



ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

SCHOOL OF PUBLIC HEALTH

**ASSESSMENT OF PAPER DUST EXPOSURE AND CHRONIC
RESPIRATORY SYMPTOMS AMONG PAPER FACTORIES WORKERS IN
ETHIOPIA, 2020: A COMPARATIVE CROSS-SECTIONAL STUDY**

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Assessment of paper dust exposure and chronic respiratory symptoms among paper factories workers in Ethiopia, 2020: a comparative cross-sectional study

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ACRONYMS AND ABBREVIATIONS

AL	Airflow Limitation
AM	Arithmetic Mean
ANCOVA	Analysis of Covariance
ANOVA	Analysis of Variance
ACGIH	American Conference of Governmental Industrial Hygienist
ATS	American Thoracic Society
COPD	Chronic Obstructive Pulmonary Disease
COSHH	Control of Substances Hazardous to Health
CI	Confidence Interval
DALY	Disability Adjusted Life Years
EDHS	Ethiopian Demographic Health Survey
FEV	Forced Expiratory Volume
FVC1	Forced Vital Capacity
GOLD	Global Initiative for Obstructive Lung Disease
GM	Geometric Mean
GSD	Geometric Standard Deviation
ILO	International Labour Organization
LLN	Lower Limit of Normal
NCD	Non Communicable Disease
OR	Odd Ratio
OEL	Occupational Exposure Limit
OHS	Occupational Health and Safety
OSHA	Occupational Safety and Health Administration
RPD	Respiratory Protective Device
WHO	World Health Organization

ABSTRACT

Background: workers in paper and pulp factories are continuously exposed to paper dust. Excessive exposure to paper dust can cause respiratory disease. The prevalence of chronic respiratory symptoms and dust exposure level among workers in paper and pulp factories were not available in Ethiopia.

Objective: To assess personal dust exposure level, prevalence of chronic respiratory symptoms and their associated factors among workers of paper factories in Ethiopia, 2020.

Methods: A comparative cross-sectional study was conducted from September 2020 to October 2020. A total of 40 dust measurements was carried out on 20 randomly selected production workers from two paper factories. To assess chronic respiratory symptoms and associated factor a total of 448 workers from paper factories and control were interviewed using standard questionnaire adapted from American Thoracic Society (ATS). For data entry and analysis, Epi-Info Version.7.2 and SPSS Version.20 statistical software were used respectively. Gravimetric analysis of the filters were done by using a standard microbalance. The total dust concentration was described in mg/m^3 and compared with Occupational Exposure Limit Value (OEL). The descriptive statistics were described using tables. Poisson regression was performed for comparing prevalence of the two groups. Bivariate and multivariable analyses were used for association factor.

Result: The arithmetic mean (AM) and geometric mean (GM) of dust exposure level among paper factories workers were **11.3 (± 7.7) and 10.2 (± 1.4) mg/m^3** respectively. About 35% of workers exposure level exceeded the threshold limit value recommended for total dust (10 mg/m^3). The prevalence ratio of developing chronic respiratory symptoms among paper factory workers was 5.6 times (PR = 5.6, 95% CL: 3.58 - 8.77) higher than control. Chronic respiratory symptoms were significantly associated with factors such as educational status less than grade 9, nearly all work sections of paper factories, work experience 5 years and above, more than 8 working hour per day, past history of occupation and respiratory illnesses.

Conclusion and recommendation: The prevalence of chronic respiratory symptoms among paper factory workers as compared to control was high. This was more common and determinant factors among less educational status, all work section of paper factories except pulp and recycle paper milling, longer work experience and working hours per day, having past history of occupational and respiratory illness. MoLSA should be give supportive supervision and solution to mitigate exposure and improve working environment.

Keywords: paper dust exposure, chronic respiratory symptoms, paper worker

1. INTRODUCTION

1.1. Background

Paper making has been around for well over a thousand years. Now a days paper is produced and used worldwide. Paper and paperboard products are primarily manufactured from pulp. (1). The papermaking has mainly used tree stems in which it passes the process of cutting, debarking, chipping and pulping. Paper pulp and fibers mainly come from softwoods, hardwoods, straw, bamboo, and cotton. The major fibre sources for pulp and paper are coniferous and deciduous trees. Which meets more than 80% demand is still wood from forests. Secondary sources include straws from wheat, rye and rice; canes, such as bagasse; woody stalks from bamboo, flax and hemp; and seed, leaf or bast fibres, such as cotton, abaca and sisal. The majority of pulp is made from virgin fibre, but recycled paper accounts for an increasing proportion of production, up from 20% in 1970 to 33% in 1991. Wood-based production accounted for 88% of pulp capacity worldwide (1-6).

Demand for paper and paper products has started to rise dramatically as Ethiopian economy has grown. The demand for paper was 219,840 tons in 2016/17 (7). However, the country managed to meet just 18% of the demand (7). The balance has been matched always by imports. In developing countries like Ethiopia, consumption of paper and paper products is growing faster due to the expansion of education. In Ethiopia there are two largest companies currently engaged in the production of rolls of paper sheets and paperboard from pulp, recycled paper and roll paper (7).

The processing of paper involves three steps. This includes preparation of pulp from plant fibres, the production of paper rolls from the pulp or recycled paper and the conversion of paper rolls into different varieties of end-use paper products. These processes are dusty (1). Paper dust contains up to 80% of cellulose fibers and the remaining 20% of inorganic material, probably from the added substances (8). The health effects of paper dust exposure have been concentrated primarily on workers in the paper-industry (8). The effect is higher to those factories using waste paper as raw material because the production process makes dustier (9). Dust is small dry solid particles ranges from one to hundred micrometers in diameter and formed by natural forces or human made processes such as crushing, cutting, shredding, grinding, milling, drilling, demolition, shoveling, conveying, screening, bagging, sweeping, etc. The dust produced has an impact on the heath of respiratory system. Inhalation is the most common route of exposure (10).

1.2. Statement of the problem

Respiratory health disorders are a wide category of diagnosis caused by the inhalation of dusts and chemicals (11). As a result, unsafe monitoring of these substances will result in a serious danger to workers because most of the workers are unaware of this hazardous effect on health (11). Respiratory health illness are most often caused by the accumulation of dust in the lungs; this seriousness of the diseases depending on the types of dust, exposure time, the concentration and size of airborne dust in the breathing zone (12).

In dusty environment, millions of people are exposed at work. They are subjected to many workplace health threats such as fumes, gases, organic and inorganic dusts and these are contributing factors in the developing respiratory health diseases. Occupational diseases cause huge suffering and losses to workers, companies, social security funds and societies. Exposure to dust, both organic and inorganic, is clearly associated with lung function impairments and clinical outcomes such as chronic obstructive pulmonary disease (COPD) and interstitial respiratory health disease (13).

Many studies suggest that the level of exposure to paper dust in paper factories is above the recommendation of occupational exposure limit (OEL) standard of $10\text{mg}/\text{m}^3$ (9, 14-16). Some studies conducted in paper factory found the level of dust exposure below OEL guideline (10, 17-19). Exposure to paper dust in excess of $10\text{ mg}/\text{m}^3$ for many years can cause obstructive and restrictive respiratory disease such as chronic obstructive lung disease, asthma and reduced lung function (mainly decreased forced expiratory volume by one second (FEV_1) and forced vital capacity (FVC)) (9, 15, 18-21). In the oldest paper mills, this exposure and impact can increase (20). By comparison, there was no correlation between exposure to paper dust and impairment of lung function in two studies of lower exposure levels ($\leq 5\text{ mg}/\text{m}^3$) (8, 22). This suggests respiratory problem often rise as the amount of dust exposure increase.

Occupational respiratory symptoms and diseases are a major burden in low and middle-income countries, like Africa. This was due to the prevalent of bad working habit, conditions and environments and the use of outdated machines with the ability to create unnecessary excessive dusty hazards (23). The number of workers in the industries will likely to increase in Africa particularly in Ethiopia due to the growth of investments (24).

Several studies have been performed in Sweden (10, 17-21, 25, 26), Germany (14), Florida (9) and Poland (26) concerning paper dust. However, there is no published scientific study to the best of our knowledge on the level of workers exposure to paper dust in Africa

particularly in Ethiopia. In addition, the paper factories in Ethiopia are very old so we anticipate high level of dust exposure that might lead different respiratory health problems among paper factories workers. Moreover, we found from field visit in paper factories that workers do not use respiratory protective device. As it stands now, further studies on paper dust effect have been helpful in recognizing the risks of working in paper factories and the prevalence of respiratory symptoms.

1.3. Rationale of the study

Occupational morbidity and mortality are becoming a significant public health issues in most developing countries including Ethiopia (23). Due to favorable investment strategy, there is rapid industrialization, which may lead to an increased number of factories and job in Ethiopia, putting a greater number of people at risk from paper dust exposure and other hazards, but no studies have been done on paper dust exposure and its chronic respiratory symptoms impact in paper factories. It is also necessary to know the exposure of paper dust and its chronic respiratory health effect. Among workers of paper factories, awareness about paper dust exposure impacts on workers and awareness of managing techniques is lacking. Although evidence-based health and safety services in workplace are relevant, there are scarce studies showing factors of occupational respiratory symptoms and diseases in paper factories. This is useful to reducing the frequency of highly rising occupational respiratory problems for peoples working in paper factories.

1.4. Significance of the study

This study is intended to evaluate the level and effect of occupational exposure to paper dust in Ethiopia. It is assumed that this work generates the consciousness of the worker of the risk of paper dust exposure to their health and its protection methods. The results and recommendations of the present study would be intended to provide information for respective paper factories for further help in the management of risk to safe guard the well-being of their workers. In order to minimize the impact the dust of workers, certain protective steps could be recommended to the employees and to the management of the factories based on the result. In addition, this study can serve a base line for future studies.

2. LITERATURE REVIEW

2.1. Paper dust exposure and respiratory health problem

According to WHO, particulate matters are capable of producing adverse effects under some condition(s) of exposure and dose through time (27). Airborne dusts are particular concern to health, as they are to be associated with occupational respiratory diseases and exposure to paper dust occurs across a range of paper industries (28). Paper dust contains particles and fibers these have an effect on the alveolar level. Exposure to paper tissue dust has been reported decreased residual volume (RV) and restrictive impairment on lung function (22).

According to the cross-sectional study in Sweden, 2019 the excessive exposure to paper dust reduces the FEV₁ significantly with 91.4% predicted as compared to the lower exposed workers 97.8%. This result shows that as FEV₁ reduces and more affected than FVC this indicates obstructive impairment is associated than restrictive. Based on global initiative for obstructive lung disease (GOLD) and lower limit of normal (LLN), defined the prevalence of air flow limitation among excessive exposed were 27.5% and 19.6% respectively as compared to low exposed which were 6.8% and 6.1% respectively. In both aspects, the result is almost similar. But there were no significant associations with asthma, wheezing, or chronic bronchitis (17). This study also supported by excessive exposure of paper dust has been associated with increased mortality due to obstructive airways disease and decreased lung function, but the risk for asthma was only slightly increased (18, 20).

A case-control study done in Sweden, selected from same area having different occupation that those exposed to paper dust found highest risk factor for occupational asthma with (OR 2.1, 95% CI 1.4 ± 3.2). When stratification for smoking was added, the risk estimates for asthma changed only very slightly (10). This supported by a case-referent study in Sweden, found on employees at a soft paper mill with high paper dust exposure level has an increased mortality from asthma and chronic obstructive pulmonary disease of (OR3.8, 95% CI 1.2-12.0). With similar lower paper dust levels, no increased mortality due to asthma was observed among the paper dust exposed process workers (20) .

Some literature (such as study done in Poland, 2003 and Sweden, 1992) shows on low exposure to total paper dust and its health effects. The level of dust in the air of paper factories ranged from 0 – 3.9 mg/m³. By controlling smoking the result shows that exposed subjects had slightly increase FEV% and developed mucous membranes irritation (eyes, nose and throat) as compared to control (19). Same paper mill and department produces small level

of dust. Low-level exposures with employment more than 10 years cause slight lung function deterioration without a clinical relevance (18, 19, 26).

A cross-sectional study done in Sweden, 1988 examined in multiple soft tissue paper mills as the level and exposure of paper dust increases those symptoms of upper respiratory tract (URT) increases. Excessively exposed employees reporting symptoms (impaired respiratory function) more often than employees with low exposure. More affection of URT rather than lower indicate that paper dust being produced was larger particle in size (18).

A study done in Swedish soft paper mill, 2001 there was an increase in nasal deposits and obstruction among those exposed to paper dust. Symptoms were reported to also reduce the sense of smell. However, exposure to inhalable paper dust with an average of 3.9 mg/m^3 was not linked with increased rates of rhinitis (29).

A cross-sectional study conducted in Germany, 2002 shows the mean concentrations for inhalable, respirable and fibrous dusts were 10.3 mg/m^3 , 0.22 mg/m^3 , and $415,000 \text{ fibres/m}^3$. Adjusted odds ratios (AOR) with relation to cumulative dust exposure intensity were significantly raised for blocked nose (18.2), mucosal irritation (6.5), dry nose (8.9), cough (3.5), phlegm (7.5), exercise induced dyspnoea (2.6), hoarseness (11.3), and sneezing attacks (7.9) (14).

A cohort study conducted in Sweden, 2011 shows with average exposure to inhalable levels of total paper dust varied between 0.40 and 1.37 mg/m^3 . The prevalence of nasal crusts (OR 1.4, 95% CI 1.01-2.0) and nose-bleeding (OR 1.7, 95% CI 1.2-2.4) was increased among the paper dust exposed workers (adjusted for superabsorbent polymer exposure). Whereas prevalence of asthma, nasal symptoms, conjunctivitis and hand eczema in the different exposure groups are somewhat small. This result shows that exposure to low concentration of paper dust have some symptoms and not told about employment year. The presence of symptoms may due to low level exposure to paper dust with long employment. As contrast high level exposure increases impaired lung function and an increased prevalence of symptoms from the lower airways are discussed on this article (25).

2.2. Socio-economic status and chronic respiratory symptoms

Socio-economic is an overall indicator of economic and social status of an individual or family comparison to others. It is focused on measures such as income, education, occupation, place of residence, housing condition and participation in social organization(30). Education is a crucial determinant of lifestyle and status of an individual enjoy in a society

and provide people with the skill and knowledge that can contribute to a better quality of life. Also level of education influences the type of occupation and income that can determine the living status (31).

It has an important influence on attitude and awareness related to family health and hygiene. The low awareness of health and safety would make more vulnerable to disease (32). Socio-economic status is a determinant of health and is well known to play an important role in the development of several diseases such as respiratory diseases (30), with lower socio-economic status being associated with higher rates of morbidity and mortality from several chronic diseases, including cardiovascular disease, chronic bronchitis and chronic obstructive pulmonary disease (33).

2.3. Organizational (Work place) factors and chronic respiratory symptoms

According to study in Sweden, as duration of exposure to paper dust increases lung function decreases. For each year of exposure to high levels of paper dust, there was a 0.87% predicted decrease in FEV1 (95% CI: 1.39–0.35). A similar, but lesser, effect was seen for FVC (–0.54% predicted, 95% CI: 1.00–0.08) (17). This study also supported with long-term greater than 10 years paper dust exposure seemed to have impaired respiratory function and cause slight lung function deterioration compared to those with short-term exposure to the dust (18, 19). For all symptoms (blocked nose, mucosal irritation, dry nose, cough, phlegm, and exercise induced dyspnea, hoarseness and sneezing attacks) with significantly raised ORs, combined effects of intensity and duration of exposure were found (14).

Two investigation studied in Swedish soft paper mills founds significant amount of paper dust. By using personal samplings measurement, the amount of total paper dust at paper machines has been intermittently exposed to about 20-40 mg/m³ and in converting departments constantly exposed to 5 -20 mg/m³. Due to mills are oldest the levels may not be representative for other mills (18). As contrast other study found 2.2 mg/m³ among paper machine operators and in converting halls the mean levels varied from 1.0 to 1.9 mg/m³ (8). Excessive exposure to paper dust (>5 mg/m³) associated to decreased lung function and increased prevalence different forms of respiratory symptoms. The development of occupational asthma or asthma like symptoms is probably a significant occupational health hazard in pulp mills (9, 18).

2.4. Environmental characteristics and chronic respiratory symptoms

Dust is accumulated in the workplace environment in poorly ventilated (lack of both artificial and natural ventilation) factories increases workers exposure to flour dust and causing respiratory diseases. Furthermore, as working space decrease and number of machine increase at temperatures and humidity of above 30 °c and 70% respectively in workers standing position and very close to the grinding machine are more exposed to high level of flour dust (34-36).

Evidences suggest that work place dust is reduced as a major solution to improving factory air ventilation. This avoids and addresses problem of respiratory tract of wood furniture factory workers (37). This is supported by a study done in Ethiopia, as the design of hopper, huller of coffee factories had opened at the top and the personal total dust exposure among machine room and transport workers was significantly increased while pouring coffee vigorously from height (38).

2.5. Behavioral and family history and chronic respiratory symptoms

According to the study in Croatia, the prevalence of chronic respiratory symptoms such as cough (51.9% vs. 19.1%) and phlegm (51.9% vs. 14.9%) had significant different in exposure to paper dust among paper factories smoker relative to non-smokers workers (39). In order to protect workers against one or more risks personal protective equipment at workplace is necessary. A study in Ethiopia, indicate that not using respiratory protective device (RPD) in dusty environment of wood factories has 1.79 fold (AOR=1.79, 95% CI: 1.06-3.03) higher odds of developing chronic respiratory symptoms compared with those using RPD (40). According to energy use at home unprocessed solid bio-fuel energy such as cow dung, crop residue, and wood for cooking and heating have higher risk for serious health outcomes relative to those using cleaner fuels such as electricity, kerosene, LPG, and biogas in the exposed population (41) .

A study found that workers with previous chronic respiratory disease were more likely to suffer chronic respiratory symptoms than those without previous chronic respiratory disease (42) similarly; other studies have indicated that Previous history of chronic respiratory diseases and family history of chronic respiratory diseases were the determinants for the development of chronic respiratory symptoms (43). Another study showed that past illness were predictors for the development of chronic respiratory symptoms (44).

Summary of literature review and Conceptual framework of the study

There are several processes of paper and pulp factories. Paper is produced from plants which containing cellulose fiber. Cellulose fiber is extracted in the factories. By using different plants cellulose fiber as raw material many kinds of paper products are produced. As the reviewed literature, most of the studies are concentrated on soft tissue paper. All kinds of paper and paper products have almost similar process of production. In the production process depending on place and machine the factories produce paper dust. Paper dust has more than 80% of cellulose fiber. The respiratory problem of pulp and paper factories workers are highly related with the concentration and duration of employees exposed to the paper dust. Those place level of dust excessive, worker's long duration of employees and uncomfortable working environment (absence of PPD, ventilation, training...) increases respiratory symptoms relative to low exposure.

By considering the above reviews, chronic respiratory symptoms and paper dust exposure among paper factories workers were summarized on the conceptual framework presented below (figure 2). This conceptual framework was developed by reviewing literature and assuming chronic respiratory symptom and associated factor of workers in paper factories. As indicated in the conceptual framework chronic respiratory symptoms of paper factories workers can be associated with socio economic factors, behavioral factors, workplace, organizational factors, environmental characteristics and paper dust.

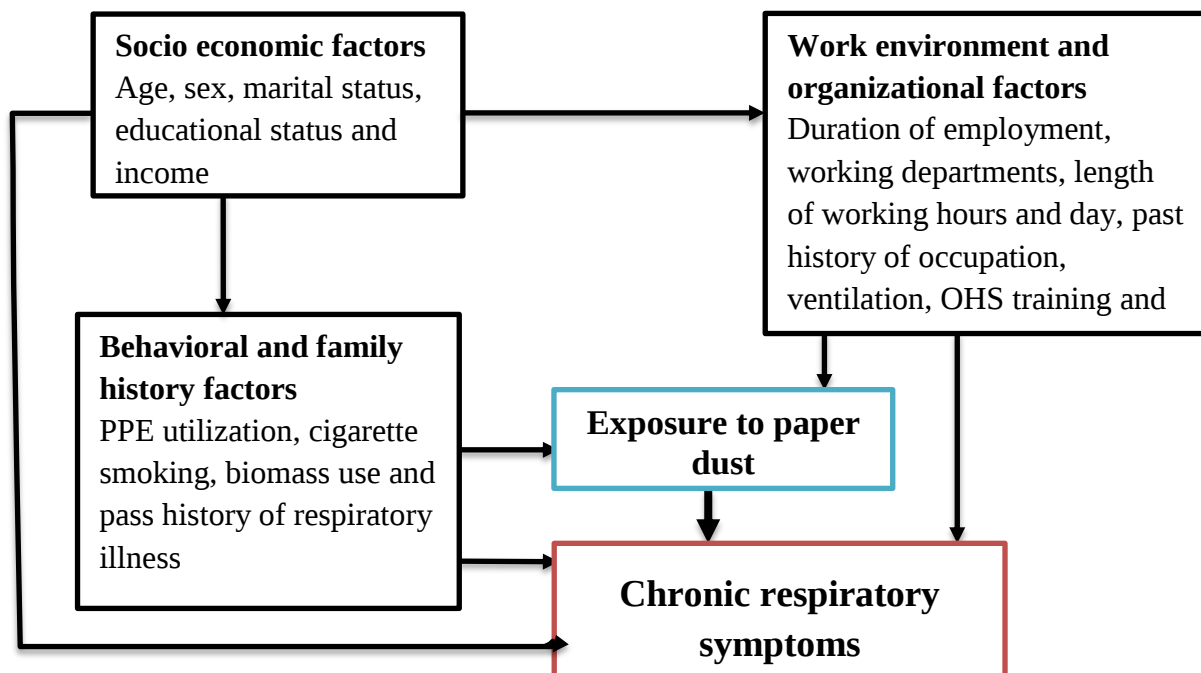


Figure 1: Prepared Conceptual framework for paper dust exposure and chronic respiratory symptoms problem among paper factories workers in Ethiopia, 2020.

3. RESEARCH QUESTIONS AND OBJECTIVES

3.1. Research Questions

1. What is the level of total dust exposure of paper factories workers in Ethiopia?
2. What is the prevalence of chronic respiratory symptoms among workers of paper factories workers compared to control in Ethiopia?
3. What is the associated factor for development of chronic respiratory symptom of paper factories workers Ethiopia?

3.2. Objectives

3.2.1. General Objective

To assess personal dust exposure level, prevalence of chronic respiratory symptoms and its associated factors among workers of paper factories and control in Ethiopia, September 2020.

3.2.2. Specific objectives

1. To measure paper dust exposure level among paper factories workers.
2. To compare the prevalence of chronic respiratory symptoms among paper factories workers and control.
3. To identify associated factors of chronic respiratory symptoms among paper factories workers.

4. METHODS AND MATERIAS

4.1. Study Area

The study was carried out in Ethiopia paper and water bottling factories. There are different types of paper factories in Ethiopia. Those were paper or soft tissue making from raw material of pulp, recycling old paper and the finished rolled paper by cutting in to different type. The study was concerning on paper factories using raw material such as pulp and recycling old paper and producing roll paper and finished paper. There are two companies engaged in the production of paper product (7, 45). They have about 894 workers that were employed.

4.2. Study design and period

A comparative cross-sectional study was conducted from September 2020 to October 2020 to assess personal dust exposure level, prevalence of chronic respiratory symptoms and its associated factors among workers of paper and water bottling factories.

4.3. Source Population

All paper factories workers and all water-bottling factories found in Ethiopia were the source population.

4.4. Study Population

Workers in selected paper and water bottling factories were the study population. Workers registrations were used as sampling frame.

4.5. Inclusion and exclusion criteria

4.5.1. Inclusion criteria

Workers who had directly engaged in the production activities, in the paper and water-bottling factories for one year and above

4.5.2. Exclusion criteria

Those workers not found at work place at the time of data collection and having age less than 18 years were excluded from the study.

4.6. Sample size determination

4.6.1. Sample size determination for specific objective one

The sample size for personal dust exposure assessment was calculated on the basis of Rappaport et al 2008 recommendation that 5-10 randomly selected individuals in a Similar Exposure Group (SEG) with repeated measurements are sufficient to pridict the group

exposure level for dust sampling based on personal exposure calculation (46). SEG is a group of workers working the same type of activities in a similar work area for the same duration of time. With the above assumptions, 4 SEG was identified from two selected factories one group from recycle paper cutting, Bell machine compactor and loader and pulp and recycle paper milling one group from each factories roll paper, carton and paper production and one group from Cone production. Five workers were randomly chosen from each SEG. This makes total of **40** dust measurements on 20 randomly chosen paper factories workers with each a repeated measurement.

4.6.2. Sample size calculation for specific objective two

A double population proportion formula was used to determine the sample size for assessing the prevalence of chronic respiratory symptoms among paper factories workers. Study done in Turkey, prevalence of cough 18.4% among control and 36.6% exposed (16) with power 95%. Based on this, the following double proportion formula was used to calculate the sample size.

$$n = \frac{Z_{\alpha/2} + Z_{\beta})^2 * (P_1(1-P_1) + P_2(1-P_2))}{(P_1 - P_2)^2}$$

Where,

n= Sample size to be determined

P1= 36.6%

P2= 18.4%

$Z_{\alpha/2}$ = Level of statistical significance 1.96 at confidence level of 95% and

Z_{β} = Desired power of 95%

In order to maximize the sample size with a prevalence ratio of 2, we recalculated by taking prevalence ratio of 1.83 on Epi info and then by adding 10% for non-response rate it becomes 224 for each subject. Finally, a total sample size of **448** was obtained.

4.6.3. Sample size determination for specific objective three

Study conducted in Sweden found that the prevalence of work-related respiratory disorders among paper factories workers for longer duration of employment (>15 years) and short duration of employment (≤15 years) with dry cough was 29.5% and 8.9% respectively (14). The double population proportion formula was used for the sample size to calculate factors associated with respiratory symptoms among paper factories workers.

$$n = \frac{Z_{\alpha/2} + Z_{\beta})^2 * (P_1(1-P_1) + P_2(1-P_2))}{(P_1 - P_2)^2}$$

n= sample size to be determined

P1= 29.5 %(proportion of respiratory disorders among workers with longer duration of employment (>15 years))

P2= 8.9 %(proportion of respiratory disorders among workers with shorter duration of employment (≤15 years))

Z α /2 = Level of statistical significance 1.96 at confidence level of 95%

Z β = Desired power for 95% power

P1-P2 = Difference between proportions

$$n = \frac{(1.96 + 1.645)^2 * (0.295(1-0.295) + 0.089(1-0.089))}{(0.295-0.089)^2} = 102$$

Adding 10% for non-response, it becomes 113 for each subject. Total sample size of 226. But we take the largest size **448**

Table 1: Sample size determination summary of the study

S/no	Parameter	Rappaport recommendation	Number of department	Number of workers	Total number of workers	Total number of dust measurement
1	Total dust measurement	5-10 from SEG	4	5 workers from each	20	40
2	Variables	Prevalence of respiratory disorders among exposed		Calculate sample size	Non-response rate (10%)	Total sample size
	Cough	36.6	18.4	406	42	448
3	Factors	Proportion among exposed		Calculate sample size	Non-response rate (10%)	Total sample size
	Work experience	29.5	8.9	204	22	226

4.7. Sampling procedure

The calculated sample size was proportionally assigned to size of the two selected factories. Then for selecting study subject from each department's simple random sampling method was used. Workers registrations were used as sampling frame.

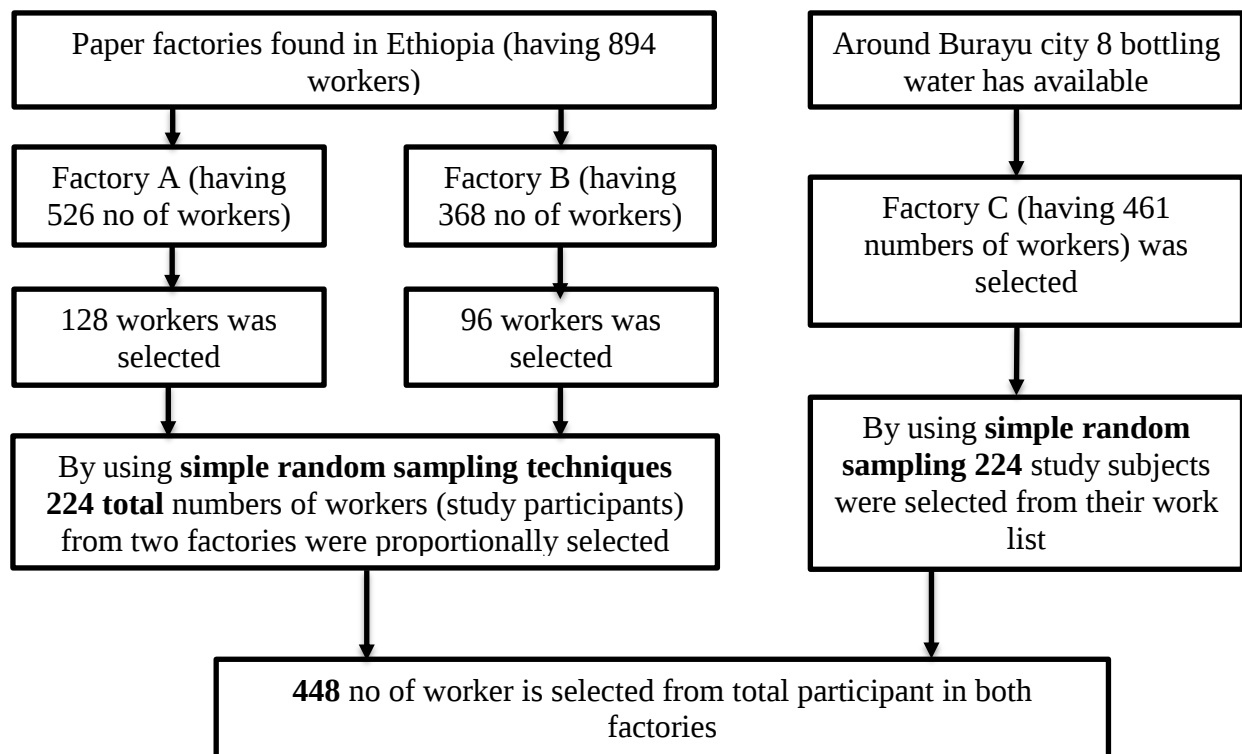


Figure 2: Schematic presentation of sampling procedure for study and comparative group in the study in Ethiopia, 2020

4.8. Study variables

4.8.1. Outcome variable

- Chronic respiratory symptoms

4.8.2. Independent variable

- Paper dust exposure
- Socio economic factors: age, sex, marital status, religion, educational status and income
- Family and behavioral factors: cigarette smoking, utilization of PPD, past history of respiratory illness and energy source used at home for food preparation
- Work place (environment) characteristics: ventilation, dustiness of working department, duration of employment, length of working hours/day, length of working days/week, past history of dust exposure and type of machine
- Organizational factors: PPD provision, OHS training and supervision

4.9. Data collection procedure

In this research, three data collection personnel were participated. Two of them were data collectors and one was supervisor with profession of BSc in environmental health involved in this study. The principal investigator was given one day training on the purpose of the study,

data collection techniques and data quality management. The trained principal investigator was conducted personal paper dust measurements. During personal paper dust sampling, the principal investigator was clearly explaining the procedures for dust measurement to study participants in a group.

4.9.1. Data Collection Tools

Primary data source was used to conduct this study by using three kinds of data collection tools i.e., personal dust measurement for paper dust exposure, questionnaire/interview to assess chronic respiratory symptoms, observational checklist for the working condition and external factors.

4.9.2. Total dust Measurements

Personal total dust was sampled using pre-weighed polyvinyl chloride (PVC) filter membranes with a pore size of 5.0 μ m inserted on a Millipore plastic closed face 37mm filter cassette (CFC) attached to an SKC sidekick pump through which air was pumped by a rechargeable battery-powered motor at a constant flow rate of 2.0 l/min. The sampling cassettes situated on shoulder straps as close to the breathing zone as possible. Sampling was carried out over an entire working time full-shift exposure measurements (8 hrs work) until the task was finished by pausing the pump during break. The time was registered using a digital minute timer. This procedure of sampling was repeated to the next day. Data collection took 4 days in each factory. While dust sampling, observation checklist and data sheet was used to relevant data.

4.9.3. Assessment of Respiratory Symptoms/ Questionnaire or Interview

Face-to-face interviews were carried out using standardized structured questionnaire adapted from ATS. The standardized questionnaire includes socioeconomic-demographic factor, duration of exposure, previous occupational history, smoking habits, past history of respiratory illnesses and respiratory symptoms such as cough, phlegm, wheezing, shortness of breath, and nose irritating, particularly those associated with the risk of respiratory morbidity.

4.9.4. Observational Checklist

Observational checklist was helps to assess the working condition (including housing condition, ventilation, type of machine) and site visit at the work area was help to observe whether the study participants utilizes the appropriate PPD or not, type of work activities the study participant covered and hand direction they use in the activity of working.

4.10. Data management

During dust sampling, a site visit was performed to check the appropriate location of the samplers on the study participants and to observe whether the sampling pump was working or not. Dust sampling equipment's was handled carefully in a bag, transported and stored in a dust free lab (Environmental and Occupational Health laboratory at the College of Health Sciences, Addis Ababa University) until they weighed. Exposure data was entered into MS-Excel spreadsheet and exported into SPSS version 20 for data analysis.

At the time of data collection, the principal investigator checked the questionnaire for completeness and consistencies. Continuous supervision was conduct during data collection at the field, fulfillment of the data was check at the site and in home by the principal investigator, daily meeting after the data collection was also held with the data collectors. The coded data was cleaned and entered into epidemiological information package (Epi Info) version 7.2. then exported to statistical package for social sciences (SPSS) version 20 for data analysis. However, prior to starting data analysis cross checking of the questionnaire with the soft copy was done to ensure consistency.

4.11. Data analysis

4.11.1. Analysis method for specific objective one (personal paper dust exposure)

The result of the dust concentration was described by using descriptive statistics such as measure of central tendency (GM) and a measure of dispersion (GSD). The exposed filter membrane was weighed quantitatively by gravimetric analysis using a standard Mettler Toledo XPE105 microbalance scale with a detection limit of 0.01 mg at Environmental and Occupational Health laboratory of College of Health Sciences, Addis Ababa University. The net concentration was calculated by weighing of the sampling filter before and after sampling.

$$\text{Concentration (mg/m}^3\text{)} = \frac{(\text{post weight of filter} - \text{pre-weight of filter (mg)} - \text{blank weight (mg)})}{\text{Flow rate (lit per min)} \times \text{sample duration (min)} \times 1/1000 \text{ m}^3/\text{lit}}$$

Where:

- Weight of the dust (mg) = (weight of the filter after sampling - weight of the filter before sampling) (mg) - weight of the field blank filter (mg)
- Volume of air sampled (m³) = Average flow rate of the pump (lit/minutes) multiplied by the time of the sampling (minutes) multiplied by 1000 lit/ m³.

- Concentration of dust (mg/m^3) = Weight of the dust (mg) divided by the Volume of air sampled (m^3).

The average dust concentration was compared with the threshold limit values (TLV) for total dust (also denoted as nuisance dust or Particles Not Otherwise Specified (PNOS), recommended by the Control of Substances Hazardous to Health Regulations 2002 (COSHH) for 8-hours exposure ($10 \text{ mg}/\text{m}^3$) (47).

4.11.2. Data analysis method for specific objective two (prevalence of chronic respiratory symptoms)

Descriptive statistics was used to describe the study populations using frequency distribution, that was displayed using tables. The two populations with similar variable and study group prevalence of chronic respiratory symptoms prevalence ratio (PR) of paper factories workers was compared by using Poisson regression model with Robust estimator by controlling for confounders those factors having significant difference distribution.

4.11.3. Analysis method for specific objective three (associated factor for chronic respiratory symptoms)

Descriptive statistics was used to describe the study populations using frequency distribution that was displayed using tables. A bivariate analysis was used to identify whether exposure variables were significantly associated with outcome variables or not. Those, variables with p value < 0.2 were included in multivariable analysis. The multivariable analysis was used to identify variables associated with outcome by identifying the confounding variables. Because of the binary nature of the outcome variable, binary logistic regression analysis was run to determine the COR and AOR with 95% CI that was used to check the association between dependent and independent variables individually.

4.12. Data quality assurance

For dust sampling, the airflow rate in the sampling pumps was measured/checked and recorded before and after each sampling event using Rota-meter (i.e., flow rates more than $\pm 10\%$ different from the target flow rate of $2.0 \text{ lit}/\text{min}$ was dropped). Each series of sampling was controlled and corrected towards one field blank samples daily. The sample head mounted based on working position. Prior to fieldwork, the primary investigator was given one-day training to the investigator. At the end of sampling, the filter cassettes were separated from the tubing and sampling pumps, then covered and carefully handled in a labeled

container to prevent damage and transported to the lab for analysis. Prior to weighing, the laboratories cleaned with alcohol and the microbalance was waited until it becomes zero. Standard balance such (100 mg) was used periodically to check the reliability and validity of the microbalance. Pilot study or pre-testing was carried out a week before the actual data collection in order to check the competency of the data collectors, and the reliability and validity of the data collection tools.

Standardized questionnaire modified from ATS was used to assure data quality. Prior to data collection, two days training was given to data collectors and supervisor in order to fill the questionnaire appropriately and to reduce bias. Additionally, the questionnaire was translated from English to Amharic and back translated to English using standard procedure to check its validity. Each data collector was check the questionnaires frequently for completeness and consistency. At the end of the day, the supervisor were checked all the filled questionnaires. The principal investigator was alertly observed and follows the overall activities of the study.

4.13. Operational definition and definition of terms

Chronic respiratory symptoms: The development of one or more of chronic symptoms such as cough, cough with sputum, breathlessness, wheezing, chest illness which lasts at least three months in one year (48).

Chronic respiratory disease: a respiratory disease such as TB, chronic bronchitis, lung cancer, asthma and heart disease that could be developed before and confirmed by physicians (43).

Chronic Cough: Experience of a cough for most days of the week (≥ 4 days) for at least three months in one year (48).

Duration of exposure: defined as the working hours of workers in the factory per day (10).

Dust: is small, dry solid particles range from one to hundred micrometers in diameter size and formed by natural forces or human made processes such as (crushing, cutting, shredding, grinding, milling, drilling, demolition, shoveling, conveying, screening, bagging, and sweeping) Etc. (10).

Previous exposure history: workers experience in the dusty environment before the current working position (43).

Chronic Breathlessness: Is defined as discomfort or difficult to breathe in different activities such as walking up a slight hill, when undressing, walking at own pace (49).

Chronic wheezing: a condition of causing a wheezy or whistling sound heard during inhalation or exhalation (at least three months in a year) (50).

Chronic phlegm/Cough with sputum production: It is sputum expectoration as much as twice a day for most days of the week (≥ 4 days) for at least three months in one year (48).

Chronic chest pain: is a chest pain that kept off work in the past one year (43).

Current smokers: Workers who were smoking at the time of the study or a person who smoke cigarettes every day or some days (51).

Ever smoker: a person smoked at least 100 cigarettes in his entire life (51).

Paper dust: refers to dust coming from finely milled or otherwise processed paper and pulp product (10).

Similar Exposure Group: is a group of workers working the same type of tasks in a similar work area for the same length of time.

Duration of employment: defined as worker's work experience in the current work (10).

4.14. Ethical issue

Ethical clearance was obtained from the School of Public Health ethical review committee and was given permission letter. An official letter was written to the selected paper and water bottling factories. The purpose and method of the study and importance of their participation was clearly explained to participants.

From the results, the average dust exposure from each department was given to the managing director if he is requesting but not for the individual workers. The participant information sheet was given to the study participants for the sake of asking if they had question or anything regarding the study purpose.

The study participants who fulfilled the requirements for the study and agreed to participate was given Amharic written consent and signed before data collection began. Verbal permission was obtained for photo taking to show the dust sampling method and it should be signed for witness. Issues of rights, privacy and confidentiality were ensured during data collection period. Confidentiality was protected by making anonymous and ensuring that information was not accessible to anyone except the research personnel. Privacy was maintained by arranging a quit and convenient place to the interviewer and study participants. Participants had the right to participate or not and to withdraw at any time when they feel discomfort. The study participant did not gain a direct profit such as money, but they became a beneficiary in the future from the study.

4.15. Dissemination of results

The result of this study was presented to Addis Ababa University; school of public health and the copies were given to selected paper factories. In addition, the results were disseminated via publication.

5. RESULT

A total of 448 workers in paper and water bottling factories were selected to participate in the study, 411 of which were involved with a response rate of 91.74%. Due to annual leave, 15 participants were not found at work place and 22 participants were unwilling to participate so they were registered as nonresponsive.

5.1. Socioeconomic demographic characteristics of workers

Out of 411 respondents, 221 (53.77%) and 190 (46.33%) were males and females respectively. The majority of the participant ages were below 25 years with the mean ($\pm$ SD) age of 28.79 ($\pm$ 7.09) years. Two hundred eleven (51.34%) of the participants were orthodox followers and 200 (48.66%) of the study participants were married. Regarding, educational level, 195 (47.45%) of the respondents attended secondary school. The mean ($\pm$ SD) monthly incomes of respondents were 3704 ($\pm$ 2388) Ethiopian birr. In general, the distribution of sex, age, marital status, religion, educational status and monthly incomes of the two comparative groups of paper and water bottling factory were significantly different (Table 2).

Table 2: Socioeconomic and demographic characteristics of the paper and water bottling factories workers in, Ethiopia, Sept 2020 (n=411)

Variables	Paper factories n=206 n (%)	Water Bottling factories n=205 n (%)	Total n=411 n (%)	p-value
Sex				
Male	130 (63.11)	91 (44.39)	221 (53.77)	<0.001 ^a
Female	76 (36.89)	114 (55.61)	190 (46.33)	
Age (in year)				
18-25	66 (32.04)	100 (48.78)	166 (40.39)	<0.001 ^a <0.001 ^b
26-34	67 (32.52)	93 (45.37)	160 (38.93)	
≥ 35	73 (35.44)	12 (5.85)	85 (20.68)	
Mean (±SD)	31.2 (±8.55)	26.36 (±3.97)	28.79 (±7.09)	
Marital status				
Single	84 (40.78)	87 (42.44)	171 (41.61)	0.255 ^a
Married	97 (47.09)	103 (50.24)	200 (48.66)	
Widowed/Widower	25 (12.13)	15 (7.32)	40 (9.73)	
Religion				
Orthodox	142 (68.93)	69 (33.67)	211 (51.3)	<0.001 ^a
Protestant	52 (25.24)	128 (62.44)	180 (43.8)	
Muslim	12 (5.83)	8 (3.9)	20 (4.9)	
Educational status				
Primary school	35 (16.99)	18 (8.78)	53 (12.9)	<0.001 ^a
Secondary school	78 (37.86)	117 (57.07)	195 (47.45)	
Above 12	93 (45.15)	70 (34.15)	163 (39.66)	
Monthly income				
<4000	152 (73.79)	54 (26.34)	308 (74.94)	<0.001 ^a <0.001 ^b
≥4000	54 (26.21)	151 (73.66)	103 (25.06)	
Mean (±SD)	3168 (±2953)	4243 (±1453)	3704 (±2388)	

Number of participant (n); ^a= χ^2 test; ^b=independent sample t-test; SD=standard deviation; significant level at $p < 0.05$

5.2. Work-related and behavioral characteristics of workers

Out of 411 respondents, 290 (70.56%) of the respondents had less than five years work experience and the majority 224 (54.5%) of the study participants worked above eight hours per day. Three hundred ninety-nine (97.1%) of the respondents worked above five days per week and 43 (10.46%) of workers had a past occupational history in dusty areas before they were employed in this paper and water factory. Past history of respiratory diseases which was confirmed by physician were 50 (12.17%). Two hundred thirty six (56.2%) of respondents was used bio-fuel (charcoal, wood and gas) as primary source for cooking at home. Only 12 (2.9%) of the participants smoke cigarette (Table 2).

Table 3: Workplace characteristics and behavioural factors of the paper and water bottling factories workers in, Ethiopia, Sept 2020 (n=411)

Variables		Paper factories (n=206) n (%)	Water Bottling factories (n=205) n (%)	p- value
Work experience (in year)	<5	102 (49.51)	188 (91.71)	<0.001 ^a <0.001 ^b
	5-9	45 (21.85)	17 (8.29)	
	≥10	59 (28.64)	0	
	Mean (±SD)	7.94 (±7.18)	2.98 (±1.67)	
Working hours per day	≤8	187 (90.78)	0 (0)	<0.001 ^a <0.001 ^b
	>8	19 (9.22)	205 (100)	
	Mean (±SD)	8.33 (±1.17)	10.87 (±0.81)	
Working days per week	≤5	12 (5.83)	0	<0.001 ^a <0.001 ^b
	>5	194 (94.17)	205 (100)	
	Mean (±SD)	6.19 (±0.53)	6.75 (±0.44)	
Past occupational history	Yes	28 (13.59)	15 (7.32)	<0.05 ^a
	No	178 (86.41)	190 (92.68)	
Work section				<0.001 ^a
Recycle paper cutting		40 (19.42)	0	
Bell machine compactor and loader		11 (5.34)	0	
Pulp and recycle paper milling		9 (4.36)	0	
Roll paper production		23 (11.17)	0	
Paper and carton production		96 (46.60)	0	
Cone production		27 (13.11)	0	
Water production		0	205 (100)	
Past history of respiratory illnesses	Yes	37 (17.96)	13 (6.34)	<0.001 ^a
	No	169 (82.04)	192 (93.66)	
Bio-fuel energy use	Yes	141 (68.45)	90 (43.9)	<0.001 ^a
	No	65 (31.55)	115 (56.1)	
Cigarette smoking behavior	Yes	7 (3.4)	5 (2.44)	<0.56 ^a
	No	199 (96.6)	200 (97.56)	
Use/wear of RPD	Yes	16 (7.77)	3 (1.46)	<0.05 ^a
	No	190 (92.23)	202 (98.54)	
Type of RPD used				0.51
Mask respiratory		13 (6.31)	2 (0.98)	
Full face pieces respiratory		0	1 (0.49)	
Breathing apparatus		3 (1.46)	0	<0.001 ^a
Reasons for not using RPD				
Not available		6 (2.91)	0	
Not comfortable for work		4 (1.94)	0	
Not provided by institution		175 (97.56)	0	
The dust is not harmful		5 (2.43)	202 (98.54)	
OHS training	Yes	79 (38.35)	139 (67.8)	<0.001 ^a
	No	127 (61.65)	66 (32.2)	
Supervision on OHS issues	Yes	48 (23.3)	84 (41)	<0.001 ^a
	No	158 (76.7)	121 (59)	

Number of participant (n); a= χ^2 test; b=independent sample t-test; SD=standard deviation; significant level at $p < 0.05$; bio fuel (charcoal, wood and gas)

Respiratory protective devices (RPD) were used only by 16 (7.77%) and 3 (1.46%) of paper and water factory workers respectively. From this, 13 (6.31%) paper factories were uses respiratory masks. The main reasons mentioned by the participants for none use of RPD of paper and water factory workers were not provided by the institution 175 (97.56%) and the dust is not harmful 202 (98.54%) respectively. On providing training on occupational health and safety (OHS) the water factories were higher than paper factories in 139 (67.8%) and 79 (38.35%) respectively and supervision OHS issue both group were equal with response of 48 (23%) (Table 3).

5.3. Personal dust exposure of paper factories workers

The overall arithmetic mean ($\pm$ SD) and geometric mean ($\pm$ GSD) of the dust concentration were **11.3 ($\pm$ 7.7) and 10.2 ($\pm$ 1.4) mg/m^3** with a range varying from **6.8-55.8 mg/m^3** . The time of measurement ranges from 196-455 minutes with mean ($\pm$ SD) of 330 ($\pm$ 64.7) minutes. Out of 40 samples with dust exposure measurements 15 (37.5%) were exposed to dust above the acceptable recommended limit value of 10 mg/m^3 of total dust of Control of Substances Hazardous to Health Regulations 2002 (COSHH) (Table 4).

Table 4: Personal total dust exposure levels by work section among paper factory workers, Ethiopia, Sept 2020 (n=40)

Work section (Task)	Range (mg/m^3)	Mean ($\pm$ SD) (mg/m^3)	GM ($\pm$ GSD) (mg/m^3)	n above OEL (10 mg/m^3)
Recycle paper cutting Bell machine compactor and loader pulp and recycle paper milling Factory A	6.8-14.5	10 ($\pm$ 2.8)	9.7 ($\pm$ 1.3)	3 (30%)
Roll paper, carton and paper production Factory A	7.5-16	11.3 ($\pm$ 2.9)	11 ($\pm$ 1.3)	7 (70%)
Factory B	7.3-55.8	15.1 ($\pm$ 14.7)	12 ($\pm$ 1.9)	5 (50%)
Both Factory A and B	7.3-55.8	13.2 ($\pm$ 10.5)	11.5 ($\pm$ 1.6)	12 (60%)
Cone production Factory B	7.7-9.8	8.6 ($\pm$ 0.7)	8.6 ($\pm$ 4.8)	0 (0%)
Factory A	6.8-16	10.7 ($\pm$ 2.8)	10.3 ($\pm$ 1.3)	10 (50%)
Factory B	7.3-55.8	11.8 ($\pm$ 10.7)	10.1 ($\pm$ 1.8)	5 (25%)
Both Factory A and B	6.8-55.8	11.3 ($\pm$ 7.7)	10.2 ($\pm$ 1.4)	15 (37.5%)

Number of participant (n); milligram per meter cube (mg/m^3); GM=Geometric mean; SD=standard deviation; GSD=Geometric standard deviation; OEL= occupational exposure limit

5.4. Observational (qualitative) findings of paper factories

Observational findings of the study revealed that dust had accumulated on the walls, ceiling, floor and machine of different working environments. Particularly very high dust accumulated in places where paper-cutting task takes place such as bell machine compactor and cone production. Both factories had a dust absorber in the machine that a central exhaust system pulls excess dust and paper waste away from the process so-called trim waste system. The central exhaust system plays important role in reducing dust exposure for machine operator. The workplaces of paper factories were wide and had one long machine. The employees were wearing respiratory protective mask, however these masks were made to prevent the transmission of Corona virus so they don't protect the workers from paper dust exposure. In one paper factory, the machine was very old this might increase dust concentration in the work place. There was no natural and mechanical ventilation. The state of design of machine and absence of natural and mechanical ventilation had increases the impact dust exposure. Workers were performed their duty by rotation (shifts) and they had similar exposure level in each departments. The factories had no written procedures for selection, use and maintenance of respiratory protective equipment and written safety signs posted on walls to protect workers from injury. However, one of the factories have clinic for periodic examinations and treating ill workers. This was essential to minimize exposure status and diseases of paper factories workers.

5.5. Prevalence of chronic respiratory symptoms of workers

The prevalence of chronic respiratory symptoms in paper factories and controls varied from 17%-33% and 4%-8% respectively. The prevalence at list one chronic respiratory symptom for paper factories and controls were 51.94 and 9.27 respectively. The prevalence ratio of all respiratory symptoms of paper factories were significantly higher than controls after adjusting for sex, age, religion, educational status, monthly income, work experience, working hours per day, working day per week, past occupational history, past history of respiratory illnesses, biofuel energy use, use of RPD, OHS training and supervision (Table 5).

Table 5: Prevalence of chronic respiratory symptoms among paper and water bottling factories workers in, Ethiopia, Sept 2020 (n=411)

Chronic respiratory symptoms	Paper factories n=206	Control n=205	PR ^a (95%CI) ^b	p-value
Cough n (%)	41 (19.9)	13 (6.34)	3.14 (1.73-5.68)	<0.001 [*]
Phlegm n (%)	37 (17.96)	11 (5.37)	3.35 (1.76-6.38)	<0.001 [*]
Wheezing n (%)	39 (18.93)	9 (4.39)	4.31 (2.15-8.67)	<0.001 [*]
Breathlessness n (%)	50 (24.27)	12 (5.85)	4.15 (2.28-7.55)	<0.001 [*]
Nose irritating n (%)	67 (32.52)	17 (8.29)	3.92 (2.39-6.44)	<0.001 [*]
Sneezing n (%)	64 (31.07)	15 (7.32)	4.25 (2.5-7.2)	<0.001 [*]
Chest pain n (%)	35 (16.99)	10 (4.88)	3.48 (1.77-6.85)	<0.001 [*]
At least one chronic respiratory symptom n (%)	107 (51.94)	19 (9.27)	5.6 (3.58-8.77)	<0.001 [*]

*Adjusted for sex, age, religion, educational status, monthly income, work experience, working hours per day, working day per week, past occupational history, past history of respiratory illnesses, biofuel energy use, use of RPD, OHS training and supervision a=prevalence Ratio; b=95% confidence interval; *= significant level at p <0.05*

5.6. Factors associated with chronic respiratory symptoms

5.6.1. Bivariate analysis

5.6.1.1. Socioeconomic and demographic factor

In the bivariate analysis, socioeconomic and demographic factors such as age and educational status were significantly associated with chronic respiratory symptoms (Table 6). Respondents their age more than and 35 were 3 times (COR=2.97, 95% CI: 1.49 -5.91) higher odds of developing chronic respiratory symptoms compared to age less than and 25 years. However, sex, marital status, religion and monthly income were not significantly associated to chronic respiratory symptoms.

Table 6: Socioeconomic and demographic associated factor with chronic respiratory symptoms among paper factories worker in, Ethiopia, Sept 2020. (n=206)

Variables	Respiratory Symptoms		COR ^a (95% CI) ^b	P-value
	Yes (%)	No (%)		
Sex				
Male	43 (40.2)	33 (33.3)	1.00	0.309
Female	64 (59.8)	66 (66.7)	0.74 (0.42-1.32)	
Age				
18-25	25 (23.4)	41(41.4)	1.00	0.097 <0.002*
26-34	35 (32.7)	32 (32.3)	1.8(0.9-3.58)	
≥35	47 (43.9)	26 (26.3)	2.97 (1.49-5.91)	
Marital status				
Single	37 (34.6)	47 (47.5)	1.00	0.186 0.084
Married	54 (50.5)	43 (43.4)	1.6 (0.89-2.87)	
Widowed/er	16 (15)	9 (9.1)	2.26 (0.9-5.69)	
Religion				
Orthodox	75 (70.1)	67 (67.7)	0.37 (0.1-1.44)	0.152
Protestant	24 (22.4)	31 (31.3)	0.26 (0.06-1.09)	0.066
Muslim	8 (7.5)	1 (1)	1.00	
Educational status				
1 – 8	25 (23.4)	10 (10.1)	3.46 (1.49-8.03)	0.004* 0.086
9-12	43 (40.2)	35 (35.4)	1.7 (0.93-3.12)	
Above 12	39(36.4)	54 (54.5)	1.00	
Monthly income				
<4000	85 (79.4)	67 (67.7)	1.85 (0.98 -3.47)	0.057
≥4000	22 (20.6)	32 (32.3)	1.00	

*a=crude odds Ratio; b =95% confidence interval; * = significant level at $p < 0.2$; 1.00=reference*

5.6.1.2. Work-related and behavior factor

Work-related factors such as work section, working experience and past history respiratory illness were significantly associated with chronic respiratory symptoms (Table 7). Workers whose work experience more than and 10 years had 2 times (COR=2.13, 95% CI: 1.11-4.11) higher odds of developing chronic respiratory symptoms compared to those who had lower than 5 years work experience. However, past occupational history, working hour per day, working day per week, biomass use, smoking behavior, PPD utilization, OHS training and OHS supervision were not significantly associated.

Table 7: Work-related and behaviour associated factors with chronic respiratory symptoms among paper factories worker and controls in, Ethiopia, September 2020. (n=206)

Variables	Respiratory symptoms		COR ^a (95% CI) ^b	P-value
	Yes (%)	No (%)		
Work section				
Recycle paper cutting	18 (14.3)	22 (7.7)	8.01 (3.67-17.5)	<0.001*
Belling(compactor) and loader	8 (6.3)	3 (1.1)	26.1 (6.38-106.8)	<0.001*
Pulp and recycle paper milling	3 (1.1)	6 (2.1)	4.9 (1.13-21.16)	0.033*
Roll paper production	16 (12.7)	7 (2.5)	22.38 (8.18-61.2)	<0.001*
Carton and paper production	49 (38.9)	47 (16.5)	10.21 (5.5-18.95)	<0.001*
Cone production	13 (10.3)	14 (4.9)	9.09 (3.73-22.14)	<0.001*
Water production	19 (15.1)	186 (65.3)	1.00	
Work experience (in year)				
<5	45 (42.1)	57 (57.6)	1.00	
5-9	25 (23.4)	20 (20.2)	1.58 (0.78-3.21)	0.202
≥10	37 (34.6)	22 (22.2)	2.13 (1.11-4.11)	0.024*
Past occupational history				
Yes	18 (16.8)	10 (10.1)	1.8 (0.79-4.12)	0.164
No	89 (83.2)	89 (89.9)	1.00	
Working hours/ day				
≤ 8	12 (11.2)	7 (7.1)	1.00	
>8	95 (88.8)	92 (92.9)	1.67 (0.63-4.4)	0.308
Working days per week				
≤5	103 (96)	91 (91.9)	1.00	
>5	4(4)	8 (8.1)	2.26 (0.66-7.77)	0.194
Past history of respiratory illnesses				
Yes	31 (29)	6 (6.1)	6.32 (2.51-15.95)	>0.001*
No	76 (71)	93 (93.9)	1.00	
Types of fuel used at home				
Biomass	75 (70.1)	66 (66.7)	1.17 (0.65-2.11)	0.6
Either electric or not	32 (29.9)	33 (33.3)	1.00	
Smoking Behavior				
Yes	5 (4.7)	2 (2)	2.38 (0.45-12.54)	0.307
No	102 (95)	97 (98)	1.00	
PPD utilization				
Yes	5 (4.7)	11 (11.1)	0.39 (0.13-1.18)	0.094
No	102 (95.3)	88 (88.9)	1.00	
OHS training				
Yes	40 (37.4)	39 (39.4)	0.92 (0.52-1.6)	0.767
No	67 (62.6)	60 (60.6)	1.00	
OHS supervision				
Yes	24 (22.4)	24 (24.2)	0.9 (0.47-1.72)	0.759
No	83 (77.6)	75 (75.8)	1.00	

a=crude odds Ratio; b =95% confidence interval; * = significant level at p <0.2; 1.00=reference

5.6.2.Multivariable Analysis

Only variables with p value < 0.2 at bivariate analysis were entered in to the multivariable analysis. Finally, educational status, monthly income, work section and work experience were significantly associated with chronic respiratory symptoms (Table 8, 9).

5.6.2.1.Socioeconomic and demographic factor

From socioeconomic and demographic factors, educational status was found to be risk factor for development of chronic respiratory symptoms. In this study respondents below secondary school had 4 times (AOR=3.84, 95%CI; 1.47-10.04) higher odds of developing chronic respiratory symptoms than above secondary schools (Table 8).

Table 8: Multivariable analysis of socioeconomic and demographic associated factor and chronic respiratory symptoms among paper factory workers and controls in, Ethiopia, September 2020 (n=206)

Variables	Respiratory symptoms		COR ^a (95% CI) ^b	P-value
	Yes (%)	No (%)		
Age				
18-25	25 (23.4)	41(41.4)	1.00	0.470
26–34	35 (32.7)	32 (32.3)	1.38 (0.57-3.33)	
≥35	47 (43.9)	26 (26.3)	1.86 (0.77-4.48)	
Marital status				
Single	37 (34.6)	47 (47.5)	1.00	0.624
Married	54 (50.5)	43 (43.4)	1.21 (0.56-2.62)	
Widowed/Widower	16 (15)	9 (9.1)	1.03 (0.34-3.18)	
Religion				
Orthodox	75 (70.1)	67 (67.7)	0.49 (0.59-2.59)	0.573
Protestant	24 (22.4)	31 (31.3)	7.59 (0.78-74.1)	
Muslim	8 (7.5)	1 (1)	1.00	
Educational status				
1 – 8	25 (23.4)	10 (10.1)	3.84 (1.47-10.04)	0.006*
9-12	43 (40.2)	35 (35.4)	1.43 (0.82-3.16)	
Above 12	39(36.4)	54 (54.5)	1.00	
Monthly income				
<4000	85 (79.4)	67 (67.7)	2.49(1.13-5.46)	0.023*
≥4000	22 (20.6)	32 (32.3)	1.00	

*a = adjusted odds Ratio; b =95% confidence interval; * = significant level at p < 0.05; 1.00=reference*

5.6.2.2. work-related and behavior factor

In the work section respondents involved in bellling (compactor) and loader 47 times (AOR=46.6, 95%CI; 6.16-353) and roll paper production 44 times (AOR=43.5, 95%CI; 7.34-257) higher odds of developing chronic respiratory symptoms compared with control. Work experiences also another that showed significantly associated with the development of chronic respiratory symptoms. The odds of developing chronic respiratory symptom from 5-9 year was 2.7 times (AOR=2.72, 95%CI; 1.16-6.41) and ≥ 10 year 3 times (AOR=3.1, 95%CI; 1.03-9.35) significantly higher among workers who had work experience of less than 5 years. Whereas the remaining other variables were not significantly associated (Table 9).

Table 9: Multivariable analysis of work-related and behavior associated factor and chronic respiratory symptoms among paper factory workers and controls in, Ethiopia, September 2020. (n=206)

Variables	Respiratory symptoms		COR ^a (95% CI) ^b	P-value
	Yes (%)	No (%)		
Work section				
Recycle paper cutting	18 (14.3)	22 (7.7)	9.52 (1.79-50.8)	0.008*
Belling(compactor) and loader	8 (6.3)	3 (1.1)	46.6 (6.16-353)	<0.001*
Pulp and recycle paper milling	3 (1.1)	6 (2.1)	6.4 (0.62-66.18)	0.119
Roll paper production	16 (12.7)	7 (2.5)	43.5 (7.34-257)	<0.001*
Carton and paper production	49 (38.9)	47 (16.5)	16.04 (4.2-61.11)	<0.001*
Cone production	13 (10.3)	14 (4.9)	13 (2.55-66.23)	0.002*
Water production	19 (15.1)	186 (65.3)	1.00	
Work experience (in year)				
<5	45 (42.1)	57 (57.6)	1.00	
5-9	25 (23.4)	20 (20.2)	2.72 (1.16-6.41)	0.022*
≥ 10	37 (34.6)	22 (22.2)	3.1 (1.03-9.35)	0.044*
Past occupational history				
Yes	18 (16.8)	10 (10.1)	1.79 (0.7-4.58)	0.224
No	89 (83.2)	89 (89.9)	1.00	
Past history of respiratory illnesses				
Yes	31 (29)	6 (6.1)	9.31 (3.65-23.76)	>0.001*
No	76 (71)	93 (93.9)	1.00	
PPD utilization				
Yes	5 (4.7)	11 (11.1)	0.5 (0.16-1.64)	0.244
No	102 (95.3)	88 (88.9)	1.00	

a= adjusted odds Ratio; b =95% confidence interval; * = significant level at $p < 0.05$; 1.00=reference

6. DISCUSSION

This study mainly found that arithmetic mean (AM ($\pm$ SD)) and geometric mean (GM ($\pm$ GSD)) of total dust concentration **11.3 ($\pm$ 7.7) and 10.2 ($\pm$ 1.4) mg/m³** respectively that was above the acceptable recommended limit value of control of substances hazardous to health (COSHH). The prevalence ratio of all chronic respiratory symptoms among paper factories workers was significantly higher than compared with the control after adjusting for sex, age, religion, educational status, monthly income, work experience, working hours per day, working day per week, past occupational history, past history of respiratory illnesses, biofuel energy use, use of respiratory protective device (RPD), occupational health and safety (OHS) training and supervision. Educational status below secondary school, nearly all work sections of paper factories, work experience from 5-9 and greater and equal to 10 years, more than 8 working hour/day, past history of occupation and respiratory illnesses were associated with the development of at least one chronic respiratory symptom.

In the present study, the personal total dust exposure of paper factory workers geometric mean (GM ($\pm$ GSD)) 10.2 ($\pm$ 1.4) was consistent with that of the two previous study conducted in Germany with GM ($\pm$ GSD) 10.3 ($\pm$ 15.5) and 12.4 mg/m³ (14, 15). The arithmetic mean personal dust exposure level in this study was also similar with the two studies conducted in Sweden with arithmetic mean of 9.9 mg/m³ and 10.8 mg/m³ and one study in Turkey with arithmetic mean of 9.7 mg/m³ (9, 16, 18). The qualitative findings of our study also support and strengthen this result. Accumulation of high amount dust on the walls, ceiling, floor and machine of different working environments is the indication for presence of dust. While this, absence of natural and mechanical ventilation and presence of very old machine increases the dust concentration. These findings were supported by study done in Sweden (20).

The finding of this study show 15 participants and the overall arithmetic mean was above recommendation of occupational exposure limit (OEL) standard of 10mg/m³. Whereas, the remaining 25 samples dust level were above 5mg/m³. However, we have seen a significant of chronic respiratory symptom among workers who have been exposed to less than 10 mg/m³. A significant of chronic respiratory symptoms with low-level exposure (from 5 mg/m³-10mg/m³) might be due to long duration of employment (more than 10 years' work experience). This finding was consistent with that of the previous four studies conducted in Sweden (10, 17, 18, 52). Another study in Sweden also seen symptoms of nose irritation while dust exposure less than 5mg/m³ (19). Most of the time, exposures to dust less than 10

mg/m³ has not expected for chronic respiratory symptoms (8, 22). In this concentration of dust presence of symptoms might be due workers not preventing from the dust. This is consistent to our observational findings, on that of workers were not aware how they protect themselves from the dust. The indications these were, wearing of respiratory protective mask to prevent the transmission of Corona virus. These masks don't protect them from paper dust exposure. While this, the factories also had no written procedures for selection, use and maintenance of respiratory protective equipment and written safety signs posted on walls to protect workers from injury.

This study showed that the prevalence of chronic respiratory symptoms were significantly lower in paper factory participants (51.94%) compared to that of the previous study done in Sweden, (61.54%) (9). The reason for the difference might be in the previous study, the age of the participant was older, the sample size was small and the period of the study was far. Therefore, the way that the factories worker to avoid and control risk factors was poor and the chances to represent all workers were lower. This might be overestimate or underestimate the result.

Our study found that significantly higher prevalence in all chronic respiratory symptoms compared to controls. However, this was different with that of the previous study done in Croatia, the prevalence of chronic respiratory symptoms such as cough (36.6% vs. 18.4%) and phlegm (34.7% vs. 16.1%) exposed workers in paper recycling with respect to control (39). With similar of study in Croatia study done in Turkey prevalence of cough (31.2% vs. 9%) and wheezing (43.1% vs. 10.3%) of exposed vs. control were different (16). This two study prevalence of exposed and control of with some symptoms were higher. This difference might be on the level of dust exposure and the time was far on the previous study. Another Study done in Germany, cough (17.2% vs. 0%) and phlegm (4.6% vs. 0%) a significant difference was shown among exposed and control. However, the finding was lower than our finding (14). The main inconsistencies of the studies might be related to the level of dust exposure and difference in the study places (area). The previous studies were conducted in high or in middle-income countries where the working condition are better than Ethiopia.

The study done in Croatia, among paper recycling workers indicated that, the prevalence of chronic respiratory symptoms such as cough (51.9% vs. 19.1%) and phlegm (51.9% vs. 14.9%) had significant difference by smoking habit (39). However, in our study exposed smokers did not significantly different from non-smokers. This was due to smoker workers were few in both exposed and control. In previous study age less and equal 40 and above 40

were also significantly associated (39) but not in our study. The difference in this study most of the participants were below 40 years this might be decreases the susceptibility to diseases.

This study found that low socioeconomic status like education and monthly income were significantly associated with the development of chronic respiratory symptoms among all participant and paper factories workers respectively. This study was consistent with the study conducted in Finland, among low socio economic status population, which indicated that population with below secondary school (AOR= 1.8, 95%CI; 1.2-2.6) and having low income (AOR=1.4, 95%CI; 1.0-1.9) develops chronic respiratory symptoms compared with higher education and high-income population respectively (53). The difference was our study conducted on paper dust in paper factories and chronic respiratory symptoms whereas the previous study on low socioeconomic status and chronic obstructive airway disease.

Our study found that there was a statistically significant association between chronic respiratory symptoms and duration of employment. Workers with work experience 5-9 and ≥ 10 years were significant with the development of chronic respiratory symptoms. This was similar to study done in Germany, in that of duration of employment more than >15 had a symptoms of cough (AOR=3.3, 95%CL; 1.4-8.8) (14). The difference might be due to that in this study at least one respiratory symptom was considered whereas in Sweden study only cough was considered. Moreover, as duration of exposure increases a chronic respiratory symptom also increases.

7. STRENGTH AND LIMITATION OF THE STUDY

7.1. Strength

To find strong evidence on respiratory symptoms of paper factories relatively effective and sufficient methodological data collection tools have been applied. These were interviewing by health professional rather than using self-administered questionnaire, using observational checklist to capture remained problems and personal total dust measurement to strength the finding on outcome variable. Additionally selecting comparative control group near to the factories were necessary for minimizing factors, which increase confounders.

On personal total dust sampling, both laboratory and field procedures were applied with alert. This include weighing (measuring) the PVC filter (pre, post and blank), transporting and handling the sample, monitoring mounted workers, As much as possible covering the whole working time and checking the flow rate of pump. In addition, the dust was measured by standard microbalance (Mettler Toledo).

7.2. Limitation

The limitations of this study were in total dust sampling Millipore plastic closed-face filter cassette (CFC) it had significantly underestimating the coarse particles in the inhalable paper dust level. Adherence of dust interior part of the cassette walls losses may occur that leads to underestimation of dust concentration. During personal dust measurements, the participants may expose intentionally to dusty area this overestimate sample.

Having respondent's recall bias and interviewer's bias was possibly introduced during interviewing the study participants. This might have influenced the results of reported duration of employment, age, past dust occupational exposure, past respiratory disease and symptoms.

The cross-sectional study design may not be strong enough to show cause and effect relationship between risk factors and outcome. Moreover, the outcome also underestimated due to health workers effect. For this limitation, longitudinal follow up study is best but it is expensive and time consuming to track the workers.

8. CONCLUSION AND RECOMMENDATION

8.1. Conclusion

Findings from this study indicate that the arithmetic mean (AM ($\pm$ SD)) and geometric mean (GM ($\pm$ GSD)) of the concentration of paper dust workers in the paper factories were **11.3 ($\pm$ 7.7) and 10.2 ($\pm$ 1.4) mg/m³** respectively with a range varying from **6.8-55.8 mg/m³**. Fifteen (37.5%) workers exposed to the concentration paper dust exceeded total dust 10 mg/m³ occupational exposure limit of control of substances hazardous to health (COSHH).

The prevalence of chronic respiratory symptoms among paper factory workers as compared to control was high. This was more common and determinant factors among less educational status, all work section of paper factories except pulp and recycle paper milling, long work experience and working hours per day, having past history occupational and respiratory illness. Most paper factories workers were unaware of the effect of exposure to paper dust. Most of the workers were not used respiratory protective devices. The study predict for those who did not develop respiratory symptoms while working/exposed on paper dust, they are at risk of developing respiratory symptoms and healthy worker effect has to be considered. Generally, working in paper factory without proper respiratory protective device has an adverse effect on respiratory health of the workers.

8.2. Recommendation

For the Ministry of Labour and Social Affairs (MoLSA): conduct supportive supervision and risk assessment of paper factories in Ethiopia to identify the level of paper dust exposure and set occupational exposure limits value.

For paper factories managers: occupational health and safety training for workers should be provided regularly. Managers should ensure that the inspection and maintenance program continues and effective. Engineering control should be important at duster place of machine. It is recommended that standard and adequate respiratory protective devices be provided and better to encourage the workers to utilize it. In the long run minimizing the dust concentration was important by modification of the old machine or changing by new machine.

For paper factories workers: Workers must properly wear respiratory protective equipment provided by the institution. They should apply occupational health and safety producers both posted in the work place and written document.

For Researchers: Further study is recommended to use longitudinal study among paper factories workers to investigate the level of personal dust exposure, chronic respiratory symptoms and lung function test.

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10.ANNEXES

Annex I Study Information sheet

My name is _____ I am working as a data collector for the study conducted in these paper factories by Bereket Meskele who is studying for her Master's degree at Addis Ababa University, Collage of Health Science, and School of Public Health. I kindly request you to give me your attention to explain you about the study and study participant.

The study title: Assessment of paper dust exposure and chronic respiratory symptoms among paper factories workers in Ethiopia

Background of the study: Dust is produced through by product of cutting, grinding, shredding, and so all. The produced dust has heath effect and inhalation is the most common route of exposure. Excessive exposure to paper dust has cause obstructive and restrictive respiratory disease. This exposure and effect can increase in oldest paper factories. In Ethiopia, the culture of workers to protect themselves from the dust is poor. Therefore, this exposure may lead to different respiratory health problems.

Objective: To determine the paper dust exposure status, assess prevalence of chronic respiratory symptoms and associated factors among paper factories workers in Ethiopia.

Significance of the study: The main aim of this study is to write a thesis as a partial fulfillment of a Master's degree in public health for the principal investigator. After completion of this study the result used as evidence and input to reduce the potential health risk of exposure to paper dust.

Study site and period of the study: The study will be carried out on paper factories workers which are found in Ethiopia. The study will be conducted from September 2019 to October 2020.

Study procedures: The numbers of paper factories will be determined. Then same exposure group will be selected. Then sampling procedure will be done. Data will be collected. On the final analysis and interpretation will be done.

Potential risks/Benefits associated: Risk of participating in this study almost nil since the study does not have invasive procedure and need collecting any samples. There would have no any direct benefits for being study participant but indirectly the findings from this research will be important for improving occupational health safety practice, information for the paper factories and for scientific knowledge.

Confidentiality/Justice/Privacy: All information forwarded kept confidential and names will not be written.

Rights of participation (Voluntary Participation): Giving permission for this study is voluntary. You have the right to permit or not for this study. If you decide to permit the study, you have the right to terminate the study at any time if you consider something related to the study is wrong.

Termination of the study: Participants are free to withdraw from the study at any time, and this will not have any impact on their subsequent management

Questions, rights and complaints

Contact address: If you have any question, which is not clear, you can contact the investigator.

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Addis Ababa University, school of public health

Annex II Informed consent

The objective of this study is to assess prevalence of chronic respiratory symptoms and associated factors and determining the paper dust exposure status among paper factories workers in this area. This study has important in determining paper dust exposure and respiratory problem. Recommendation will be provided as per the study findings.

If you agree to participate in this study, we will stay together for a short while. The information that you will provide will be kept confidential. Only the principal investigator, co investigators and interviewer will know the information. Otherwise, it will be kept secret and coded. You are free to answer only what you understand, to ask any question, and to terminate participation in the interview.

Are you agree to participate? Yes----- No-----

If you agree to participate Signature -----

Annex III English Version Questionnaire

S/N	Question	Response	Skip
PART I. SOCIO-DEMOGRAPHIC CHARACTERISTICS			
100	Sex	1. Male 2. Female	
101	Age	_____years	
102	Marital status	1. Single 2. Married 3. Divorced 4. Widowed/Widower 5. Separated	
103	Religion	1. Orthodox 2. Muslim 3. Protestant 3. Catholic 4. Others (specify)	
104	Educational level	_____level	
105	What is your income per a month?	_____Ethiopian birr	
106	How long do you working in this job?	_____Year	
107	How many working hours per a day?	_____hours	
108	How many working days per a week?	_____days	
109	Which section are you working now and for how long?	Working department	Service year
		Recycle paper cutting	
		Bell machine compactor and loader	
		pulp and recycle paper milling	

S/N	Question	Response		Skip
		Roll paper, carton and paper production		
		Cone production		
		Others		
110	Have you ever worked in other sections in the past in the paper factory?	1. Yes 2. No		
111	If Q 110 answer is "Yes" indicate which section and for how long? (in years & months) (Multiple answer is possible)	Working department	Service year	
		Recycle paper cutting		
		Bell machine compactor and loader		
		pulp and recycle paper milling		
		Roll paper, carton and paper production		
		Cone production		
		Others		
PART II. PAST OCCUPATIONAL HISTORY				
200	Have you ever worked for any other dusty job?	1. Yes 2. No		If -No, skip to No. 202
201	If -Yes for Q. No 200 For how long did you work in the areas listed below (more than one answer is possible)	1. Welding _____ 2. Crusher _____ 3. Mining _____ 4. Paper factories _____ 5. Flour mill _____ 6. Sweeping _____ 7. Other (specify) ____		
202	Does food prepared in your home by you or other person?	1. Yes 2. No		If -NO skip to 204

S/N	Question	Response	Skip
203	If –Yes for Q. No 202 What kind of energy source mostly do you use for food preparation? (your primary fuel type)	1. Coal 2. Wood 3. Gas 4. Electric 5. LPG 6. Others (specify)_____	
PART III. PAST HISTORY OF RESPIRATORY ILLNESSES			
204	Did you have previous chronic lung conditions told by a doctor?	1. Yes 2. No	If - ‘NO’ “go to Q. No 300
205	If –Yes for Q. No 204 What type of health problem did you experienced earlier? (more than one answer possible)	1. Chronic bronchitis 2. Emphysema 3. Asthma 4. Lung cancer 5. Tuberculosis (TB) 6. Other (specify) _____	
PART IV. CIGARETTE SMOKING BEHAVIOUR			
Ever smoker: - a person smoked at least 100 cigarettes in his entire life. Currently smoker:- a person who smoke cigarettes every day or some days.			
300	Have you ever smoked cigarettes?	1. Yes 2. No	If -‘NO’ go to Q. No. 304
301	Do you now smoke cigarettes (as of 1 month ago)?	1. Yes 2. No	
302	How many cigarettes do you smoke per day now?	_____cigarettes/day	
303	For how long did you smoke cigarette?	_____years	
304	Is there any person who smoke cigarette in your home?	1. Yes 2. No	
PART V. Respiratory Symptoms			
A. Cough:			

S/N	Question	Response	Skip
Cough: Experience of a cough as much as 4– 6 times per day occurring for most days of the week (≥ 4 days) or cough at all on getting up in the morning or during the rest of the day/night for at least three months in one year)			
400	Do you usually have a cough?	1. Yes 2. No	If -“ No” go to No. 403
401	Do you usually cough as much as 4 to 6 times a day, 4 or more days out of the week?	1. Yes 2. No	
402	Do you usually cough at all on getting up in the morning?	1. Yes 2. No	
403	Do you usually cough at all during the rest of the day or at night?	1. Yes 2. No	
404	If -Yes to any of the above (400, 401,402, or 403), Answer the following 2 questions: Do you usually cough like this on most days for 3 consecutive months or more during the year?	1. Yes 2. No	If- “ No” to all skip to Q.No. 406
405	For how many years have you had this cough?	_____years	
A Cough with sputum production related questions A Cough with sputum :- is sputum expectoration on most days of the week (5 days) for at least three 3 consecutive months in one year			
406	Do you usually cough with sputum first thing in morning	1. Yes 2. No	
407	Do you usually cough with sputum during the day or at night?	1. Yes 2. No	
408	Do you usually cough with sputum for 4 or more days in a	1. Yes 2. No	

S/N	Question	Response	Skip
	week?		
409	Do you cough with sputum on most of days for as much as 3 consecutive months or more in a year?	1. Yes 2. No	
Phlegm Phlegm: Sputum expectoration as much as twice a day for most days of the week (≥ 4 days), or bring up phlegm at all on getting up in the morning, or during the rest of the day/night for at least three months in one year.			
410	Do you usually bring up phlegm from your chest as much as twice a day, 4 or more days out of the week?	1. Yes 2. No	
411	Do you usually bring up phlegm at all on getting up in the morning?	1. Yes 2. No	
412	Do you usually bring up phlegm at all during the rest of the day or at night?	1. Yes 2. No	
413	If –Yes to any of the above (410, 411, 412), Answer the following 2 questions: Do you bring up phlegm like this on most days for 3 consecutive months or more during the year?	1. Yes 2. No	If-“No” to all skip to No. 415
414	For how many years have you had trouble with phlegm?	_____years	
Wheezing, Nose Irritating, and Sneezing Wheezing: - is a condition of causing a wheezy or whistling sound heard during inhalation or exhalation (at least for three months in a year).			
415	Do you have wheeze/whistling/	1. Yes 2. No	If –“ No” go

S/N	Question	Response	Skip
	sound in your chest?		to Q. No.418
416	When you have wheeze/whistling/ sound in your chest?	1.In the morning 2. In the daytime 3. At night	
417	For how long has this wheezy sound persisted?	_____(Years)	
418	Are you troubled by nose irritation?	1. Yes 2. No	If -“No” go to Q. No.420
419	For how many years has this been present?	____years	
420	Are you troubled by sneezing once you start paper factories?	1. Yes 2. No	If “ No”go toQ. No. 422
421	For how many years has this been present?	____years	
Breathlessness Related Questions Breathlessness :- is a discomfort or difficult to breathe in different activities or a condition occurring when hurrying on the level ground or walking up a slight hill for at least 3 months in a year)			
422	Are you troubled with shortness of breath when hurrying or walking uphill?	1. Yes 2. No	If -“ No” go to Q. No.428
423	If Yes Q. 422, Do you have to walk slower than people of your age on the level because of breathlessness?	1. Yes 2. No	
424	Do you ever have to stop for breath when walking at your own pace on the level?	1. Yes 2. No	
425	Do you ever have to stop for breath after walking about 100 yards or 96 m (after a few minutes) on the level?	1. Yes 2. No	

S/N	Question	Response	Skip
426	Are you too breathless to leave the house or breathless on dressing or undressing?	1. Yes 2. No	
427	For how long have you been this short of breath?	_____(In years)	
Chest pain Related Questions			
428	In the past three years, have you experienced any chest illness that kept you off duty, or in bed?	1. Yes 2. No	If-“ No” go to Q. No.500
429	If you get a cold, does it usually go to your chest?	1. Yes 2. No	
430	Did you produce phlegm with any of these chest illnesses?	1. Yes 2. No	

Adopted from: American Thoracic Society and National Heart & Lung Institute
Division of Lung Disease Respiratory Questionnaire (ATS-DLD) (54)

Part V. Behavioral factors of workers Respiratory protective devices			
500	Do you usually wear respiratory protective devices while at work?	1. Yes 2. No	If-“No” go to 502
501	Which of the following type of protective devices did you use? (choose all that you apply in your working area)	1 Mask respiratory 2. Full face pieces respiratory 3. Breathing apparatus 4.others_____	
502	If Q.500, answer is "No -Select the most appropriate reasons for not using	1. Not available 2. Not comfortable for work 3. Not provided by institution 4. The dust is not harmful 5. Others specify____	
503	Do you ever have occupational health and safety training?	1. Yes 2. No	
504	Do you ever been supervised at work place on occupational safety issues?	1. Yes 2. No	

Annex IV: Observational Checklist for PPE usage and workplace ventilation

S/no	PPE Usage	Response		Comments
		Yes	No	
1	Is required equipment provided and used?			
2	Is there a written procedure for the selection, use and maintenance of PPE?			
3	Is personal protection utilized only when it is not reasonably practicable to eliminate or control the hazardous substance or process?			
4	Are the areas requiring PPE usage properly identified by warning signs?			
Workplace ventilation				
1	Is the work place well ventilated /free fresh air movements?			
2	Is the ventilation system appropriate for the work performed?			
3	Is exhaust ventilation required before confined space entry?			
4	Is there any Dust absorber			
5	Do you ever had occupational health and safety training?			Document observation

Annex V: Dummy table for dust level measurement

Table 10: Measurements of paper dust sampling in Ethiopia, 2020

Code	Pre - weight of filter (mg)	Post - weight of filter (mg)	Starting time (min)	Ending time (min)	Initial flow rate (lit/min)	Final flow rate (lit/min)	Blank weight (mg)	Dust concentration (mg/m ³)
1								
2								
3								
4								
5								

Table 11: Dust Sampling Worksheet (PI: Bereket M.)

Factories name: _____ Name of data collector: _____

Blank ID number: _____ department _____

Date	Name of participant	Code of participant	Round	Work shift	Filter/ Sample ID #	Pum PID #	Type of task	Time start (Time1)	Time end (Time2)	Initial flow rate (Flow rate1)	Final flow rate (Flow rate2)	Remark

One data sheet is used only for **one day** and **one blank** serves only for one day

Annex VI. ለቃለ መጠይቅ የሚሰጥ የመረጃ መስጫ

ጤና ይስጥልኝ!

እንደምን አለ? ስሜ _____ ይባላል። እዚህ የተገኘሁት የአዲስ አበባ ዩኒቨርሲቲ ጤና ሳይንስ ኮሌጅ የህብረተሰብ ጤና ሳይንስ ትምህርት ቤት የድህረ-ምረቃ ተማሪ የሆኑት በረከት መስቀሌን ወክሎ ነው። እሳቸውም በወረቀትና ፕልፕ ኢንዱስትሪዎች ውስጥ በሚሰሩ ሰራተኞች የወረቀት አቧራ/ብናኝ መለካትና የመተንፈሻ አካላት ችግርና መንስኤዎቻቸው ዙርያ ላይ ጥናት በመስራት ላይ ይገኛሉ። ይህንን ጥናት ለማካሄድ ተሳታፊ የሚሆኑትን በሎቶሪ የናሙና አወጣጥ ምልመላ ሲካሄድ እርሶ በዚህ ጥናት እንዲሳተፉ የተመረጡ ስሆን ጥናቱ በሚካሄድበት ወቅት የመተንፈሻ አካላት ችግርና መንስኤዎቻቸውን ዳሳሳ ለማድረግ ደረጃውን የጠበቀ መጠይቅ እጠቀማለሁ። መጠይቁንም ለመሙላት ከ30 እስከ 45 ደቂቃዎች የሚወስድ በመሆኑና የእርስዎንም ሙሉ ትብብር የሚጠይቅ በመሆኑ ይህንኑ እንዲያደርጉ በታላቅ ትህትና እጠይቅዎታለሁ።

በጥናቱ ላይ በመሳተፍዎ በእርሶ ላይ የሚደርስ ምንም አይነት የጎንዮሽ ጉዳት የሌለ ሲሆን ከጥናቱም የሚያገኙት ምንም አይነት ቀጥተኛ ጥቅም የለም። ነገር ግን በተዘዋዋሪም ጥናቱ በወረቀትና ፕልፕ ኢንዱስትሪዎች በሚሰሩ ሰራተኞች ላይ የሚታዩ የመተንፈሻ አካላት ችግሮች ለመከላከልና ለመቆጣጠር ትልቅ አስተዋፅኦ ይኖረዋል። በተጨማሪም ለቀጣይ ምርምር መሰረት በመሆን ከማገልገሉም ባሻገር ይህንን ጥናት መሰረት በማድረግ መንግስትና የተለያዩ ባለድርሻ አካላት ትኩረት በመስጠት ችግር ላይ የራሳቸው አስተዋፅኦ እንዲያደርጉ ይረዳል ብዬ አስባለሁ።

የሚሰጡን መረጃ ሁሉም ምስጢራዊነቱ የተጠበቀና ቅፅ ላይ ስም አይሰፍርም። ስለዚህ በጥናቱ መሳተፍም ሆነ አለመሳተፍ የእርሶ መብት ነው። በጥናቱ ላይ መሳተፍ በሙሉ ፈቃደኝነት የተመሰረተ ነው። ስለሆነም በጥናቱ ላይ ለመሳተፍም ሆነ ባልተመቸዎት ጊዜ ጥናቱ አቋርጦ ለመውጣት መብትዎ የተጠበቀ ነው። እርስዎ የሰጡን መረጃ ከግል ማንነትዎ ጋር ምንም ዓይነት ግንኙነት የለውም።

ለበለጠ መረጃ: ጥናቱ በተመለከተ ማንኛውም ጥያቄ ካለዎት በረከት መስቀሌ (የጥናቱ ተመራማሪ) በአዲስ አበባ ዩኒቨርሲቲ ጤና ሳይንስ ኮሌጅ የህብረተሰብ ጤና ትምህርት ክፍል ስልክ ቁጥር +251-9-13-06-12-98 ወይም ዶ/ር ሳምሶን ዋቁማ ስልክ ቁጥር +251-9-23-94-09-98 ወይም ዶ/ር ተፈሪ አበጋዝ ስልክ ቁጥር +251- 9-11-36-16-07 (የጥናቱ አማካሪዎች) በአዲስ አበባ ዩኒቨርሲቲ ጤና ሳይንስ ኮሌጅ የህብረተሰብ ጤና ትምህርት ክፍል ወይም የህብረተሰብ ጤና ትምህርት ክፍል የስነ-ምግባር ግምገማ ተቋም ስልክ ቁጥር +251115157701 ደውለው ማነጋገር ይችላሉ። እባክዎ ጥናቱ በተመለከተ ማንኛውም ግልፅ ያልሆነ ጥያቄ ካለዎት? በጥናቱ ለመሳተፍ ፈቃደኛ ነዎት?

Annex VII. ለአባራ መለካት የሚሰጥ የመረጃ መስጫ

ጤና ይስጥልኝ!

እንደምን አሉ እኔ _____ እባላለሁ፡፡ ከአዲስ አበባ ዩኒቨርሲቲ፣ ጤና ሳይንስ ኮሌጅ ሕብረተሰብ ጤና ትምህርት ክፍል መረጃ ለመሰብሰብ ነው የመጣሁት፡፡ የዚህ ጥናት ዋና ዓላማ በኢትዮጵያ ከሚገኙት የወረቀትና ፕልፕ ኢንዱስትሪዎች ሰራተኞች በሰውነት ውስጥ ሊገባ የሚችል የወረቀት አባራ/ብናኝ መለካት፣ የመተንፈሻ አካላት ችግር ምልክቶች ዳሰሳ ማድረግ፣ የሳንባን ሁኔታን መለካት ና የመተንፈሻ አካላት ችግር መንስኤዎቻቸውን ማረጋገጥ ነው፡፡ በዚህ መሰረት ይህ ጥናት በወረቀትና ፕልፕ ኢንዱስትሪዎች ሰራተኞች ላይ የሚታዩ የመተንፈሻ አካላት ችግሮች በመከላከልና መቆጣጠር ትልቅ አስተዋፅኦ ይኖረዋል፡፡ ስለሆነም ይህንን ጥናት መንግስትና የተለያዩ ባለ ድርሻ አካላት በችግሩ ላይ ትኩረት በመስጠት በነኚህ ሰራተኞች ላይ ሊያጋጥም የሚችል ችግር መፍትሄ እንድያሰቀምጡ ይረዳል ብዬ አስባለው፡፡ ጥናቱ በሚካሄድበት ወቅት የወረቀት አባራ/ብናኝና የሳንባ (የመተንፈሻ) አካል ሁኔታ መለኪያ መሳርያ እጠቀማለሁ፡፡ ጥናቱ ከሕብረተሰብ ጤና ትምህርት ክፍል የስነ-ምግባር ፈቃድ የተሰጠው ነው፡፡ እርስዎ በጥናቱ ስለተመረጡ ስለጥናቱ አስፈላጊውን መረጃ እንዲሰጡኝ በትህተና እጠይቃለሁ፡፡

የወረቀት አባራ/ብናኝ መለካት አካሄድ፡ የወረቀት አባራ /ብናኝ መለኪያ መሳሪያ በሰውነትዎ ላይ እንድያደርጉ በትህትና ይጠየቃለሁ፡፡ መሳርያው በመተንፈሻ አካላት ዙርያ የሚደረግ አባራ መለኪያ የያዘ ሆኖ ወገብ ላይ የሚደረግ ፓምፕ አለው፡፡ ፓምፑ በአባራ መለኪያ በኩል መተንፈሻ አካላት አካባቢ ላይ ያለውን አየር ለመሳብ የሚያገለግል ነው፡፡ የእንጨት አባራ /ብናኝ መለኪያ መሳሪያ ከትንሽ ድምፅ በስተቀር በጤና ይሁን በስራ ላይ የሚያመጣው ተፅዕኖ የለም፡፡ የእንጨት አባራ /ብናኝ የምንለካው ሙሉ የስራ ሰዓት የሚሸፍን ነው፡፡ የጥናቱ ተመራማሪ መሳርያው በሰውነትዎ በማድረግ፣ ፓምፑ በማስጀምርና በማስቆም ይረድዎታል፡፡

ጥናቱ ለተሳታፊዎች በቀጥታ የሚሰጥ ነገር የለውም፡፡ ነገር ግን ከጥናቱ የሚገኝ መረጃ መሰረት በማድረግ የመስተካከል እርምጃ እንዲወሰድ ይረዳል፡፡ ከዚህ በተጨማሪ በዳሰሳ ግዜ የተገኘውን የብናኝ ደረጃ እናሳውቅዎታለን፡፡ ጥናቱ አባራ/ብናኝ ለመለካት ከሚፈጀው ግዜ ውጭ በተሳታፊዎች የሚያስከትለው አንዳች ጉዳት የለውም፡፡ በጥናቱ ላይ መሳተፍ በሙሉ ፍቃደኝነት የተመሰረተ ነው፤ ስለሆነም በጥናቱ ላይ ለመሳተፍም ሆነ ባልተመችዎት ግዜ ጥናቱ አቋርጦ ለመውጣት መብትዎ የተጠበቀ ነው፡፡ በተሳታፊዎች ላይ የሚገኝ የአባራ መጠን ከጥናቱ አባላት ውጭ ለሌላ ማንም ተላልፎ አይሰጥም፡፡ እርስዎ የሰጡን መረጃ

ከግል ማንነትዎ ጋር ምንም ዓይነት ግንኙነት የለውም፡፡ የሰጡንን መረጃ ምስጢራዊነቱ የተጠበቀ ነው፡፡

ለበለጠ መረጃ፡ ጥናቱ በተመለከተ ማንኛውም ጥያቄ ካለዎት በረከት መስቀሌ (የጥናቱ ተመራማሪ) በአዲስ አበባ ዩኒቨርሲቲ ጤና ሳይንስ ኮሌጅ የሕብረተሰብ ጤና ትምህርት ክፍል ስልክ ቁጥር +251-9-13-06-12-98 ወይም ዶ/ር ሳምሶን ዋቁማ ስልክ ቁጥር +251-9-23-94-09-98 ወይም ዶ/ር ተፈሪ አበጋዝ ስልክ ቁጥር +251- 9-11-36-16-07 (የጥናቱ አማካሪዎች) በአዲስ አበባ ዩኒቨርሲቲ ጤና ሳይንስ ኮሌጅ የሕብረተሰብ ጤና ትምህርት ክፍል ወይም የሕብረተሰብ ጤና ትምህርት ክፍል የስነ-ምግባር ግምገማ ተቋም ስልክ ቁጥር

+251115157701 ደውለው ማነጋገር ይችላሉ፡፡

እባክዎ ጥናቱ በተመለከተ ማንኛውም ግልፅ ያልሆነ ጥያቄ ካለዎት? በጥናቱ ለመሳተፍ ፈቃደኛ ነዎት?

Annex VIII. የስምምነት መዋዋያ ቅጽ

ጥናቱን በሚያካሂደው አካል ስለጥናት በቂ መረጃ ተሰጥቶኛል፡፡ የጥናቱ ዋና ዓላማ በኢትዮጵያ ከሚገኙት የወረቀትና ፕልፕ ኢንዱስትሪዎች ሰራተኞች በሰውነት ውስጥ ሊገባ የሚችል የወረቀት አቧራ/ብናኝ መለካት፣ የመተንፈሻ አካላት ችግር ምልክቶች ዳሰሳ ማድረግ፣ የሳንባን ሁኔታን መለካት ና የመተንፈሻ አካላት ችግር መንስኤዎቻቸውን ማረጋገጥ መሆኑን ተረድቻለሁ፡፡ ከዚህም በተጨማሪ ከኔ የሚወሰደው መረጃ በእኔ ላይ ምንም ዓይነት ጉዳት የማያስከትልና መረጃውን ለጥናት ዓላማ ብቻ እንደሚውል ተረድቻለሁ፡፡

ማንኛውም እኔን የተመለከተ መረጃ ሚስጥራዊነቱ የተጠበቀ ነው፡፡ እንደዚሁም በጥናቱ ለመሳተፍ ፍቃደኛ ካልሆንኩ በጥናቱም ለመሳተፍ እንደማልገደድ ነገር ግን በዚህ ጥናት መሳተፌ ለሳይንሳዊ ዕውቀት ጠቃሚ መረጃ የማበርከትና ወደፊት በዚህ ዙሪያ ለሚሰሩ ስራዎች መሰረት የሚሆኑ ግብዓት መስጠት እንደምችል ተረድቻለሁ፡፡ በመሆኑም በዚህ ጥናት ላይ ለመሳተፍ የተስማማሁ መሆኑን በፊርማዬ አረጋግጣለሁ፡፡

የተሳታፊው ፊርማ _____ ቀን _____

የመረጃ ሰብሳቢው ስምና ፊርማ _____ ቀን _____

Annex IX. Amharic Version Questionnaire

አዲስ አበባ ዩኒቨርሲቲ፣ ጤና ሳይንስ ኮሌጅ፣ የሕብረተሰብ ጤና ትምህርት ክፍል ለጥናቱ ተሳታፊዎች የመረጃ መስጫ

በ 2011 ዓ/ም በኢትዮጵያ ፋብሪካዎች ውስጥ በሚገኙ ሰራተኞች ሊይ የሚታየውን የአቧራ/ብናኝ መጠንና የመተንፈሻ አካል በሽታዎችን ለመወሰን የተዘጋጀ መጠይቅ፡፡

ቃለ-መጠይቅ የተደረገበት ቀን _____

የመጠየቁ ኮድ _____ የሚሰሩበት የስራ ክፍል-----

የፋብሪካው ስም 1. የኢትዮጵያ የፐላስቲክ ወረቀት ፋብሪካ 2. የቡራዩ ወረቀትና ፕሪንቲንግ ፋብሪካ 3. የቶፕ ቢቨረጅስ ኢንዱስትሪስ ኤንድ ተሬዲንግ

እባክዎ መልስዎን ከትክክለኛው አማራጭ ሊይ ሙሉ በሙሉ በሰማያዊ እስክርቢቶ በማክበብ ይመልሱ፡፡ መልስዎ በቁጥር ከሆነ እባክዎ ትክክለኛ ቁጥር በተሰጠው ከፊት ቦታ ያስቀምጡ ለምሳሌ ዕድሜ በዓመት፡፡

ተ/ቁ	መጠይቅ	መልስ	ማሳሰቢያ
ክፍል አንድ፡ ማህበራዊና ዱሞግራፊያዊ መስፈርት			
100	ፆታ፡	1. ወንድ 2. ሴት	
101	ዕድሜ	_____ ዓመት	
102	የጋብቻ ሁኔታ	1. ያላገባ/ች 2. ያገባ/ች 3. ተለያይተው የሚኖሩ 4. የፈታ/ች 5. የሞተችበት/ባት	
103	ሐይማኖትዎ ምንድን ነው?	1. ኦርቶዶክስ 2. ሙስሊም 3. ፕሮቴስታንት 4. ካቶሊክ 5. ሌላ ካለ ይግለፁ _____	
104	የትምህርት ደረጃ	_____ ደረጃ	
105	የወር ገቢዎት ምን	_____ ብር	

ተ/ቁ	መጠይቅ	መልስ		ማሳሰቢያ
	ያህል ነው?			
106	በዚህ ስራ ላይ ምን ያህል ግዜ ሰሩ?	_____ ዓመት _____ ወር		
107	በአማካይ በቀን ለምን ያህል ሰዓት ይሰራሉ?	_____ ሰዓት		
108	በአማካይ በሳምንት ለምን ያህል ቀን ይሰራሉ?	_____ ቀን		
109	አሁን የሚሰሩበት በየተኛው የሥራ ክፍል ለምን ያክል ጊዜ ሰሩ?	የሥራ ክፍል	ለምን ያክል ጊዜ	
		1. _____ 2. _____		
110	ከአሁን በፊት እዚህ ፈብሪካ ሊይ በሌላ የስራ ክፍል ሰርተው ያውቃሉ?	1. አዎ 2. አይደለም		
111	ለጥያቄ ቁጥር 110 አዎ ከሆነ መልስዎ በየተኛው የሥራ ክፍል ለምን ያክል ጊዜ ሰሩ?	የሥራ ክፍል	ለምን ያክል ጊዜ	
		1. _____ 2. _____		
ክፍል ሁለት፡ ከስራው ጋር የተያያዘ የቀድሞ ታሪክ				
200	ከዚህ በፊት ከወረቀት ፋብሪካ ዉጪ አቧራማ በሆነበታ ላይ ሰርተዋል?	1. አዎ 2. አይደለም		መልስዎ አይደለም ከሆነ ወደ ጥያቄ ቁጥር 202 ይለፉ
201	ለጥያቄ ቁጥር 200 መልስዎ አዎ ከሆነ፣ ለምን ያህል ጊዜ ከዚህ በታች ሰርተዋል (በዓመት) (ከአንድ በላይ መልስ ይቻላል)	1. ብረታ ብረት 2. ድንጋይ መፍጫ 3. ህንፃ ግንባታ 4. ዱቄት ፋብሪካ 5. መንገድ ጥርጊያ/ ፅዳት 6. ሌላ ካለ የጥቀሱ		
	ከመኖሪያ ቤትዎ ዉስጥ	1. አዎ 2. አይደለም		

ተ/ቁ	መጠይቅ	መልስ	ማሳሰያ
202	ምግብ በራስዎ ወይም በላሊ ሰው ያበስላሉ?		
203	ለጥያቄ ቁጥር 202 መልስዎ አዎ ከሆነ በአብዛኛው ምግብ ለማብሰልምን ዓይነት ሀይል ይጠቀማሉ? (ከአንድ በላይ መልስ ይቻላል)	1.ከሰሌ 2. እንጨት 3. ጋዝ 4. ኤላክትሪክ 5. LPG (ስሊንደር) 6. ሌላ ካለ ይጥቀሱ	
ክፍል ሦስት፡ የቀድሞ ታሪክ የመተንፈሻ አካላት ህመም በተመለከተ			
204	በቀድሞ ሂወትዎ በሃኪም የተነገሩት የቆየ የሳንባ ችግር ታመው ያውቃሉ?	1. አዎ 2. አይደለም	መልስዎ አይደለም ከሆነ ወደ ጥያቄ 300 ይለፉ
205	መሌስዎ አዎ ከሆነ የትኛው ዓይነት የጤና ችግር ከዚህ በፊት ገጥሞዎት ነበር (ከአንድ በላይ መልስ ይቻላል)	1.የቆየ የጉሮሮ ቁስለት (የቆየ ብሮንካይትስ) 2.መተንፈስ የሚያውክ የሳንባ በሽታ 3.አስም 4.ሳንባ ካንሰር/ቲቢ 5.ሌላለ አይነት ካለ ይትቀሱ----- -----	
ክፍል አራት፡ ሲጋራ የማጨስ ባህሪ			
300	ሲጋራ አጭሰው ያውቃሉ? (የለም ማለት እስካሁን ድረስ ከ 20 ፓኮ በታች ማጨስ ወይም በቀን ከአንድ ሲጋራ በታች ለአንድ አመት ማጨስ)	1. አዎ 2. አይደለም	አይደለም ከሆነ ወደቁ.304 ይለፉ

ተ/ቁ	መጠይቅ	መልስ	ማሳሰቢያ
301	መልስዎ አዎ ከሆነ አሁን ሲጋራ ያጨሳሉ (ባለፈው አንድ ወር ውስጥ)?	1. አዎ 2. አይደለም	
302	አሁን በአማካይ በቀን ምን ያህል ሲጋራ ያጨሳሉ?	_____ ሲጋራ በቀን	
303	ምን ያህል አመታት ሲጋራ አጨሰ (በአመት)?	_____ አመት	
304	በቤትዎ ውስጥ ሲጋራ የሚያጨስ ሰው አለ ወይ?	1. አዎ 2. አይደለም	
ክፍል አምስት፡ የመተንፈሻ አካላት ችግር ሀ. ሳል ሳል፡ በአንድ አመት ውስጥ ለሶስት ወር ያህል በቀን ከ4-6 ጊዜ፣ በሳምንት 4 ቀንና ከዛ በላይ ወይም አብዛኛውን ጊዜ ጠዋት ከእንቅልፍዎ ሲነሱ ወይም በተቀሩት የቀን ወይም የለሊት ሰዓት ሳል ካልዎት/ካላሉት			
400	አብዛኛውን ጊዜ በጠዋት ያስልዎታል?	1. አዎ 2. አይደለም	ወደ ጥ.ቁ. 403
401	አብዛኛውን ጊዜ ከ 4 እስከ 6 ጊዜ በቀን ፣ 4 ወይም ከዛ በላይ በሳምንት ሳል ያስልዎታል?	1. አዎ 2. አይደለም	
402	አብዛኛውን ጊዜ ጠዋት ከእንቅልፍዎ ሲነሱ ያስልዎታል?	1. አዎ 2. አይደለም	
403	በተቀሩት የቀን ወይም የሌሊት ሰዓት ያስልዎታል?	1. አዎ 2. አይደለም	
404	ለአንዳቸው ጥ.ቁ. (400, 401, 402 ወይም 403)	1. አዎ 2. አይደለም	አይደለም ከሆነ ወደ ቁጥር 406

ተ/ቁ	መጠይቅ	መልስ	ማሳሰቢያ
	መልስዎ ኣዎ ከሆነ የሚከተሉት ሁለት ጥያቄዎች ይመልሱ፡፡ በ 1 ዓመት ውስጥ እንደዚህ ዓይነት ሳል በአብዛኛው ቀናት ለተከታታይ 3 ወርና ከዛ በላይ አስልዎት ያውቃል?		ይለፉ
405	ሳሉ ለምን ያህሌ ጊዜ ቆይቷል?	_____ ዓመት	
ለአክታ አክታ፡ በአንድ አመት ውስጥ ለሶስት ወር ያህል በቀን ሁለቱ፣ በሳምንት 4 ቀንና ከዛ በላይ ወይም አብዛኛውን ጊዜ ጧት ከእንቅልፎ ሲነሱ ወይም አብዛኛውን ጊዜ በቀን ወይም በሌሊት አክታ የመውጣት ችግር ካልዎት			
406	አብዛኛውን ጊዜ ከደረትዎ አክታ ይወጣል?	1. አዎ 2. አይደለም	
407	አብዛኛውን ጊዜ በቀን ወይም በሌሊት አክታ አሎዎት?	1. አዎ 2. አይደለም	
408	አብዛኛውን ጊዜ እንደዚህ አይነት አክታ በቀን 2 ጊዜ ወይም በሳምንት 4 ወይም ከዛ በላይ ይወጣል?	1. አዎ 2. አይደለም	
409	በአመት እንደዚህ አይነት አክታ ያለበት ሳል በአብዛኛው ቀናት ለተከታታይ ሶስት ወር ነበረብዎት?	1. አዎ 2. አይደለም	

ተ/ቁ	መጠይቅ	መልስ	ማሳሰቢያ
410	በአብዛኛው በቀን 2 ጊዜ፤4 ወይም ከዛ በላይ በሳምንት ከደረሱት አክታ ይወጣል?	1. አዎ 2. አይደለም	
411	በአብዛኛው ጊዜ ጥዋት ከእንቅልፎ ሲነሱ አክታ ይወጣል?	1. አዎ 2. አይደለም	
412	በአብዛኛው ጊዜ በእረፍት ቀን ወይም ለሊት አክታ ይወጣል?	1. አዎ 2. አይደለም	
413	ለአንዳቸው ጥ.ቁ. (410, 411 ወይም 412) መልስዎ አዎ ከሆነ በ 1 ዓመት ውስጥ እንደዚህ ዓይነት አክታ በአብዛኛው ቀናት ለተከታታይ 3 ወርና ከዛ በላይ ነበረብዎት?	1. አዎ 2. አይደለም	መልስዎ አይደለም ከሆነ ወደቁጥር 415 ይሂዱ
414	እንደዚህ አይነት አክታ የመውጣትችግር ከጀመረዎት ስንት ዓመት ሆነዎት?	_____ ዓመት	
ሐ. የማንከራፋት ድምፅ በተመለከተ የማቃተት ድምፅ: በአንድ አመት ውስጥ ለሶስት ወር ያህል ወደ ውስጥ ወይም ወደ ውጭ ሲተነፍሱ ወይም ሲቀዘቅዝዎት ወይም አልፍ አልፎ ከቅዝቃዜ ሲወጡ ወይም አብዛኛው ቀን ወይም ሌሊት ደረሱት የማንከራፋት ወይም የማፋጨት ድምፅ ደረሱት ሊይ የማንከራፋት ወይም የማፋጨት ድምፅ ካልዎት			
415	ከደረሱት የማንከራፋት ወይም የማፋጨት ድምፅ ይሰማል?	1. አዎ 2. አይደለም	መልስዎ አይደለም ከሆነ ወደ ቁጥር 418 ይሂዱ

ተ/ቁ	መጠይቅ	መልስ	ማሳሰቢያ
416	መቼ ነው ከደረሱት የማንከራፋት ወይም የማፋጨት ድምፅ የሚሰማው?	1. ጥዋት 2. ቀን 3. ማታ	
417	ይሄን የማንከራፋት ድምፅ ማሰማት ከጀመረዎት ምን ያህል ጊዜ ሆነዎት?	_____ ዓመት	
418	የአፍንጫ መቆጣት ችግር አለዎት?	1. አዎ 2. አይደለም	አይደለም ከሆነ ወደ ቁ. 420 ይሂዱ
419	መልስዎ አዎ ከሆነ ይሄን የአፍንጫ መቆጣት ከጀመረዎት ምን ያህል ጊዜ ሆነዎት?	_____ ዓመት	
420	ይሄን ስራ ከጀመሩ የማስነጠስ ችግር ይታይባታል	1. አዎ 2. አይደለም	አይደለም ከሆነ ወደ ቁ. 420 ይሂዱ
421	መልስዎ አዎ ከሆነ, ይሄን አይነት ማስነጠስ ከጀመረዎት ምን ያህል ጊዜ ሆነዎት?	_____ ዓመት	
የትንፋሽ ማጠር ወይም መቆራረጥ መ. የትንፋሽ ማጠር፡ በአንድ አመት ውስጥ ለሶስት ወር ያህል በፍጥነት ሲራመዱ ወይም ኮረብታ ሲወጡ የትንፋሽ መቆራረጥ ችግር ካለዎት			
422	በፍጥነት ሲራመዱ ወይም ኮረብታ ሲወጡ የትንፋሽ ማጠር ችግር አጋጥመዎት ያውቃል?	1. አዎ 2. አይደለም	ጥ.ቁ. 428

ተ/ቁ	መጠይቅ	መልስ	ማሳሰቢያ
423	ከትንፈሽ ማጠር ምክንያት ከእኩዮችዎ ባነሰ ፍጥነት የመራመድ ችግር አጋጥመዎት ያውቃል?	1. አዎ 2. አይደለም	
424	በራስዎ ፍጥነት ሜዳ ላይ ሲራመዱ የትንፋሽ መቋረጥ ችግር አጋጥመዎት ያውቃል?	1. አዎ 2. አይደለም	
425	ለ100 ያርድ ወይም 96 ሜ ያህል ሜዳ ላይ ከተራመዱ በኋላ የትንፈሽ መቋረጥ ችግር አጋጥመዎት ያውቃል?	1. አዎ 2. አይደለም	
426	ከቤት ሲወጡ ፣ ልብስ ሲለብሱ ወይም ስያወልቁ ከፍተኛ የትንፋሽ መቋረጥ ችግር አጋጥመዎት ያውቃል?	1. አዎ 2. አይደለም	
427	እንደዚህ አይነት የትንፈሽ መቋረጥ ችግር ከጀመረዎት ስንት ዓመት ሆነዎት?	_____ ዓመት	
ሠ. የደረት ህመም			
428	ባለፉት ሦስት አመታት በደረት ህመም ምክንያት ስራ ቀርተዉ(ተኝተዉ) ያዉቃል?	1. አዎ 2. አይደለም	መልስዎ አይደለም ከሆነ ወደ ጥያቄ 500 ይለፉ
429	በአብዛኛዉ ለቅዝቀዜ በሚጋለጡበት ጊዜ የደረት	1. አዎ 2. አይደለም	

ተ/ቁ	መጠይቅ	መልስ	ማሳሰቢያ
	ህመም ይሰማዎታል?		
430	የደረት ህመሙ አክታኑሮት ያወቃል?	1. አዎ 2. አይደለም	
ክፍል ስድስት፡ የሰራተኞች ባህሪ በተመለከተ (ለመተንፈሻ አካል መከላከያ መሳሪያ አጠቃቀም በተመለከተ)			
500	በስራ ላይ በሚሆኑበት ወቅት የብናኝ መከላከያ ይጠቀማሉ?	1. አዎ 2. አይደለም	መልስዎ አይደለም ከሆነ ወደ ጥያቄ 502ይሉ
501	አዎ ከሆነ ከሚከተለት ውስጥ የትኛውን መከላከያ ይጠቀማሉ? (ከአንድ በላይ መልስ ይችላሉ)	1.የአፍ/አፍንጫ መሸፈኛ 2.ጭምብል (የፊት መሸፈኛ) 3.የአየር ማጣሪ መሳሪያ 4.ሌላ ካለ ይጥቀሱ_____	
502	ለጥያቄ ቁጥር 500 መልስዎ አይደለም ከሆነ፤ የብናኝ መከላከያ ሌብስ የማይለብሱበት ምክንያቱ ምንድን ነው?	1.ጭራሽ ስለሌለ 2.ለመልበስ ስመማይመች 3.በመስሪያ ቤቱ ስለማይቀረብ 4. ብናኝ ስለሌለ 5.ሌላ ካለ ይጥቀሱ_____	
503	የስራ ደህንነትና ጤና ስሌጠና ወስደው ያውቃሉ?	1. አዎ 2. አይደለም	
504	በስራ ደህንነት ጤና ጉዳዮች ላይ ክትትልና ድጋፍ ተደርጎሎት ያውቃል?	1. አዎ 2. አይደለም	

የመረጃ ሰብሳቢዉ ባለሙያ ስም _____

Annex X Curriculum Vitae (CV)

1. Personal Background

Full name: Bereket Meskele Negash

Sex: Male

Date of birth: 22 July 1986

Place of birth: Oromia Regional State, Bale Zone, Agarfa Town

Nationality: Ethiopian

Marital Status: Married

Email: bereketmeskele27@gmail.com

Cell phone: +251913061298

2. Educational Background

Sep 2018- up to now: Attending MPH (Environmental and Occupational Health) in Addis Ababa University, Ethiopia

Level of Education	Place	Academic Year
Primary School	Agarfa Primary School	1993-2001
Secondary School	Agarfa Secondary School	2001-2003
Preparatory School	Agarfa Preparatory School	2003-2005
Higher Education	Gondar College of Medical Sciences	2005-2008
	Addis Ababa University	2018-present

3. Educational Qualification

BSc in Environmental Health Science Gondar University in 2008

4. Professional Registration

Registered as Senior Expert Environmental Health Professional

5. Work Experience

Year	Organization	Position
April 08, 2018 to October 2018	Addis Ababa City Administration, Health Bureau	Sanitation and Hygiene Promotion Officer
June 08, 2015 to April 7, 2018	Addis Ababa City Administration, Health Bureau	Reform and Good Governance Coordinator
February 25, 2014 to June 07, 2015	Addis Ababa City Administration, Bole Sub City Administration, Wereda 06 Administration Capacity Building Office	Head of the Office

Year	Organization	Position
February 06, 2015 to February 24, 2009	Addis Ababa City Administration, Bole Sub City Administration, Wereda 06 Administration Capacity Building Office	Head of the Office
October 08, 2008 to February 05, 2010	Amhara Regional State, Oromia Zone Administration, Bora Wereda Administration Health Office	Environmental Health Inspector

6. language Skill

Language	Speaking	Writing	Listening	Reading
Amharic	Excellent	Excellent	Excellent	Excellent
Oromic	V. Good	V. Good	V. Good	V. Good
English	V. Good	V. Good	Excellent	Excellent

7. Additional Skills

Computer program Skill, MS-Word, MS-Excel, MS-power point, SPSS software application, Epi-Info software application.

8. References

Abas Hassen (MPH, B.Sc.) Ministry of Health Clinical Directorate Director

Cell phone: +251910342855, E-mail: abashassen55@gmail.com

Declaration

I, the undersigned, declared that this my original work has never been presented for degree in this or other university and that all sources of materials used for this thesis has been fully acknowledged.

Name: **Bereket meskele**

Signature _____

Place: Addis Ababa University

Date of submission_____

This thesis has been submitted for examination with my approval as university advisor.

Name: **Samson Wakuma (MPH, MSC, PhD)**

Signature _____