar to all grade. There were significant differences in byssinosis prevalence between exposed and unexposed group (p-value < 0.05) (Table 4-2).

Table 4-3: Prevalence of byssinosis by department among textile workers, (N = 164)

Byssinosis Grade	departments			
	Spinning n (%) n = 41	Weaving n (%) n = 81	Final Processing n (%) n = 42	P value
Grade 0	33 (80.5)	69 (85.2)	31 (73.8)	0.31
Grade 1/2	7 (17.1)	10 (12.3)	5 (11.9)	0.79
Grade 1	8 (19.5)	12 (4.8)	11 (26.2)	0.31
Grade 2	5 (12.2)	8 (9.9)	10 (23.8)	0.09

Prevalence of byssinosis Grade 1 (26.2%) was higher in the final processing department than other department followed by Grade 2 (23.8%) also in the final processing department there were no significant differences in byssinosis prevalence between exposed and unexposed group (p-value >0.05) (Table 4-3).

Table 4-4: Prevalence of respiratory symptoms among study participants (N=325)

Respiratory Symptoms	**Exposed n (%)**	**Unexposed n (%)**	**P-value**
Cough	41 (25.0)	31 (19.3)	0.23
Morning cough	22 (53.7)	14 (45.2)	0.63
Cough day and night	30 (73.2)	26 (83.9)	0.39
Cough 4-6 days a week	25 (61.0)	20 (64.5)	0.8
Cough more days in 3 months	19 (46.3)	2 (6.3)	**0.001***
Cough with Sputum	40 (24.4)	38 (23.6)	0.48
Morning cough with sputum	24 (61.5)	22 (59.5)	0.85
Cough day and night with sputum	27 (69.2)	28 (75.7)	0.61
Cough 4-6 day a week with sputum	19 (48.7)	13 (38.2)	0.47
Cough more days in 3 months with sputum	11 (28.2)	7 (18.9)	0.42
Wheezing	39 (23.8)	22 (13.7)	**0.02***
Breathlessness			
Dyspnoea I	26 (96.3)	21 (75.0)	**0.03***
Dyspnoea II	22 (81.5)	13 (46.4)	**0.007***
Dyspnoea III	17 (63.0)	6 (21.4)	**0.002***

The cotton textile workers had higher prevalence of respiratory symptoms than the unexposed group. Among cotton textile workers respiratory symptoms were Cough (25%), coughing with sputum (24%), wheezing (23%). But there were no significant differences for the mentioned respiratory symptoms between exposed and unexposed group (p-value > 0.05). However, coughing more days in 3 months, wheezing, dyspnoea I, II and III respiratory symptoms had a significant difference between the exposed and unexposed group as indicated by a star and bolded (p-value < 0.05), (Table 4-4)

4.3. Factors associated with Byssinosis

Table 4-5: Multivariable binary logistic analysis of factors associated with byssinosis (N=164)

Variables		Byssinosis		COR (95%CI)	AOR (95%CI)	Pvalue
		No	Yes			
Departments						
Final processing		31 (81.1)	11 (26.2)	1.00	1.00	
Weaving		69 (85.2)	12 (14.8)	0.49 (0.95,1.06)	0.40 (0.15,1.06)	0.67
Spinning		33 (80.)	8 (19.8)	0.68 (0.24,1.92)	0.58 (0.15,1.62)	0.25
Work experience (years)				**1.06 (1.01,1.11)**	**1.07 (1.01,1.13)**	**0.02**
Gender						
Female		84 (81.6)	19 (18.4)	1.00	1.00	
Male		49 (80.3)	12 (19.7)	0.9 (0.41, 2.06)	1.5(0.72, 3.118)	0.24
Age(years)						
18 - 38		20 (76.9)	6 (23.1)	1.00	1.00	
39 - 59		93 (82.3)	20 (17.7)	1.20 (0.31,4.57)	1.21 (0.29,4.97)	0.79
Above 60		20 (80.0)	5 (20.0)	0.79 (0.21, 2.34)	0.88 (0.26, 2.90)	0.82
Smoking	No	114 (82.0)	25 (18.0)	1.00	1.00	
	Yes	19 (76.0)	6 (24.0)	1.44 (0.55, 3.97)	1.4(0.44, 4.06)	0.60
Previous resp symptoms	No	118 (86.1)	19 (13.9)	1.00	1.00	
	Yes	15 (55.6)	12 (44.4)	4.97 (2.01, 12.22)	**4.83 (1.95, 11.98)**	**0.001**
PPE use	No	126 (82.9)	26 (17.1)	1.00	1.00	
	Yes	7 (58.3)	5 (41.7)	3.46 (1.01, 11.75)	**4.5 (1.14, 17.72)**	**0.03**

***COR**=crude odds ratio, **AOR**=Adjusted Odds ratio. Controlled for Age, gender; smoking previous respiratory symptoms*

In the bivariate analysis, previous respiratory symptoms, and PPE use had a p-value < 0.25. However only, working experience, previously respiratory symptoms and PPE use had a statistically significant association with byssinosis in the final multivariable binary logistic regression analysis.

The finding shows that those workers with previously respiratory symptoms had 4.83 times higher odds of developing byssinosis compared to those respondents with no previously respiratory symptoms (AOR=4.83,95%CI:1.95, 11.98).

Employees who used personal protective equipment's had 4.50 times higher odds of developing byssinosis when compared to those employees who didn't use personal protective equipment (AOR=4.5, 95%CI:1.17,4.72). During the study, workers were observed using inappropriate personal protective equipment which might increase dust exposure.

After controlling for outliers, working experience was statistically significant (AOR=4.5, 95% CI:1.07 (1.01,1.13)),with p-value < 0.02. This shows that for every unit increase in working year experience there is 7% increase in odds of byssinosis holding other factors constant (Table 4-5)

4.4. Lung Function status

Baseline characteristics of the subjects such as age, height, weight, and body mass index (BMI) of the study participants were assessed prior lung function test. The exposed group had a higher mean age 50.96±11.42 compared to the unexposed group which had low mean age 27.88±7.17 (Table 4-6)

Table 4-6: Baseline characteristics of the subjects

Parameters	**Mean ± SD**		
	Exposed	**Unexposed**	**P-value**
Age (years)	50.96 ± 11.42	27.88 ± 7.17	0.001
Height (cm)	163.56 ± 3.42	164.5.56 ± 0.0	0.001
Weight (kg)	68.86 ± 4.9	66.88 ± 0.01	0.001
BMI (kg/m2)	25.1 ± 0.4	25.5 ± 8.0.0	0.11

Table 4-7: Comparison of Spirometry parameters between exposed and unexposed (N=325)

	Mean ± SD				95%CI of the	P-
Parameters	**Exposed**	**Unexposed**	**t**	**df**	**mean difference**	**value**
FVC (L)	3.43 ± 0.62	4.22 ± 1.01	8.38	263.90	0.60, 0.97	0.001
FEV_1 (L)	2.50 ± 0.48	3.30 ± 0.54	13.95	318.20	0.68 ,0.90	0.001
FEV_1/FVC%	82.49±4.9	97.84 ± 0.01	4.53	281.95	4.44 ,11.25	0.001

An independent-samples t-test was conducted to compare the mean of lung function parameters, FVC (L), FEV_1 (L) and FEV_1/FVC% between the exposed and unexposed group. There was a significant differences in mean between exposed and unexposed group t (263.90) =8.38, p=0.001, t(318.20)= 13.95,p=0.001, t(281.95)= 4.53,p=0.001 for FVC (L), FEV_1 (L) and FEV_1/FVC% respectively, (Table 4-7).

Table 4-8: Comparison of Spirometry parameters by Departments (N=164)

Parameters	**Departments**	**Mean ± SD**	**F**	**(df)**	**P-value**
FVC (L)	Spinning	2.96 ± 0.20	21.11	2,161	0.001
	Weaving	3.65 ± 0.63			
	Final Processing	3.45 ± 0.62			
FEV_1 (L)	Spinning	2.34 ± 0.12	4.47	2,161	0.013
	Weaving	2.51 ± 0.49			
	Final Processing	2.50 ± 0.70			
FEV_1/FVC%	Spinning	85.14 ± 4.9	6.35	2,161	0.002
	Weaving	80.49 ± 4.9			
	Final Processing	82.49 ± 4.9			

A one-way post hoc Bonferroni ANOVA was conducted to compare the mean differences of three Lung function parameters which are FVC (L), FEV1 (L) and FEV1/FVC% between three departments of spinning, weaving and final Processing. The analysis of variance showed that the mean differences between the departments for three parameters were statistically significant, FVC (L) F (2,161) = 21.11, p = .001. FEV1 (L)F (4.47) = 99.82, p = .001 and FEV1/FVC% F (2,161) = 6.35, p = .001, (Table 4-8).

Table 4-9: Airflow obstruction according to forced expiratory volume in 1second (FEV1 %pred.) by group

FEV_1 %pred.	**Category**	**Exposed (n=164) n (%)**	**Unexposed (n=161) n (%)**	**P-value**
≥ 80	No effect	78 (47.6)	140 (87.0)	0.001
60 - 79	Mild to Moderate effect	47 (28.7)	14 (8.7)	0.001
< 60	Severe effect	39 (23.8)	7 (4.3)	0.001

The study participants presenting expected FEV% in normal mild to moderate and severe were high proportion in exposed group compared to unexposed group and the difference was significant with p-value < 0.001.

4.5. Cotton dust level

Dust samples were collected from three departments which are spinning weaving and final processing. The department of weaving had higher dust level of arithmetic mean of 2.20 mg/m^3 (SD =0.32) and geometric mean 2.14 mg/m^3 (GSD=0.25) (mg/m^3**)**. (Table 4-10).

Table 4-10: Dust level in the textile industry by department

Department	**Total Dust levels (mg/m^3)**		
	GM (GSD)	**AM(SD)**	**95% CI**
Spinning	1.92(0.18)	2.03(0.13)	1.99 -2.07
Weaving	2.14(0.32)	2.20(0.25)	2.15-2.26
Final Processing	1.36(0.09)	1.64(0.05)	1.63 -1.66

GM - geometric mean, GSD - geometric standard deviation, AM - arithmetic mean, mg/m3 - milligram per cubic meter

CHAPTER FIVE

5. DISCUSSION

5.1 Introduction

This study assessed the cotton dust exposure, the prevalence of byssinosis and factors associated with byssinosis among (164) textile workers (exposed) and (161) drinking water bottling plant (unexposed). The study found out that the prevalence of byssinosis was higher among the exposed group (18.9 %) versus 6.2% of the unexposed group. The exposed group had a lower mean of lung function parameters. The mean difference of lung function parameters (FVC (L), FEV1 (L) and FEV1/FVC%) among the exposed and unexposed group were statistically significant with P-value < 0.05.

The dust level was higher in the weaving department compared to the other two departments, the dust level range (1.64 – 2.20) mg/m^3. Factors such as working experience, previously respiratory symptoms, and personal protective equipment had a statistically significant associated with byssinosis with P-value < 0.05.

5.2 Prevalence of Byssinosis

In the current study, the prevalence of byssinosis was higher among participants exposed to cotton dust, where one out of five workers exposed to cotton dust had byssinosis compare to unexposed respondents where almost 1 out of 20 workers had byssinosis. The results of this study are similar to other studies found in Benin, Pakistan, and Ethiopia (1,3,20). This might be due to exposure to cotton dust. Hence, this shows that occupational exposure to cotton dust can be associated with byssinosis.

The findings of this study show a higher prevalence of byssinosis in the final processing department which had more than 25% prevalence of byssinosis. The finding differs with what was reported by other studies which found the prevalence of byssinosis to be higher in the spinning department (1,20). This difference can be due to the fact that in the industry where the study was done, the final processing department is the department with less dust compared to other departments. During data collection, it was reported that workers who had some

problem form other departments were shifted to final processing department as the alternative place with less dust which might be one of the reasons why there is a higher prevalence in the final processing department.

This study revealed a higher prevalence of byssinosis among workers with working experience above 10 years who had almost 20% compared to those with 10 years of working experience who had prevalence > 10%. The finding is similar to other study done in Ethiopia (20).

On other hands the prevalence of byssinosis decreased by an increase in the level of education, this is in comparison to the study by Memon, et al, which also reported prevalence decreased by the increase in education level (3). This might be due to the fact that those with higher education level occupier higher position like supervisor hence are less exposed to dust for the whole working shift.

5.3. Factors associated with Byssinosis

It is clear that exposure to cotton dust is significantly associated with byssinosis. It is necessary but not a sufficient factor, because there are other risk factors.

The study assessed different factors the study found that workers who had previously respiratory symptoms had higher odds of having byssinosis. (AOR = 4.83, 95% CI: 1.95, 11.98). This finding shows that, previously respiratory problem significant increase the chance of developing byssinosis.

According to this study, the participant who used personal protective equipment had higher odds of developing byssinosis compared to those who did not use AOR = 4.5, 95% CI: 1.14, 17.72). This is striking finding in this study. During an assessment, of the use of personal protective equipment, it was observed that workers were using inappropriate personal protective equipment. This shows that the use of inappropriate personal protective equipment increases dust exposure, which leads to a higher prevalence of byssinosis. (Refer figures **a** and **b** Appendix VIII)

This study shows that, for every unit year increase in working experience there is 7% increase in odds of developing byssinosis holding other factors constant. The finding is consistent to other studies done in Ethiopia, Benin, and Pakistan (1,3,20).

There is no clear association between smoking and byssinosis. Some researcher has shown that smoking is associated (3). This study found that smoking was not associated with byssinosis. This finding is similar to what reported by other studies (20,30), which also found that smoking was insignificantly associated. The reason for this finding might be due to few numbers of smoking in the study.

This study shows that past dust exposure is insignificantly associated with byssinosis (AOR = 2.9, 95% CI: 1.04, 8.09). The finding is similar to the study done in Turkey where they found that past exposure to dust had insignificantly associated with byssinosis (30).

In the present study, the working department was found to be insignificantly associated with the byssinosis, the results are contrary to other study done in Pakistan, Turkey, and Ethiopia (3,20,30), where they found a significant association of working section and the prevalence of byssinosis. The difference is due to spinning department and weaving department are close to each other in the present study, workers move from one section to another.

Moreover, this study didn't detect any significant association between sex and age. The finding is similar to other studies done in Turkey, Ethiopia (20,30) which also found no significant association.

5.4. Lung Function status

In the present study the mean Pulmonary function, indices such as FVC, FEV1, FEV1%, of the exposed group were lower compared to the unexposed group. (Refer table 4-7) The mean differences were found to be statistically significant. This is supported by other studies which record higher mean lung indices among the unexposed group (24,31–33). The decline in FCV and FEV1 might be due to the accumulation of exposure to cotton dust among the exposed group which lead to airflow limitation. This study revealed that the exposed group had lower forced expiratory volume in one second compared to unexposed group. More than twenty

percent had severe effect The finding is similar to the study done in Benin (32).This might be due long duration of exposure to cotton dust among exposed group

5.5. Cotton dust level

All departments of the industry had higher cotton dust level. Workers were exposed to a high level of cotton dust compare to the permissible threshold limit value (TLV, 0.2 mg/m^3) (34). The highest was in the weaving department (2.20 mg/m^3) and the lowest in a final processing department (1.64 mg/m^3). This finding is contrary to other studies (20,24) where they found higher dust in sections of the spinning department. This difference may be due to reason that during our study the section of spinning anticipated to have higher dust were not working so probably we sampled the section within spinning with lest dust.

5.6. Study limitations and mitigation

Recall bias of the respondents may lead to information bias as some respondents were not be able to recall some information asked. This limitation was reduced by improving how the questions were asked which helped the participants to recall the important event.

Response bias participants may provide information which is not correct especially how they utilize the PPE, and how they work. This bias was minimized through further probing of interviewees and also observing how they used PPE and the way they work which enabled to collect more correct information.

The study design used was cross-sectional which is difficult to assess the causal relationship, but due to limited time, this was the best option. Despite the limitation, it had its good method in assessing the prevalence and even association which were well addressed in this study.

CHAPTER SIX

6. CONCLUSION AND RECOMMENDATIONS

6.1: Conclusion

In conclusion, this study found out that the prevalence of byssinosis and other respiratory symptoms were high among the exposed group (18.9%) compared to (6.2%) of unexposed group.

Working experience, previously respiratory symptoms, and not using appropriate personal protective equipment were significant risk factors for byssinosis with pvalue 0.02, 0.001 and 0.03 respectively

Exposed group had a lower mean of Lung function parameters compared to unexposed group.

The concentration of cotton dust in all department were found to be above the permissible threshold limit value (TLV) 0.5mg/m^3.

6.2 Recommendations

Industry management should take proactive preventive measure to minimize the prevalence of byssinosis and respiratory symptoms among workers by improving the ventilation system of the industry and providing ensuring workers use appropriate personal protective equipment and reduce the cotton dust level, through proper maintenance and regular proper cleaning

Industry Management should establish a proper system of pre-entry, a regular medical check-up for workers so that work-related diseases are detected as early as possible.

.6.3. Future perspective

Further studies, to determine the level of endotoxin in cotton dust and its association with byssinosis is required.

7. REFERENCES

1. Hinson, V.Schlünssen, G.Agodokpessi , T.Sigsgaards BF. The Prevalence of Byssinosis among Cotton Workers in the North of Benin. 2014;5:194–200.
2. Alemu K, Kumie A, Davey G. Byssinosis and other respiratory symptoms among factory workers in Akaki textile factory, Ethiopia. Ethiop J Heal Dev. 2010;24(2):133–9.
3. Ismail Memon MBBS , Amanullah Panhwar FCPS DKR. Prevalence of Byssinosis in Spinning and Textile Workers of. 2017;8244(November).
4. Mustafa KY, Bos W, Lakha AS. Byssinosis in Tanzanian textile workers. Lung. 1979;157(1):39–44.
5. Lai PS, Christiani DC, Unit CC, Hospital MG. Long term respiratory health effects in textile workers Peggy. 2014;19(2):152–7.
6. Keregero K, Egero E, Chirongo E, Chirongo M, Moses MC. A Study on the Performance of Textile Sector in Tanzania-Challenges and ways Forward. J Bus Manag
7. Nafees AA, Fatmi Z, Kadir MM, Sathiakumar N. Pattern and predictors for respiratory illnesses and symptoms and lung function among textile workers in Karachi, Pakistan. Occup Environ Med. 2013;70(2):99–107.
8. Abbas AH. Respiratory Dysfunction in Textile Factory Workers. 2015;12(2):378–84.
9. Suneeta.M, Kumar.S Mk. Incidence Of Byssinosis , Effects Of Indoor Pollutants And Associated Risk. Int J Basic Appl Physiol. 2015;152–60.
10. Ghasemkhani M, Kumashiro M, Rezaei M. Prevalence of Respiratory Symptoms among Workers in Industries of South Tehran , Iran. 2006;218–24.
11. Jannet J. V. Pulmonar health status of ginning factor y Pulmonary factory women laborers in Tirupur, India. 2006;10(3):116–20.
12. Sevincc RASOFFAHCMZC. Prevalence of Byssinosis and Respiratory Symptoms among Cotton Mill Workers. 2002;52–6.
13. Daba Wami S, Chercos DH, Dessie A, Gizaw Z, Getachew A, Hambisa T, et al. Cotton dust exposure and self-reported respiratory symptoms among textile factory workers in Northwest Ethiopia: A comparative cross-sectional study. J Occup Med Toxicol.

2018;13(1):1–7.

14. Taylor P, Dube KJ, Ingale LT, Ingle ST. Respiratory Impairment in Cotton-Ginning Workers Exposed to Cotton Dust Respiratory Impairment in Cotton-Ginning Workers Exposed to Cotton Dust. 2015;19(September):3–12.
15. Schlünssen V Hinson AV, , Agodokpessi G, Sigsgaards T, Fayomi B. The prevalence of byssinosis among cotton workers in the North of Benin. Int J Occup Environ Med. 2014;5(4):194–200.
16. Mansouri F, Pili J, Abbasi A, Soltani M, Izadi N. Respiratory problems among cotton textile workers. Lung India [Internet]. 2016;33(2):163.
18. Awad M, Adel A, Ahmed E, Hegazy M. Egyptian Journal of Chest Diseases and Tuberculosis Respiratory symptoms and pulmonary function among cotton textile workers at Misr Company for Spinning and Weaving EL-Mahalla , Egypt. Egypt J Chest Dis Tuberc
19. Ghasemkhani M, Kumashiro M, Rezaei M, Anvari Ar, Mazloumi A, Sadeghipour Hr. Prevalence Of Respiratory Symptoms Among Workers In Industries Of South Tehran, Iran. Ind Health
20. Kumie A , Alemu K, , Davey G. Byssinosis and other respiratory symptoms among factory workers in Akaki textile factory , Ethiopia. 2010;
21. Hinson AV, Lokossou VK, Schlünssen V, Agodokpessi G, Sigsgaard T, Fayomi B. Cotton dust exposure and respiratory disorders among textile workers at a textile company in the Southern part of Benin. Int J Environ Res Public Health. 2016;13(9).
22. Lai PS, Hang JQ, Zhang FY, Lin X, Zheng BY, Dai HL, et al. Gender differences in the effect of occupational endotoxin exposure on impaired lung function and death: The Shanghai Textile Worker Study. Occup Environ Med. 2014;71(2):118–25.
23. Shi J, Mehta AJ, Hang J qing, Zhang H, Dai H, Su L, et al. Chronic lung function decline in cotton textile workers: Roles of historical and recent exposures to endotoxin. Environ Health Perspect. 2010;118(11):1620–4.
24. Dube KJ, Ingle ST. Respiratory Impairment in Cotton-Ginning Workers Exposed to Cotton Dust. 2013;19(4):3–12.

25. Dangi B, Bhise A. Cotton dust exposure: Analysis of pulmonary function and respiratory symptoms. Lung India [Internet]. 2017;34(2):144.
26. Saha A, Doctor P, Bhagia L, Majumdar P, Patel B. A study of respiratory function among the workers engaged in ginning processes. Indian J Occup Environ Med [Internet]. 2014;18(3):118.
27. Nagoda M, Okpapi JU, Babashani M. Assessment of respiratory symptoms and lung function among textile workers at Kano Textile Mills , Kano , Nigeria. 2012;15(4).
28. Mberikunashe J, Banda S, Chadambuka A, Gombe NT, Shambira G, Tshimanga M, et al. Prevalence and risk factors for obstructive respiratory conditions among textile industry workers in Zimbabwe, 2006. Pan Afr Med J. 2010;6:1–8.
29. Medical Research Council. Questionnaire on respiratory symptoms. 1986. p. 1–4.
30. Sibel Ö, Beyza A, Murat K, Fatma E, Göksel K, Sevin B. Respiratory symptoms and pulmonary function of workers employed in textile dyeing factory in Turkey. Med J Malaysia. 2012;67(4):375–8.
31. Nagoda M, Okpapi JU, Babashani M, M. N, J.U. O. Assessment of respiratory symptoms and lung function among textile workers at Kano Textile Mills, Kano, Nigeria. Niger J Clin Pract [Internet]. 2012;15(4):373–9.
32. Hinson AV, Lokossou VK, Schlünssen V, Agodokpessi G, Sigsgaard T, Fayomi B. Cotton Dust Exposure and Respiratory Disorders among Textile Workers at a Textile Company in the Southern Part of Benin. (2008).
33. Factory T, Minch A, Kanko T, Shibru G, Feleke G, Girma E. Assessment of Respiratory Symptoms and Lung Function among Workers Exposed to Cotton Dust at Arba Minch. 2017;4531:380–92.
34. ACGIH. Hazordous substance fact sheet. 2001;

APPENDIECES

Appendix I: Questionnaire- English Version

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES SCHOOL OF PUBLIC HEALTH AND SOCIAL SCIENCES

DEPARTMENT OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH

Date of interview……Questionnaires number ……

Name of interviewer……

Identification

Number…...

Part I: Socio-demographic characteristics				
No.	Questions	Response	Code	Remark
1	What is the Sex of respondents?	1. Male 2. Female		
2	What was your Date of birthday?			
3	What is your Education level?	1. Informal education 2.Primary Education 3.Secondary Education 4.Diploma 5. University.		
4	What is your marital status?	1. Single 2. Married 3.Cohabiting 4 .Separated 5.Widow		
5	Which department are you Working?	1.Spinning 2.Weaving 3.Knitting 4.Dyeing 5. Ginning 6.Other		
6	Which section are you Working?			Mention
7	For how many years you have been employed in this textile Industry?			
8	How many hours do you work per day?			
Part II: Respiratory symptoms (These questions are applicable mainly to your chest. Please answer YES or NO.)				
Cough				
9	Do you usually have a cough?	1. Yes 2. No		If No skip

				to 14
10	Do you usually cough first thing in the morning?	1. Yesanalysis2. No		
11	Do you usually cough at day or during the rest of the night?	1. Yes 2. No		
12	Do you usually cough 4 to 6 times a day, 4 or more days out of a week	1. Yes 2. No		
13	Do you usually cough on most days for 3 consecutive months or more in the last 2 years?	1. Yes 2. No		

Phlegm				
14	Do you usually bring up phlegm from your Chest?	1. Yes 2. No		
15	Do you usually bring up phlegm first thing in the morning?	1. Yes 2. No		
16	Do you bring up phlegm during a day or night	1. Yes 2. No		
17	**If Yes to 14,15 & 16** Do you usually bring up phlegm as much 4-6 times a day or 4 or more days in a Week?	1. Yes 2. No		
18	Do you bring up phlegm on most days for 3 consecutive months or more in the last 2 years?	1. Yes 2. No		
19	For how many years have you had trouble with phlegm?			
Episodes of cough and phlegm				
20	In the past three years have you had periods or episodes of (increased) cough and phlegm lasting for three weeks or more?	1. Yes 2. No		If No skip to 22
21	**If Yes 20:** Have you had more than 1 such period?	1. Yes 2. No		
Wheezing				

22	Does your chest ever sound wheezy or whistling?	1. Yes 2. No		
23	Have you had attacks of wheezing in your chest at any time in the last 12 months?	1. Yes 2. No		
24	Have you been short of breath when the wheezing noise was present?	1. Yes 2. No		
25	Have you ever required medicine or treatment for the (se) attack(s)?	1. Yes 2. No		
26	Is/was your breathing absolutely normal between attacks?	1. Yes 2. No		
27	Have you at any time in the last 12 months been woken at night by an attack of shortness of breath?	1. Yes 2. No		

Breathlessness **If disabled from walking by any condition other than heart or lung disease, omit this section**				
28	Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill?	1. Yes 2. No		
29	**If Yes to 28:**			
	Do you have to walk slower than people of your age on the level because of breathlessness?	1. Yes 2. No		
	Do you ever have to stop for breath when walking at your own pace on the level after a few minutes?	1. Yes 2. No		
	Are you too breathless to leave the house or breathless on	1. Yes 2. No		

	dressing or undressing			
30	For how long have you been this short of breath?(in years)			
Chest illnesses				
31	During the past three years, have you had any chest illnesses that have kept you off work, indoors at home, or in bed for as much as a week?	1. Yes 2. No		If No skip to 216
32	If Yes to 31:			
	Did you produce phlegm than usual in any of these chest illnesses?	1. Yes 2. No		
33	Have you had more than one? Illness like this in the last three years?	1. Yes 2. No		

Chest tightness				
34	Does your chest ever feel tight or your breathing become difficult?	1. Yes 2. No		
35	Is your chest tight or your breathing difficult on any particular day of the week? (When you have been away from work for 2days or more?)	1. Yes 2. No		If No skip to 301
36	If `Yes': Which day?	1. First day of the working week 2. First day and other weekdays 3.Last day of working week		
37	If YES 1st day of working week: At what time on Monday does your chest feel tight or you're breathing	1.Before entering the industry 2.After entering the industry		

	difficult?			
Part III: Past illnesses				
38	Have you ever had any of the following?			
	1. Chronic bronchitis	1. Yes 2. No		
	2. Emphysema	1. Yes 2. No		
	3. Heart attack.	1. Yes 2. No		
	4. Lung cancer.	1. Yes 2. No		
	5. Tuberculosis (TB)	1. Yes 2. No		
	6. Pneumonia	1. Yes 2. No		
	7. Any chest injuries	1. Yes 2. No		
39	Was it confirmed by a doctor?	1. Yes 2. No		
Part IV: Occupational history				
40	Have you ever worked full time (40 hours per week or more) for 6 months or more?	1. Yes 2. No		

41	Have you ever worked for a year or more in any dust job?		1. Yes 2. No		
42	If Yes to 41:	Specify what kind of dust			
Part V: Source of fuel					
43	What source of fuel are you most using at home?		1.Wood 2. Charcoal 3. Kerosene 3. Gas 4. Electricity 5.Other Mention		
Part VI: Smoking Habit					
44	Have you ever smoked tobacco (cigarettes or pipe) for as long as a year?		1. Yes 2. No		**If YES go 45 If NO go 52**
45	How old were you when you started smoking regularly?		Enter approximate age		
46	Do you smoke at present? If YES, go on to Question 47 If NO, skip to Question 48		1. Yes 2. No ***YES' means smoking tobacco in the last month or more***		

47	How much do you now smoke on average?	Number of cigarettes per day Pipe tobacco in grams/week		
48	Have you ever stopped smoking completely?	1. Yes 2. No If YES, go on to Question 48 If NO, skip to Question 50		
49	How old were you when you stopped smoking completely?			
50	How many years in total did you smoke cigarettes? (Do not include the years the participant stopped before they started again.)			
51	On average of the entire time you smoked, how much did you smoke?	Number of cigarettes per day Pipe tobacco in grams/week		
52	Have you been regularly exposed to tobacco smoke from other people smoking? cigarettes or pipe in the last 12 months?	1. Yes 2. No		
Part Vii: Asthma				
53	Have you ever had asthma?	1. Yes, 2. No		
54	Have you ever had an asthma attack? *An "asthma attack" is when your asthma symptoms (wheezing, shortness of breath, chest tightness or cough) are worse than usual*	1. Yes, 2. No		
55	Were you employed when you had your first attack of asthma?	1. Yes, 2. No		
56	How many attacks of asthma have you had in the last 12 months?	1. Yes, 2. No		
57	Are you current using medicine for asthma?	1. Yes 2. No		

Thank You in advance for your cooperation!

Appendix II: Questionnaire – Swahili Version

CHUO KIKUU CHA AFYA NA SAYANSI SHIRIKISHI CHA MUHIMBILI

SHULE YA AFYA YA JAMII

IDARA YA AFYA MAZINGIRA NA MAHALA PA KAZI

DODOSO LA UTAFITI

	Tarehe ya usaili ……Nambari ya dodoso ……Kundi		
	SEHEMU I: UTAMBULISHO		
1.	Jinsia ya mhojiwa? **(*Angalia Usimuulize)***	1.Mwanamme 2.Mwanamke	
2.	Umri wako ni miaka mingapi? ***(Au muulize ulizaliwa mwaka gani)***		
3.	Kiwango cha elimu ulionayo?	1. Sijasoma 2. Elimu ya msingi 3. Elimu ya sekondari 4. Diploma 5. Elimu ya juu.	
4.	Hali yako ya Mahusiano? ***(Muulize kwa kutaja hayo machaguo kama swali halielewi vizuri.Mfano umeolewa au umeoa?)***	1. Sijaoa/Sijaolewa 2. Nimeoa/Nimeolewa 3. Naishi na mwenza bila ndoa 4. Nimetengana/Nimechana. 5.Mjane/Mgane	
5.	Unafanya kazi idara gani?		Jaza
6.	Unafanya kazi kitengo gani? (***Kama kipo jaza)***		
7.	Umefanya kazi miaka mingapi hapa kiwandani?		
8.	Unafanya kazi kwa saa ngapi kwa siku?		
	SEHEMU II: DALILI ZA MARADHI YA MFUMO WA UPUMUAJI- KIKOHOZI		
9.	Je huwa unakohoa mara kwa mara? **(Kama jibu ni HAPANA nenda swali la 14)**	1. Ndiyo 2. Hapana	
10.	Je huwa unakohoa unapo amka asubuhi ?	1. Ndiyo 2. Hapana	

11.	Je huwa unakohoa mchana au usiku ?	1. Ndiyo 2. Hapana	
12.	Je huwa unakohoa mara 4 mpaka 6 kwa siku 4 au zaidi kwa wiki ?	1. Ndiyo 2. Hapana	
13.	Je uliwahi kukohoa muda wa miezi 3 mfululizo kwa kipindi cha miaka 2 iliyopita?	1. Ndiyo 2. Hapana	
	KUKOHOA NA KUTOA MAKOHOZI		
14.	Je Huwa unakohoa na kutoa makohozi? ***(Kama jibu HAPANA nenda swali la 20)***	1. Ndiyo 2. Hapana	
15.	Je! Huwa unakohoa na kutoa makohozi mara unapoamka asubuhi?	1. Ndiyo 2. Hapana	
16.	Je! Huwa unakohoa na kutoa makohozi wakati wa mchana au usiku ?	1. Ndiyo 2. Hapana	
17.	***Jibu swali hili kama swali la 14,15 na 16 jibu ni NDIYO*** Je! huwa unakohoa na kutoa makohozi mara 5- 6 kwa siku au zaidi ya siku 4 kwa wiki ?	1. Ndiyo 2. Hapana	
18.	Je! huwa unakohoa na kutoa makohozi kwa miezi mitatu mfululizo kwa mwaka?	1. Ndiyo 2. Hapana	
19.	Kwa miaka mingapi unakohoa na kutoa makohozi?		
	VIPINDI VYA KIKOHOZI NA KUTOA MAKOHOZI		
20.	Katika kipindi cha miaka 3 iliyopita, umewahi kupata ongezeko la kukohoa na kutoa makohozi yaliyodumu kwa wiki tatu au zaidi?	1. Ndiyo 2. Hapana	
21.	***Kama swali la 20 jibu ni NDIYO***: Je ongezeko la kukohoa na kutoa makohozi yaliyodumu kwa wiki tatu au zaidi imekutokea zaidi ya mara moja?	1. Ndiyo 2. Hapana	
	KUSHINDWA KUPUMUA NA KUTOA SAUTI NYEMBAMBA WAKATI WA KUPUMUA.		
22.	Je, ulishawahi kupumua na kutoa sauti kama ya filimbi kutoka kifuani?	1. Ndiyo 2. Hapana	
23.	Kwa muda wa miezi 12 iliyopita umekuwa ukitoa sauti kama filimbi unapopumua?	1. Ndiyo 2. Hapana	
24.	Huwa unabanwa na kifua ukiwa kazini hadi unakosa pumzi?**kama jibu hapana nenda swali la 27**	1. Ndiyo 2. Hapana	
25.	Je uliwahi kupata matibabu yoyote unapobanwa na kifua?	1. Ndiyo 2. Hapana	

	(***Kama jibu ndiyo ataje hayo matibabu)***		
26.	Je unapobanwa na kifua huwa unapumua kawaida?	1. Ndiyo 2. Hapana	
27.	Kwa kipindi cha miezi 12 iliyopita kuna siku uliwahi kubanwa au kukosa pumzi usiku?	1. Ndiyo 2. Hapana	
	KUPUMUA KWA SHIDA		
28.	Je! Unapata shida ya kupumua unapotembea tambarare au kwenye mwinuko kidogo? **Kama swali 28 Jibu ni HAPANA nenda Swali la 31.**	1. Ndiyo 2. Hapana	
29.	i. Je!inakulazimu kutembea taratibu zaidi ya watu wa umri wako kwenye eneo la tambarare??	1. Ndiyo 2. Hapana	
	ii. Huwa inakulazimu kusimama ili uweze kupumua unapotembea na watu wa rika lako eneo la tambarare?	1. Ndiyo 2. Hapana	
	iii. Je huwa una shida ya kupumua kiasi kwamba kama upo ndani ya nyumba au ofisini unalazimika kutoka nje au kupunguza idadi ya nguo ulizovaa ?	1. Ndiyo 2. Hapana	
30.	Kwa kipindi cha miaka mingapi umekuwa na shida ya kupumua?		
	MAGONJWA YA KIFUA		
31.	Katika kipindi cha miaka mitatu iliyopita umewahi kuumwa kifua ambacho kilikufanya usiende kwenye shughuli zako za kawaida kwa zaidi ya wiki? ***(Kama jibu HAPANA nenda swali la 34)***	1. Ndiyo 2. Hapana	
32.	Je uliwahi kutoa makohozi zaidi ya kawaida katika kipindi chochote cha kuumwa kwako?	1. Ndiyo 2. Hapana	
33.	Je uliwahi kuumwa zaidi ya mara moja katika kipindi cha miaka mitatu ?	1. Ndiyo 2. Hapana	
	KUBANWA NA KIFUA		
34.	Je huwa unapata tatizo la kubanwa na kifua au kupumua kwa shida unaporudi kazini siku ya Jumatatu baada ya mapumziko ya mwisho wa wiki?	1. Ndiyo 2. Hapana	
35.	Je huwa unabanwa na kifua au kukosa pumzi siku ya kwanza unaporudi kazini mfano baada ya kuwa likizo au mapumziko ya siku kadhaa ?	1. Ndiyo 2. Hapana	
36.	Je huwa unapata tatizo la kubanwa na kifua au kupumua kwa shida kuanzia Jumatatu hadi Ijumaa unapokuwa kazini?	1. Ndiyo 2. Hapana	
37.	Kama tatizo hilo hukutokea.Je ni muda gani kifua kinabana au	1.Kabla ya kuingia	

	kukosa pumzi?	kazini 2.Wakati unafanya kazi 3.Baaada ya kutoka kazini	
	SEHEMU YA III: MAGONJWA ULIYOPATA AWALI		
38.	Je uliwahi kupata Magonjwa yafuatayo?		
	i. Kukohoa kusikokoma	1. Ndiyo 2. Hapana	
	ii. Kuvimba Mapafu	1. Ndiyo 2. Hapana	
	iii. Pumu	1. Ndiyo 2. Hapana	
	iv. Mshituko wa moyo	1. Ndiyo 2. Hapana	
	v. Kansa ya mapafu	1. Ndiyo 2. Hapana	
	vi. Kifua kikuu (TB)	1. Ndiyo 2. Hapana	
	vii. Pneumonia	1. Ndiyo 2. Hapana	
	viii. Ajali/upasuaji ulioathiri kifua chako	1. Ndiyo 2. Hapana	
39.	Matatizo hayo uliyoyataja yaliwahi kuthibitishwa na Daktari?	1. Ndiyo 2. Hapana	
	SEHEMU YA IV: KAZI ULIZOWAHI FANYA AWALI?		
40.	Kabla ya kuajiriwa kwenye kiwanda hiki, Je uliwahi fanya kazi ya kudumu kwa wastani wa saa 8 kwa siku au 40 kwa wiki kwa muda wa miezi 6?	1. Ndiyo 2. Hapana	
41.	Hiyo kazi ilihusisha kufanya kazi eneo lenye vumbi?	1. Ndiyo 2. Hapana	
42.	**Kama jibu swali la 41 jibu ni NDIYO**: i. Taja hiyo kazi?		
	ii. Kwa miaka mingapi umefanya kazi hiyo?		
	SEHEMU V: VYANZO VYA NISHATI		
43.	Ni aina gani ya nishati unayoitumia Zaidi nyumbani? (***chanzo kimoja tu kinacho tumika zaidi)***	1.Kuni 2.Mkaa 3.Mafuta ya Taa 4. Gesi 5.Umeme 6.Hapiki	
	SEHEMU VI: UVUTAJI WA SIGARA		
44.	Je umewahi kuvuta sigara ? (**Kama jibu ni NDIYO nenda**	1. Ndiyo 2. Hapana	

	swali la 45 kama jibu ni HAPANA nenda 52)		
45.	Ulianza kuvuta sigara ukiwa na umri gani ? ***(Taja miaka au mwaka alioanza kuvuta)***	Kadria miaka	
46.	Je unavuta sigara kwa sasa?**(Kama jibu ni NDIYO nenda 47 kama HAPANA nenda 48)** **(*Kuvuta sigara kuanzia mwezi 1 na zaidi uliopita)***	1.Ndiyo 2. Hapana	
47.	Kwa wastani unavuta Sigara ngapi kwa siku?		
48.	Je uliawahi acha kuvuta sigara?	1. Ndiyo 2. Hapana	
49.	Ulikuwa na umri gani ulipoacha kuvuta sigara **(Au jaza mwaka)**		
50.	Jumla ya miaka mingapi umekuwa ukivuta sigara? **(Usiweke miaka ambayo mshiriki aliacha kuvuta sigara)**		
51.	Kwa muda huyo wote mevuta wastani kiasi gani cha sigara ? ***(Usiuulize tutafanya mahesabu baadaye*** ***kwa tutatafuta idadi ya sigara kwa miaka aliyovuta)***	Jaza watani/Idadi ya sigara kwa siku Gram kwa wiki	
52.	Je umekuwa karibu na moshi kutoka kwa watu wanaovuta sigara kwa kipindi cha miezi 12 iliyopita?	1. Ndiyo 2. Hapana	
	SEHEMU VII: ASTHMA		
53.	Je uliwahi kuwa na pumu (Asthma) ?	1. Ndiyo 2. Hapana	
54.	Uliwahi kupata mshituko au dalili za pumu (Asthma) ?	1. Ndiyo 2. Hapana	
55.	Ulikuwa umeajiriwa ulipopata mshituko au dalili za pumu (Asthma)?	1. Ndiyo 2. Hapana	
56.	Je ulipata mshituko au dalili za pumu (Asthma) mara ngapi kwa miezi 12 iliyopita? ***(Jaza idadi ya mishtuko aliyopata)***		
57.	Je unatumia dawa ya pumu (Asthma) kwa sasa ?	1. Ndiyo 2. Hapana	

Ahsantae kwa ushirikiano wako!

Appendix III - Consent to participate in research – English version

ID NO: ……

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

Research on Dust Exposure and Byssinosis among Cotton Textile Workers in Dar es Salaam.

Dear sir/madam

You are hereby invited to participate in a study conducted by Luco Mwelange for his Masters Dissertation at Muhimbili University of Health and Allied Sciences.

PURPOSE OF THE STUDY: The purpose of this study is to asses' cotton dust exposure level, lung function test, and byssinosis among Cotton Textile Workers in Dar es Salaam

VOLUNTARY PARTICIPATION: Participation in this study is voluntary. You may decide to participate or not to. No measure will be taken upon your refusal to participate. You are free not to answer any question or any part of the discussion. If you consent to participate, you have the right to withdraw from the study at any time if you wish to do so.

BENEFITS: There are no direct benefits for participating in the study but if you agree to participate you will help to generate important finding. Findings from this study will provide valuable information that will help to make a recommendation for appropriate intervention to improve the health and safety in your workplace and protecting worker's health and the public in general.

There will be no compensation for you to participate in the study. The study also has no monetary personal benefits and there will be no costs incurred in your participation.

RISKS AND DISCOMFORT: There are no risks or discomforts involved in this study.

COMPENSATION FOR TIME: You will not receive any payment or other compensation for participation in this study. There is also no cost to you to participate in the study except your time.

CONFIDENTIALITY: Your participation in this study will remain confidential and your identity will be not disclosed.

RESULTS: The results of the study will be made available to you through a planned means of research dissemination.

CONSENT FORM: I confirm that I have read carefully, understood the information provided and consent to participate in the study.

CONTACT: In case of any question or query concerning this study, please contact the principal investigator, Luco Mwelange from MUHAS, P. O. BOX 65015, Dar es Salaam, mobile number 0655049524,email:mwelange@gmail.com. If you have any question about your rights as a participant you may contact, Chairperson of the research and Publications Committee, MUHAS. P.O. Box 65001, Dar es Salaam-Tanzania, Tel +2552150302-6)

I …… have read the contents of this consent form and my questions have been adequately answered. I, therefore, agree to participate in this study.

Signature of the participant ……. Date ……

Signature of the interviewer ……....Date ……

Appendix IV - Ridhaa ya kushiriki kwenye utafiti – nakala ya Kiswahili

Namba ya utambulisho……

CHUO CHA AFYA NA SAYANSI SHIRIKISHI MUHIMBILI

Utafiti wa tathmini ya kiwango cha vumbi,uwezo wa mapafu na namadhara yamfumo wa upumua **kwa wafanyakazi wa wa viwand a vya nguo za pamba katika mkoa Dar es Salaam.**

Mpendwa Msahili;

Nakukaribisha kushiriki katika utafiti unaofanywa na Bw. Luco mwelange, mwanafunzi wa stashada ya pili kutoka katika chuo kikuu cha afya na sayansi shirikishi Muhimbili.

MADHUMUNI YA UTAFITI: Dhumuni la utafiti huu ni kutathmini ya kiwango cha vumbi,uwezo wa mapafu na namadhara yamfumo wa upumua kwa wafanyakazi wa wa viwand a vya nguo za pamb katika mkoa Dar es Salaam.

USHIRIKI WA HIARI: Ushiriki katika utafiti huu ni wa hiari na una haki ya kukataa kushiriki katika utafiti. Kama utkubali kushiriki utatakiwa kuweka sahihi yako katika fomu hii nakujibu maswali utakayokuwa unaulizwa na msahili. Hakuna adhabu itakayotolewa kwa kukataa kushiriki.Na kama utakubali kushiriki utafiti huu una haki ya kujitoa wakati wowote utafiti unapoendelea.

FAIDA: Hamna faida ya moja kwa moja kwa wewe kushiriki katika utafiti huu. Lakini kama utakubali kushiriki utafuti utatusaidia kupata matokeo muhimu. Matokeo haya yatatusaidia kupata taarifa muhimu zitakasaidia sisi kutoa mpemdeke kwa uongozi wa kiwanda juu ya mbinu mbadala ili kuboresha afya za wafanyakazi na jamii kwa ujumla.

HASARA: Hakuna hasara za moja kwa moja zitakazotokana na utafiti huu.

FIDIA: Hakuta kuwa na malipo yoyote kutokana na ushiriki wa utafiti huu na pia kama mshiriki hutakuwa na gharama zozote za wewe kushiriki katika utafiti huu ispokuwa muda wako tu.

USIRI: Ushiriki wako katika tafiti hii utabaki kuwa siri na taarifa zote zitakazokusanywa zitashughulikiwa kwa usiri wa hali ya juu. Jina lako halitatumika katika taarifa zozote zitakazopatikana katika utafiti huu.

MATOKEO: Matokeo ya utafiti huu utaypata kupitia njia mbalimbali zitakazo pangwa jinsi uwasilishwaji matokeo kwa wadau.

FOMU YA UTAFITI: Nakiri kwamba nimesoma maelezo yote kwa umakini na nimeelewa kila kilichoandikwa katika fomu,nakubali kushiriki

MAWASILIANO KUHUSIANA NA UTAFITI HUU

Kama una maswali kuhusiana na utafiti huu unaweza kuwasiliana na mtafiti mkuu,

Luco Mwelamge kutoka chuo kikuu cha afya na sayansi shirikishi Muhimbili., S.L.P 65015, Dar es Salaam. Namba ya simu 0655049524,nukushi mwelange@gmail.com. Kama una swali juu ya stahili zako unaweza kuwasiliana na mwenyekiti wa kamati ya utafiti na uchapaji, S. L. P 65001, Chuo kikuu cha Afayna Sayansi ya Jamii Muhimbili,

Dar es Salaam au simu namba +2552150302-6.

Mimi, …… Nimesoma maelezo yote katika fomu hii na maswali yangu yameweza kujibiwa..Nakubali kushiriki katika utafiti huu.

Sahihi ya Mshiriki..... Tarehe ……

Sahihi ya Msahili ……..... Tarehe ……

Appendi

x VI: Workplace Assessment Checklist (English)

SN	ITEM	YES	NO	COMMENT
1	**AVAILABILITY OF PERSONAL PROTECTIVE EQUIPMENTS (PPEs)**			
	Respirator			
	Hand gloves			
	Eye protection/goggles			
	Foot wear (boots)			
	Clothing/apron/overall			
	Reflectors			
	Helmet			
	Nose/mouth masks			
	Are the following types of equipment used by workers?			
2.	**UTILIZATION OF PERSONAL PROTECTIVE EQUIPMENTS (PPEs)**			
	Respirator			
	Hand gloves			
	Eye protection/goggles			
	Foot wear (boots)			
	Clothing/apron/overall			
	Reflectors			
	Helmet			
	Nose/mouth masks			
	Are the following facilities available at the work area?			
3	**WORK ENVIRONMENT**			
	Type of machine New/Current Outdated			
	How much production per day? in tons or kg.			
	Are machines serviced?			
	Where are machines serviced?			
	How frequently do service of machines done?			
	How many shift per day?			
	Working duration per day in hours			
	How many workers in the factory?			
4	**VENTILATION CONDITION**			
	Mechanical ventilation system (ventilator, Local exhaust ventilation system)			
	Natural ventilation systems (doors, windows, and any other openings).			
	Obstruction of air flow			

	i. Poor design of the working units;			
	ii. Inadequate if the unit lacks a functional mechanical and natural ventilation system			
	iii. If the airflow obstructed by adjacent buildings and poor layout of the unit.			
5	**OTHER QUESTIONS**	YES	NO	
	Work area (Inside or outside)			
	Number of machines in the industry			
	Cleanliness done by dry sweeping?			
	Cleanliness done by wet sweeping			
	Sources of raw materials, where?			
	Does the worker change overall every day at work?			

Appendix VI: Workplace Assessment (Kiswahili Version)

ORODHA YA UTAFUTAJI

SN	ITEM	YES	NO	COMMENT
	MATUMIZI NA UPATIKANAJI WA VIFAA VYA KINGA BINAFSI			
1.	Je vifaa vifuatavyo vinapatikana katika eneo la kazi kiwandani?			
	Kipumulio			
	Glovsi za mikononi			
	Miwani ya macho/uso			
	Viatu vya buti			
	Overali			
	Koti la kung'aa			
	Kofia ngumu ya kichwa			
	Kiziba mdomo na pua			
2.	Je wafanyakazi wanatumia vifaa vifuatavyo wanapokuwa kazini?			
	Kipumulio			
	Glovsi za mikononi			
	Miwani ya macho/uso			
	Buti			
	Overoli			
	Koti la kungaa			
	Kofia ngumu ya kichwa			
	Kiziba mdomo na pua			
	Je vifaa vifuatavyo vinapatikana katika eneo la kazi kiwandani?			
3.	**MAZINGIRA YA KAZI**			
	Aina za mashine : Mpya Chakavu			
	Uzalishaji kiasi gani kwa siku ? Tani au kilogramu au lita.			

	Je mashine zinakaguliwa?			
	Mashine zinakaguliwa wapi?			
	Ni mara ngapi mashine hukaguliwa?			
	Je kuna shifti ngapi za kazi kwa siku?			
	Je shifti moja ina masaa mangapi?			
	Je kuna wafanyakazi wangapi ?			
4	**MFUMO WA HEWA**			
	Mfum wa mekanika			
	Mfum wa asili			
	Kizuizi cha mfumo hewa			
	i. Mfumo mbaya wa hewa katika kitengo			
	ii. Mfumo wa makenika hufanyi kazi			
	iii. Mfumo wa hewa umezuiliwa na jengo			
5	**MASWALI MENGINEYO**			
	Kazi zinafanyika nje au ndani?			
	Kuna mashine ngapi katika kiwanda?			
	Usafi wa kiwanda unafanyika kwa kufagia bila kutumia maji?			
	Usafi wa kiwanda unafanyika kwa kutumia maji?			
	Malighafi zinapatikana wapi? Taja eneo/mahali			
	Je mfanyakazi hubadilisha nguo ya kazi (koti gumu) kila anapokuja kazini?			

Appendix VII: Ethical clearance permission

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES

P.O. Box 65001
DAR ES SALAAM
TANZANIA
Web: www.muhas.ac.tz

Tel G/Line: +255-22-2150302/6 Ext. 1015
Direct Line: +255-22-2151378
Telefax: +255-22-2150465
E-mail: dpgs@muhas.ac.tz

Ref. No. DA.287/298/01A/

7th May, 2019

Mr. Luco Patson Mwelange
MSc. Environmental and Occupational Health
MUHAS.

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED: "DUST EXPOSURE AND BYSSINOSIS AMONG COTTON TEXTILE WORKERS IN DAR ES SALAAM"

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has, on behalf of the Senate, approved ethical clearance for the above-mentioned study. Hence you may proceed with the planned study.

The ethical clearance is valid for one year only, from 3rd **May, 2019 to 2nd May, 2020.** In case you do not complete data analysis and dissertation report writing by **2nd May, 2020,** you will have to apply for renewal of ethical clearance prior to the expiry date.

Dr. Emmanuel Balandya
ACTING: DIRECTOR OF POSTGRADUATE STUDIES

cc: Director of Research and Publications
cc: Dean, School of Public Health and Social Sciences, MUHAS

Appendix VIII: Figure 0-1:Pictures from cotton textiles industry

a. Picture showing a worker wearing (inappropriate) personal protective equipment. Source: researcher

b. Picture showing a worker wearing (inappropriate personal protective equipment. Source: researcher

c. Picture showing printing section in the final processing department

d. Picture showing the spinning department. Source: researcher

e. Picture showing the weaving department. Source: researcher