# RESPIRATORY SYMPTOMS AND PEAK EXPIRATORY FLOW RATE AMONG MALE WORKERS IN AUTOMOBILE SPRAY PAINTING SMALL SCALE INDUSTRIES IN DAR ES SALAAM

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**Masters of Public Health Dissertation**
**Muhimbili University of Health and Allied Sciences**
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# RESPIRATORY SYMPTOMS AND PEAK EXPIRATORY FLOW RATE AMONG MALE WORKERS IN AUTOMOBILE SPRAY PAINTING SMALL SCALE INDUSTRIES IN DAR ES SALAAM.

**By**

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**A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Public Health of the Muhimbili University of Health and Allied Sciences**

**Muhimbili University of Health and Allied Sciences**
**October, 2014**

## CERTIFICATION

The undersigned certifies that he has read and hereby recommended for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled; **Respiratory Symptoms and peak expiratory flow rate among male workers in Automobile spray painting small scale Industries in Dar Es Salaam,** in a fulfillment of the requirements for the Degree of Master of Public Health of the Muhimbili University of Health and Allied Sciences.

_____

**LMB Rongo, PhD**

Supervisor

_____

**Date**

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

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## DEDICATION

*I dedicate this dissertation to my father the late Mr. Sali m Abdul Sekibo and my mother Mrs. Maajab Sekibo*

## ABSTRACT

**Background:** Workers in Small scale industries in Tanzania are exposed to many hazard such as noise, heat and others including isocyanates from spray paints and specific agents here in. Studies conducted in the area had shown that workers exposed to spray paints have an increased risk of developing occupational asthma, lung function deficit, respiratory symptoms and reduced respiration capacity.

**Method:** A descriptive cross-sectional, comparative study design was conducted using workers in Automobile Spray Paint Industry as exposed group and office workers as control group in all the three districts of Dar es Salaam. The study involved 440 subjects divided equally from both groups sampled by multistage sampling technique. Pre-testing was conducted and data collection was done using a questionnaire and peak flow meter.

**Results:** Respiratory symptoms were found to be more prevalent in automobile spray painters than office workers. Among automobile spray painters, Cough 30.9% (n=68) and Wheezing 30.8% (n=67) were found to be most prevalent respiratory symptoms. The odds ratio (95% Confidence interval) of the spray painters to experience respiratory symptoms compared to Office workers was 8 (3.8 to16.5) for Shortness of breath (SoB), 14.5 (6 to 31.7) for Wheezing, 3.8 (1.7 to 8.6) for Cough, 5.1 (2.7 to 9.8) for Phlegm and 3.1 (1.4 to 6.3) for Cough with Phlegm. The mean peak expiratory flow rate value for painters was less 381.6 L/min ± 88.3 compared to office workers, 470.03 L/min ± 72.4 and the observed difference in mean was statistically significant ($p<0.01$). The use of relevant Personal Protective Equipment (PPE) was found to be very low 25.3 % among the Automobile Spray Painters.

**Conclusion:** There was high prevalence of respiratory symptoms among automobile spray painters in comparison to the Office workers. Peak expiratory flow rate values were significantly lower in painters as compared to office workers. Despite the fact that half of painters reported using protective gears at workplace, the equipments used were inappropriate in protecting respiratory airways. Appropriate and all time use of protective equipment at work is recommended to the automobile spray painters to prevent respiratory illnesses.

# TABLE OF CONTENTS

CERTIFICATION ..... ii

DECLARATION AND COPYRIGHT ..... iii

ACKNOWLEDGEMENT ..... iv

DEDICATION ..... v

TABLE OF CONTENTS ..... vii

LIST OF TABLES ..... x

LIST OF FIGURES ..... x

LIST OF ABBREVIATIONS ..... xi

DEFINITIONS ..... xii

CHAPTER ONE ..... 1

1.0 INTRODUCTION ..... 1

1.1 Background ..... 1

1.2 Statement of the problem ..... 5

1.3 Conceptual Framework ..... 6

1.4 Research Questions ..... 7

1.5 Objectives ..... 7

1.5.1 Main objective ..... 7

1.5.2 Specific Objectives ..... 7

1.6 Significance of the study ..... 8

CHAPTER TWO ..... 9

2.0 LITERATURE REVIEW ..... 9

2.1 Global situation of respiratory symptoms in automobile Spray Painters ..... 9

2.2 African region situation of exposure to occupational hazards and safety problems among automobile small scale industry spray painters ..... 10
2.3 Tanzania situation of exposure among automobile small scale industry spray painters 10
2.4 Prevalence of respiratory symptoms ..... 11
2.5 Respiratory symptoms ..... 12
2.6 Utilization of PPE ..... 12
CHAPTER THREE ..... 13
3.0 METHODOLOGY ..... 13
3.1 Study design ..... 13
3.2 Study area ..... 13
3.3 Study Population ..... 14
3.4 Study sample size ..... 14
3.5 Inclusion and Exclusion criteria ..... 15
3.5.1 Inclusion Criteria ..... 15
3.5.2 Exclusion Criteria ..... 15
3.6 Sampling Procedures. ..... 15
3.7 Research Assistants recruitment and training ..... 16
3.8 Pre-testing ..... 16
3.9 Data Collection ..... 16
3.10 Measurement of peak flow rate ..... 17
3.11 Investigation toots's validity and reliability issues ..... 17
3.12 Data Analysis and Presentation ..... 17
3.13 Ethical issues ..... 18
3.14 Study limitations and mitigations ..... 18

CHAPTER FOUR……..19

4.0 RESULTS ..... 19

4.1 Socio-demographic characteristics ..... 19

4.2 Severity of respiratory symptoms ..... 21

4.3 Differences in prevalence of Respiratory symptoms among small scale industry spray Painters and Office workers ..... 24

4.4 Peak expiratory flow rate among the Automobile spray Painters and Office workers .. 27

4.5 Use of PPE among the Automobile Spray painters ..... 28

CHAPTER FIVE ..... 29

5.0 DISCUSSION ..... 29

5.1 Small scale industrial workers (SSIW) setting of spray painters ..... 29

5.2 Prevalence of respiratory symptoms among Automobile small scale industry spray painters ..... 29

5.3 Differences in prevalence of Respiratory symptoms among the automobile spray Painters and Office workers ..... 30

5.4 Utilization of Personal Protective Equipment (PPE) ..... 32

5.5 Results from Peak expiratory flow rate ..... 32

CHAPTER SIX ..... 34

6.0 Conclusion ..... 34

6.1 Recommendations ..... 34

REFERENCE ..... 35

APPENDICES ..... 40

Appendix I: Questionnaire – English Version ..... 40

Appendix II: Questionnaire – Swahili Version ..... 46

Appendix III: Informed Consent – English Version ..... 53

Appendix IV: Informed Consent – Swahili Version ..... 55

## LIST OF TABLES

**Table 1:** Socio-demographic characteristics of the study population (n=440)……20

**Table 2:** Prevalence of Respiratory Symptoms among Automobile painters (n=220)…23

**Table 3:** Duration of Coughing and Phlegm among painters……...…23

**Table 4:** Periods of Cough and Phlegm……24

**Table 5:** Prevalence of Respiratory Diseases (n=220)……25

**Table 6:** Differences in prevalence of Respiratory Symptoms among painters and office workers……26

**Table 7:** Logistic regression on Respiratory Symptoms among painters adjusted to age and previous history of smoking……27

**Table 8:** Difference in Peak expiratory flow meter values among painters and office workers.....28

**Table 9:** The use of protective gears among painters (n=220)……29

## LIST OF FIGURES

**Figure 1:** Bar graph showing severity in shortness of breath among painters……...21

**Figure 2:** Bar graph showing severity in wheezing among painters……...……..22

**LIST OF ABBREVIATIONS**

| | |
|---|---|
| BMRC | British Medical Research Council |
| CARB | California Air Resource Board |
| CDC | Center for disease control |
| CFC's | Chloro Fluoro carbons |
| HDI | Hexamethylene di-isocyanate |
| MDI | Methane di-isocyanate |
| MPH | Master of public health |
| MUHAS | Muhimbili university of health and allied sciences |
| PEF | Peak expiratory flow |
| PEFR | Peak expiratory flow rate |
| PPE | Personal Protective Equipment |
| PPI | Polymethylene polyphenylisocyanate |
| PU | Polyurethane |
| SoB | Shortness of breath |
| SSI | Small Scale Industries |
| SSIW | Small scale industrial workers |
| TDI | Toluene di-isocyanate |
| USAID | United states agency for international development |
| VOC | Volatile organic compound |

## DEFINITIONS

**Dyspnea:** An abnormal condition in a person's respiratory system causing difficulty in breathing,

**Tachypnea:** An abnormal condition in a person's respiratory system causing rapid breathing

**Hypopnea:** An abnormal condition in a person's respiratory system causing shallow breathing

**Hyperpnea:** An abnormal condition in a person's respiratory system causing deep breathing

**Apnea:** An abnormal condition in a person's respiratory system causing absence of breathing

**Emphysema:** Inflammatory response in the lungs resulting in narrowing of the small airways and breakdown of lung tissue

**Bronchitis:** Is an inflammation of the mucous membranes of the bronchi (the larger and medium-sized airways that carry airflow from the trachea into the more distal parts of the lung

**Tachycardia:** Is a heart rate that exceeds the normal range.

**Hypotension:** Is low blood pressure, especially in the arteries of the systemic circulation

**Spray painting:** Is fluid coating technique where a device (Gun or Can) sprays a coating material (paint, ink, varnish, etc.) through the air onto a surface.

# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1 Background

Respiratory symptoms are the common indications of lung or heart conditions. Common medical terms for respiratory symptoms include dyspnea (difficulty breathing), tachypnea (rapid breathing), hypopnea (shallow breathing), hyperpnea (deep breathing), and apnea (absence of breathing). Breathing problems may occur in conditions affecting the lungs alone or may be seen in association with more generalized conditions, such as dehydration or infections (Pronk et al., 2007).

Common causes of respiratory symptoms are chronic obstructive pulmonary disease (COPD, including emphysema and chronic bronchitis) and asthma. Other common causes include infections, such as pneumonia or acute bronchitis. Inflammation may also cause respiratory symptoms, as seen in pleuritis or chronic bronchitis. Depending on the cause, respiratory symptoms may originate from one or both lungs and may be accompanied by rapid heart rate (tachycardia), low blood pressure (hypotension), or other cardiovascular signs and symptoms (Sari-Minodier et al., 1999).

Respiratory diseases may occur if workers are exposed at a relatively higher exposure periods resulting in pathological conditions affecting the organs and tissues that make gas exchange possible in higher organisms, and includes conditions of the upper respiratory tract, trachea, bronchi, bronchioles, alveoli, pleura and pleural cavity, and the nerves and muscles of breathing. Respiratory diseases range from mild and self-limiting, such as the common cold, to life-threatening diseases like bacterial pneumonia, pulmonary embolism, and lung cancer (Kogevinas et al., 2007).

In spray painting, the most common types employ compressed gas usually air to atomize and direct the paint particles. The technique may use single color aerosol paint cans which are

portable and easy to store or spray guns which can be either automated or hand-held and have interchangeable heads to allow for different spray patterns.

The chemicals found in spray paint depend on the particular product. Generally they include ingredients such as solvents for dissolving the chemicals, adhesives to aid in the coat attachment to surfaces and propellants required to move the paint out of container and even spray. Common isocyanates chemicals found in spray paint include Strontium Zinc Phosphosilicate, Acrylic Copolymer and Acrylic Polyurethane, the active agents of isocyanates type found in spray paint which are essential in coatings to create weather-resistant surfaces are known to be associated with adverse problems such as irritation to the eyes, skin, and respiratory system. Short-term exposure can cause dermatitis and irritation or burns to the eyes, nose, and throat. Even a small amount of isocyanates can produce significant health effects, such as asthma (Sari-Minodier et.al., 1999).

In Tanzania paints used are made locally or imported but most paints contain an active agent acrylic component which has excellent retention and sustain the tropical climate; other active agent found are HB Epoxy primer, styrene, Polymethyl acrylate and Polymethyl methacrylate

Apart from respiratory symptoms and diseases from isocyanate containing spray paint another indication for respiratory system problems is lower capacity of lungs functioning from measures of peak expiratory flow (PEF), also called peak expiratory flow rate (PEFR); This is a person's maximum speed of expiration.; it is measured with devices such as peak flow meter, a small, hand-held device used to monitor a person's ability to breathe out air. It measures the airflow through the bronchi and thus the degree of obstruction in the airways. Peak flow readings are higher when patients are well and lower when the airways are constricted (Miller 2004). From changes in recorded values, patients and doctors may determine lung function, severity of asthma symptoms, and treatment options (Randolph et al., 1997).

Since its birth in the 1950s, the spray paint industry has enjoyed considerable success but has also met with many challenges. For instance in the late 1970s, legislators in the USA banned paints from using CFC propellants due to the role these solvents are thought to play in

atmospheric ozone depletion. In the late 1990s, the (CARB) began imposing limits on the amount of VOCs that can be used in spray paint which were associated with respiratory problems. VOCs have been shown to contribute to air pollution as well. These regulatory mandates have dramatically affected the quality of spray paint formulations. In spite of these challenges, spray paints continue to be popular consumer commodities. In 1997 nearly 25 million gal of spray paint where produced in the United States alone (Kogevinas et al., 2007).

There has been a sharp rise in the utilization of spray paint both in the developed and least developed worlds for instance by 1973, USA Big Spray Company was producing 270 million cans annually in the U.S.in 2013 Last year, U.S. spray-paint manufacturers produced 412 million cans. Expansion of spray paint use Isocyanates, low-molecular-weight compounds characterized by highly reactive NCO groups, is one of the most commonly identified causes of occupational asthma. Besides allergic asthma, isocyanates exposure may also induce irritant asthma, hypersensitivity pneumonitis, and possibly accelerated lung function decline. Di-isocyanates are used as cross-linking agents in PU products, such as foams, paints, lacquers, inks, insulating materials, varnishes, rubber modifiers, and bonding and vulcanizing agents. The PU industry continues to increase, together with the number of workers at risk for exposure. (TDI), (MDI), and (HDI) are the most frequently used di-isocyanate monomers (Kogevinas et al 1997; Pronk et al., 2007).

In Tanzania spray painting is practiced extensively both in the large scale industries in the formal sector as well as small scale industries in the informal sector .The term informal sector is defined broadly to refer to very small-scale private units employing less than 10 people and involved in the production of goods and services for sale in both rural and urban areas. Workers in SSI are exposed to many hazards such as noise, heat and others including isocyanates from paints and specific agents here in. Studies have shown that Workers exposed to spray paints have an increased risk of developing occupational asthma, lung function deficits, and respiratory symptoms. Respiratory symptoms and lung function changes have been associated with a variety of chemicals found in the spray paint (Rongo et al., 2004).

The characteristics of these SSWIs are different from those found in large-scale industries in developed countries. Most of the industries are located alongside the roads. No exposure control equipment, such as exhaust ventilations as the work area is an open space. Most tasks are done manually from pealing-off of old paint, scratching, smoothing and painting. Normally each experienced painter has 2 or 3 painters under him and 1 or 2 students who are trained in the job by doing the actual tasks.

Data from respiratory studies in Tanzania shows that prevalence of non communicable diseases including chronic and acute respiratory diseases in Tanzania are among the highest in the sub Saharan region; this could be a result of contributions from illnesses resulting from occupations with remarkably high exposure. Two studies have reported prevalence of asthma in Tanzania to range from 2% to 5% (Mugusi et al., 2004; Mayige et al., 2012).

Despite the fact that the small scale industries have been operating and recognized by the government as a significant contributor to national economy for quite a long period and the pace of growth is remarkably high employing a big number of population including women and youth; workers in the industry have been found to possess poor knowledge and awareness on workplace hazard prevention, little effort have been put to ensure the workers in the industry are protected from all forms of hazards including isocyanates exposure and poor supervision and inspection is conducted by private and national agencies (Mamuya et al 2007). This situation poses a big challenge in achieving national and universal targets of Occupational health and safety.

Recognizing high prevalence of respiratory diseases and considering the poor occupational health and safety standards in the informal sector in Tanzania there is an urgent need to study the extent and magnitude of respiratory problems faced by workers in the spray paint industry. These workers are highly exposed to chemicals found in paints especially isocyanates and have very poor protection or absence of protection at all. This study aims at exploring respiratory symptoms of workers in the industry in Dar-es-salaam as well as establishing the magnitude, distribution of the problem, and assessing the lung function capacity through measurements of peak expiratory flow.

## 1.2 Statement of the problem

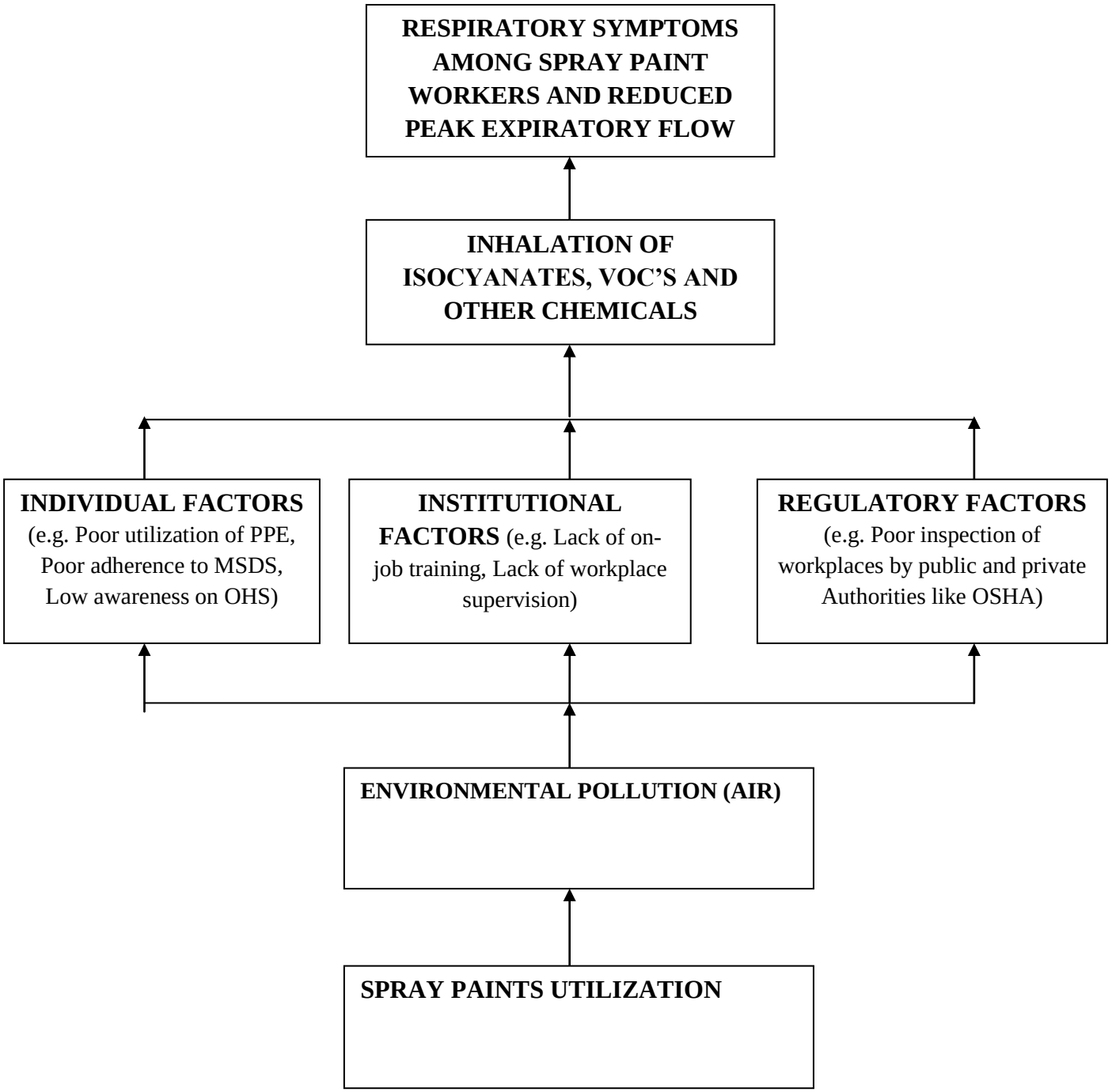
Use of isocyanates spray paints has been on increase in Africa and worldwide in general (Chan-Yeung, M 1990). The use is common in both large formal industries as well as small scale informal industries in Tanzania.

Previous studies on occupational health in Tanzania show that despite the fact that the informal industry is growing very fast with Statistics showing that the population in the small scale industry in the country has almost doubled in a period of about ten years from 2.5 million in 2002 to 5.2 million in 2013.Workers are being employed in different industries including spray paint (UNIDO, 2013). Workers in the sector do not access adequate occupational health and safety services leaving behind their work areas being inspected for industrial hygiene, safety or any type of supervision when it comes to Occupational health and safety.

Spray paint contents (solvents, adhesives and propellants) have been found to be harmful e.g toluene, xylene, acetone (Gregersen, P. et al 1987) and some have been associated with illness of respiratory system such as coughing, asthma and wheezing diseases that have contributed subsequently in increased morbidities and possibly mortalities of diseases, that are exacerbated with lowering in immunity like Tuberculoisis (Murray & Lopez 1997) Scarce and inadequate data and information on the levels and effects of exposure to isocyanates on workers from the spray paint use is observed and nevertheless the situation shows that workers in the industry are exposed to multiple hazards including fumes from isocyanates based spray paints, fumes or dusts, noise and heat.

There is a need to conduct a study that will partly ascertain the current level of respiratory symptoms among small scale industries workers in spray paint industry and assessment of the respiratory capacity and their utilization of measures of hazard protection at the workplace the information on magnitude and pattern of the problem will pave for respiratory disease, control, prevention and other interventions.

### 1.3 Conceptual Framework



## 1.4 Research Questions

1. What is the prevalence of Respiratory Symptoms among workers in Automobile Spray Painting small scale industries in Dar-es-salaam?
2. How good is the lung capacity for spray painters in Automobile Spray Painting small scale Industries in Dar-es-salaam?
3. Is the prevalence of respiratory symptoms similar between Automobile Spray painting small scale industries workers and the compared Office workers?
4. Do the spray painters in the Automobile Spray painting industry use PPE at all? If so what is the level of adherence.

## 1.5 Objectives

### 1.5.1 Main objective

To assess Respiratory Symptoms and Peak Expiratory Flow Rate among Workers in Automobile Spray Painting small scale Industries in Dar es Salaam.

### 1.5.2 Specific Objectives

1. To compare prevalence of respiratory symptoms among male workers in automobile spray painting small scale industries in Dar-es-salaam and the controls office workers.
2. To Compare PEFR of male workers in automobile spray painting small scale industry in Dar-es-salaam and the controls.
3. To compare the prevalence of respiratory symptoms presented by automobile spray painting small scale industry workers and controls Office workers?
4. To assess the utilization of PPE by automobile spray painters of small scale industries?

### 1.6 Significance of the study

This study has explored Respiratory Symptoms and (PEFR) among Workers in automobile spray painting industries in Dar-es-salaam together with assessing the difference in Respiratory symptoms presented by Automobile Spray Painting workers and office workers and the utilization of PPE by the Automobile small scale industry Spray Painters.

Findings from this study are expected to provide better understanding of the magnitude and pattern of the problem of respiratory illnesses from workers exposed to isocyanates in the spray paint industry in Tanzania.

Important information on the kind of people exposed and affected in terms of age, education and other demographic factors, conditions of work they are in and other factors such as utilization of hazard prevention and protection measures had been obtained which are critical when planning for inspection and other occupational health and safety interventions.

Results from this study adds to knowledge on the effects of spray paint use especially prevalence of respiratory symptoms considering the situation and exposure level as well as working conditions in informal small scale industries Tanzania as it is different from those in Europe, America, Asia and some other areas in Africa.

# CHAPTER TWO

## 2.0 LITERATURE REVIEW

### 2.1 Global situation of respiratory symptoms in automobile Spray Painters

Occupational asthma is the most common occupational lung disease in industrialized countries and the second most common occupational lung disease reported after pneumoconiosis in developing countries (Jeebhay, M. F et al 2007). The median proportion of adult cases of asthma attributable to occupational exposure including spray paint containing isocyanates is between 10% and 15% (Quirce, S. et al 2011). The high-risk occupations and industries associated with the development of occupational asthma vary depending on the dominant industrial sectors in a particular country. High-risk exposure to cleaning agents and pesticide exposure in developing countries appear to be as important as exposure to isocyanates in paints, cereal flour/grain dust, welding fumes, wood dust and, more recently, hairdressing chemicals, commonly reported in industrialized countries.(Jeebhay, M. F et al 2007) However, up to one third of workers with occupational asthma continue to remain exposed to the causative agent or suffer prolonged work disruption, discrimination and risk of unemployment (Kogevanis et al., 2007).

Occupational exposures to workplace hazards including spray paint account for a substantial proportion of adult asthma (Kogevinas, M et al 2007). A study conducted on 6837 participants from 13 countries who previously took part in the European Community Respiratory Health Survey (1990–95) to estimate the relative and attributable risks of new-onset asthma in relation to occupations. Work-related exposures, and inhalation accidents showed a significant excess asthma risk after exposure to substances known to cause occupational asthma such as spray paint containing isocyanates (Relative risk=1·6, 95% CI 1·1–2·3). Risks were highest for asthma defined by bronchial hyper-reactivity in addition to symptoms (2·4, 1·3–4·6, p=0·008). The population-attributable risk for adult asthma due to occupational exposures ranged from 10% to 25%, equivalent to an incidence of new-onset occupational asthma of 250–300 cases per million people per year (Kogevanis et al 2007).

## 2.2 African region situation of exposure to occupational hazards and safety problems among automobile small scale industry spray painters

In Africa, many workers in the automobile spray painting industries are at high risk of exposure to respiratory system affecting chemicals; study conducted in Mbabane city Swaziland to assess the risks among workers in the informal car maintenance, welding and Automobile Spray-painting Industry in Mbabane city in Swaziland. Results revealed that most workers in this sector were indeed at high risk of exposure to occupational health and safety problems. They worked under unfavorable conditions such as working in the open and subjected to adverse weather conditions, exposed to solvents, welding fumes and gases, strenuous work, improper postures, lifting heavy loads, exposed to spray painting aerosols and fumes and exposed to dust (Mamba 2007). (1 More reference from Africa)

Another study done in Algeria on 2007 to asses Respiratory function and bronchial responsiveness among industrial workers exposed to different classes of occupational agents had revealed the adverse effects of respiratory symptoms among workers exposed to harmful solvents. The author pointed out the importance of instituting preventive measures to avoid the adverse effects (Ould-Kadi,F et al 2007).

## 2.3 Tanzania situation of exposure among automobile small scale industry spray painters

In Tanzania, occupational exposure situation is not very different from other African countries. Extensive Occupational exposures to workplace hazard including spray paint is very common. Study conducted on 300 workers in 90 small scale industries chosen at random in Dar-es-salaam revealed that 25 different types of chemicals were being used, ranging from heavy metals to acids and solvents. Most of the workers were handling toxic chemicals without using personal protective equipment. Low level of awareness among employers and workers on health hazards related to handling of toxic chemicals and poor hygienic practices were the main factors associated with high exposure to chemicals (Rongo et al., 2005).

**2.4 Prevalence of respiratory symptoms**

Spray painting, especially those with isocyanates compounds are the main causes of Respiratory symptoms in workers. Isocyanate-exposed workers survey conducted in 1999 at USA demonstrated significantly higher prevalence rates of rhinitis and asthmatic symptoms among exposed spray painters group than non-exposed subjects. Exposed workers, primarily painters from small factories, reported significantly more wheezing (8.6% vs 3.6%), more Breathlessness with Wheezing (3.4% vs 0.6%) in the last year, and more Rhinitis (33.1% vs 19.1%) than did control workers. A trend for more Asthma (2.1% vs 0.8%; $P \leq 0.07$) was also observed. Furthermore, 16.4%, 16.2%, and 10.6% of exposed workers reported (respectively) cough, rhinitis, and chest tightness when working in contact with isocyanates (Sari-Minodier 1999).

Association of spray paint use and high prevalence of occupational asthma was also assessed in four paint shops of a large assembly plant. A study was conducted involving 51 employees who were exposed to several types of isocyanates, including Polymethylene polyphenyl isocyanates (PPI). Three employees were first referred by their physician for asthma symptoms. A questionnaire was administered to the other 48 employees. Seven of these were suspected of having work-related asthma. Airway hyper excitability to inhaled histamine was demonstrated in these ten subjects (three referred and seven screened). The diagnosis of occupational asthma was confirmed in six subjects (three referred and three screened) through specific inhalation challenges a paint system component containing PPI in the laboratory. Thus, the prevalence of occupational asthma was 11.8% in these paint shops using several types of isocyanates, including PPI. (Séguin, P. 1987)

A population-based study conducted by Kogevinas and others in 1999 on occupational asthma in different work setting in Europe and other industrialized areas showed that risk of asthma varied between occupations for asthma defined as bronchial hyper responsiveness and asthma symptoms or medication, painters (spray painters, other) were among the occupations with the highest risk of asthma (Kogevinas 1999).

## 2.5 Respiratory symptoms

Common respiratory symptom faced by the automobile spray painters is asthmatic attack. The symptoms normally appear with different prevalence in different situations and different studies had shown different data depending on the area of exposure. (Ould-Kadi,F et al 2007) Example of respiratory symptoms are cough symptoms in last 12 months, coughing up phlegm, woken regularly because of cough, asthma symptoms in last 12 months, wheezing without a cold and asthma attack. Occupational asthma symptoms improve during a holiday.

## 2.6 Utilization of PPE

An important factor that might be escalating the levels of respiratory symptoms in Africa includes low utilization of PPE. A study conducted in Mbabane Swaziland show that there is very low utilization of PPE. The workers' occupational health and safety was made worse by the fact that most of them did not have or use personal protective equipment. Ninety percent of the workers were exposed to emissions while spray painting and 10% of them were exposed to paint. All the workers that were doing spray painting were exposed to paint (95%) and solvents 5%). Although 75% of the workers, doing spray painting had some kind of personal protection provided however the usage rate was very low. Minimal use of PPE were found in that study, about 76% did not have any respiratory protective gears however, among those provided with, only 33.3% of them were using the PPE provided and 66.7% were not using them. Therefore most of the workers were at risk of breathing in welding fumes and other welding related gases. This means 92 % of workers were at risk to welding fumes and gases. 68% of the workers did not have protection for the hands, only 32% had. Those workers that had hand protection (32%) had gloves with shorter cuffs and separate sleeves (12%). Others had leather gauntlet gloves with canvas or cuffs (20%). 75% of these workers who had PPE were not using them, only 25% did (Mamba 2007).

# CHAPTER THREE

## 3.0 METHODOLOGY

### 3.1 Study design

A descriptive Cross-sectional Study design was conducted using workers in automobile spray paint industry as exposed group and office workers as controls. The study compared the occurrence of respiratory symptoms in the two groups and also measured the difference in respiratory capacity through peak expiratory flow rate measurements among the groups.

A quantitative approach was used in which a standard questionnaire designed by BMRC (MRC 1986) was used to gather information on respiratory symptoms in the previous twelve months. Little modification in the questionnaire was done to include questions on demographic characteristics, working conditions, implementation of universal precautions including Personal Protective Equipments and history of tobacco smoking. We assumed reporting on the occurrence of respiratory symptoms in the previous 12 months could minimize the possibility of recall bias.

### 3.2 Study area

This study was conducted in Dar-es-salaam. The main reason for choosing Dar-es-salaam was the abundance of industries both large scale and small scale.

Most of the garages are located on the remote areas along streets in Dar-es-salaam. Different from big industries, Small scale ones are located on the outdoor settings. Most tasks are done manually from pealing-off of old paint, scratching, smoothing and painting. Material used include, spray paints and automobiles being spayed using a can connected to an air compressor machine. No exposure control equipment, such as exhaust ventilations as the work area is an open space. Normally each experienced painter has 2 or 3 painters under him and 1 or 2 students who are trained in the job by doing the actual tasks

The magnitude of respiratory symptoms and peak expiratory flow rate of workers in spray paint small scale industries is unknown.

### 3.3 Study Population

Workers in automobile spray painting small scale industries as exposed group and office workers as a control group. The study included all workers found in the spray paint industry despite of their work category as well as office workers. All workers had been in the job for at least 1 year as the study required information of the last 12 months.

Office workers were obtained from the same localities far from spray paint garages to avoid them having exposures of the isocyanates, they included workers from the local government offices, stationeries and other small offices.

### 3.4 Study sample size

We required a sample size of 220 spray painters and 220 Office workers which was obtained using the formula below:

- $P_o$ = 0.4= Proportion of outcome in the unexposed
- $P_1$ = 0.5= Proportion of outcome in the exposed
- $q_o = 1 - P_o = 1-0.5=0.5$
- $q_1 = 1 - P_1 = 1-0.4=0.6$
- z (1-a/2) = 1.96= Value of the normal distribution corresponding to a significance level of a (1.96 for a 2 sided test at the 0.05 level)
- z(1-b) = 0.84= Value of the standard normal distribution corresponding to the desired level of power (0.84 power of 80%)
- Proportion of 0.5 was obtained by taking average of proportions of respiratory symptoms on a similar study in the group of wood workers. (Rongo et al 2002)

$$n = \frac{(P_o q_o + P_1 q_1)(z_{(1-a/2)} + z_{(1-b)})^2}{(P_1 - P_o)^2}$$

Therefore: 220 automobile spray painters (and 220 office workers)

### 3.5 Inclusion and Exclusion criteria

#### 3.5.1 Inclusion Criteria

Workers in spray paint industries for more than one year in the job.

#### 3.5.2 Exclusion Criteria

Workers in spray paint industries for more than one year in the job who refuse to participate in the study.

### 3.6 Sampling Procedures.

A multistage sampling technique was used to select study sample. A total of 220 workers in spray painting industry as well as 220 workers in office work who had worked in the areas for more than a year continuously were involved in the study. Dar-es-salaam city was selected by convenience with reasons mentioned in the study area section.

Sampling steps shall be as follows

1. list of 3 districts forming the sampling frame
2. 1 division was selected from each district
3. 1 ward was selected randomly from each division
4. 1 street was selected randomly from each ward.

   The streets visited were Gerezani for Ilala district, Sudani for Temeke and Sinza for Kinondoni

From the selected streets a sampling frame of eligible workers who had worked for more than a year was obtained from leaders of spray paint open workshops. Proportional allocation formula was applied to obtain number of workers who formed the sample from each street after random selection.

### 3.7 Research Assistants recruitment and training

Before data collection, training was conducted to 5 research assistants. Recruited research assistants were three graduates and two form four Leavers. Training focused on the data collection tool, the use of peak flow meter in measuring Peak Expiratory Flow (PEF) and awareness on the general objective as well as specific objectives.

### 3.8 Pre-testing

Data collection tools were pretested at one of the Temeke district streets in Kata ya 14 ward that was not included in the study. A total of about 40 workers (from both the spray painters and office workers) who have continuously worked for one past year were involved in the pilot test. The purpose of the pre-test was to verify whether the tool would collect the desired information as well as assuring the consistency of questions. Necessary modifications were made before data collection.

### 3.9 Data Collection

Measurement of respiratory symptoms

We interviewed study subjects using a structured questionnaire. Supervision was conducted every day to ensure completeness and accuracy. Questions were asked in Kiswahili using the translated questionnaire. To avoid distortion the English questionnaire was translated to Swahili then back to English by a medical doctor conversant in both English and Kiswahili whereby no significant difference was observed. The questionnaire had four sections asking on demographic information regarding age, gender, job category, job experience, cadre, symptoms of Respiratory diseases, Measurement of peak flow rates and use of Personal Protective Equipments.

### 3.10 Measurement of peak flow rate

Data on the peak expiratory flow rate collected through measurements by a special equipment (peak flow meter). Clement Clarke Mini-Wright Standard Peak Flow Meter, EU Scale (3103387)

The peak expiratory flow (PEF), also called peak expiratory flow rate (PEFR) is a person's maximum speed of expiration, as measured with a peak flow meter, a small, hand-held device used to monitor a person's ability to breathe out air. It measures the airflow through the bronchi and thus the degree of obstruction in the airways. A participant would stand up straight, a marker is then checked to ensure that it is on the lowest point, the participant is then instructed to inhale fully and fill the lungs, then instructed to insert a small portion of the mouth piece attached on the meter and exhale forceful once while holding the meter perpendicular to him. The procedure was performed three times and the highest recording was taken for analysis.

Measurement of PEFR requires training to correctly use a meter and the normal expected values depends on a patient's sex and age. It is classically reduced in obstructive lung disorders such as asthma.

### 3.11 Investigation toots's validity and reliability issues

The questionnaire used was a standard one designed by British Medical research Council and has been extensively used in many studies of the same kind (MRC 1986)

The peak flow meters were checked for their functionalities and calibrations were done wherever necessary.

### 3.12 Data Analysis and Presentation

After completion of data collection exercise, coding of the data from questionnaires were done and entered into SPSS for windows version 16.0 software for data analysis. Data was cleaned, checked for missing entries, outliers and unsound data. Descriptive analysis to obtain frequency distributions of all the variables was performed. In performing bi-variate analysis of

the data, Chi-square test was used to establish statistical association between dependent variable and independent variables. The *p*-values under 0.05 were considered to indicate statistical significance. A multiple logistic regression analysis was performed to explore factors relating to the occurrence of respiratory symptoms. Explanatory variables included those which were found to be significant during bi-variate analysis. Study findings are presented in text and tables.

### 3.13 Ethical issues

Ethical clearance was obtained from MUHAS research ethics committee. During implementation period, permission to conduct the research was approved by the relevant authorities (District Medical Officers) of the areas we visited. Informed consent forms were used to study subjects to perceive the information there in and sign on the form willingly. Assurance was provided on confidentiality of information that they provided. Code numbers were used instead of participants' names as a way to ensure confidentiality. All questions which were raised regarding the study or their participation were responded accordingly. Study subjects were free to proceed or terminate their participation any time in the course of the interview and measurements even when they had already agreed to participate and signed the informed consent form.

All those who were found with respiratory symptoms advise were provide for them to seek medical attention and for those with poor PEFR they were recommended to visit hospital for checkup.

### 3.14 Study limitations and mitigations

Since the region of conducting this study was purposively selected. It is difficult to generalize the findings that will be obtained for the rest of Tanzania. Information from the sample is prone to some few errors particularly when it comes from the portion of population of interest rather than the whole population. Structured prepared questions are also prone to have recall bias since the information to be requested from the study participants might have occurred more than 11 months ago.

# CHAPTER FOUR

## 4.0 RESULTS

### 4.1 Socio-demographic characteristics

The present study enrolled a total of 440 participants. Out of interviewed workers, 220 (50%) were Automobile Spray Painters and 220 (50%) were Office workers. Participants were recruited from three districts of Dar es Salaam city; Temeke 147 (33.33%), Ilala 147 (33.3%) and Kinondoni 146 (33.3%) with all participants being male. Overall, the mean age was 28.6 years (SD=11). Most (46.8%) were aged between 16 to 25 years. Among painters, about half (51.4%) were aged 16 to 25 years whereas a group of office workers, had most of its participants (42.3%) on the same age group. On marital status, half of painters reported to be married compared to office workers who had about half (50.9%) of its participants reported being single. About three quarter (74.5%) of painters had primary school education level, compared to 59.1% of office workers. Table 1 summarized the findings.

**Table 1: Socio-demographic characteristics of the study population (n=440)**

**The mean age was 28.6 years (SD=11). Most (46.8%) were aged between 16 to 25 years.**

| Character | Automobile Painters n=220 | | Office workers n=220 | | Total | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| **Age (years)** | | | | | | |
| Less than 16 | 5 | 2.3 | - | - | 5 | 2.3 |
| 16 to 25 | 113 | 51.4 | 93 | 42.3 | 206 | 46.8 |
| 26 to 35 | 58 | 26.4 | 90 | 40.9 | 148 | 33.6 |
| 36to 45 | 24 | 10.9 | 17 | 7.7 | 41 | 9.3 |
| 45 to 55 | 11 | 5 | 15 | 6.8 | 26 | 5.9 |
| More than 55 | 9 | 4.2 | 5 | 2.3 | 14 | 3.2 |
| **Marital status** | | | | | | |
| Single | 46 | 20.9 | 112 | 50.9 | 152 | 34.5 |
| Married | 110 | 50 | 79 | 35.9 | 195 | 44.3 |
| Divorced | 15 | 6.8 | 7 | 3.2 | 22 | 5 |
| Cohabiting | 49 | 22.3 | 22 | 10 | 71 | 16.1 |
| **Education level** | | | | | | |
| Primary | 164 | 74.5 | 130 | 59.1 | 294 | 66.8 |
| Secondary | 52 | 23.7 | 67 | 30.5 | 118 | 26.8 |
| Certificate | 4 | 1.8 | 14 | 6.4 | 14 | 3.2 |
| Diploma | - | - | 5 | 2.3 | 4 | 0.9 |
| Bachelor degree | - | - | 4 | 1.8 | 10 | 2.3 |

### 4.2 Severity of respiratory symptoms

Severity of SoB among painters was assessed; proportionally, 33.5% (n=19) of interviewed Automobile painters, self-reported to experience shortness of breath while walking with other people of their same age on a level ground whereas 37. 5% (n= 21) reported that they had to stop for breath while working on a level ground. About 27.3% (n=17) of interviewed Automobile Spray painters reported to experience shortness of breath after a run (Figure1).

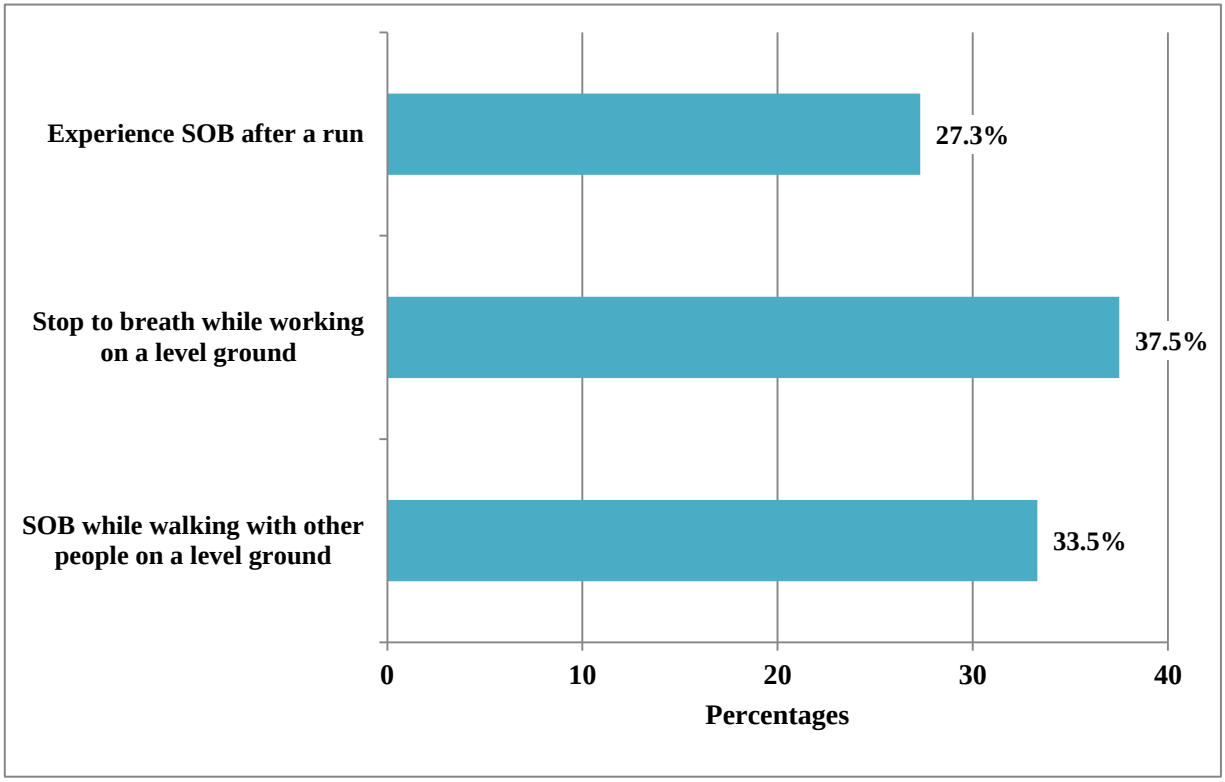



**Figure 1: Bar graph showing severity of shortness of breath among painters**

About 21% (n=46) of painters reported to experience wheezing after a run or stairs climb whereby 19.5% (n= 43) reported to experience their sleep being broken by wheezy and 17.3% (n=38) experienced Wheezing after a morning wake-up (Figure 2).

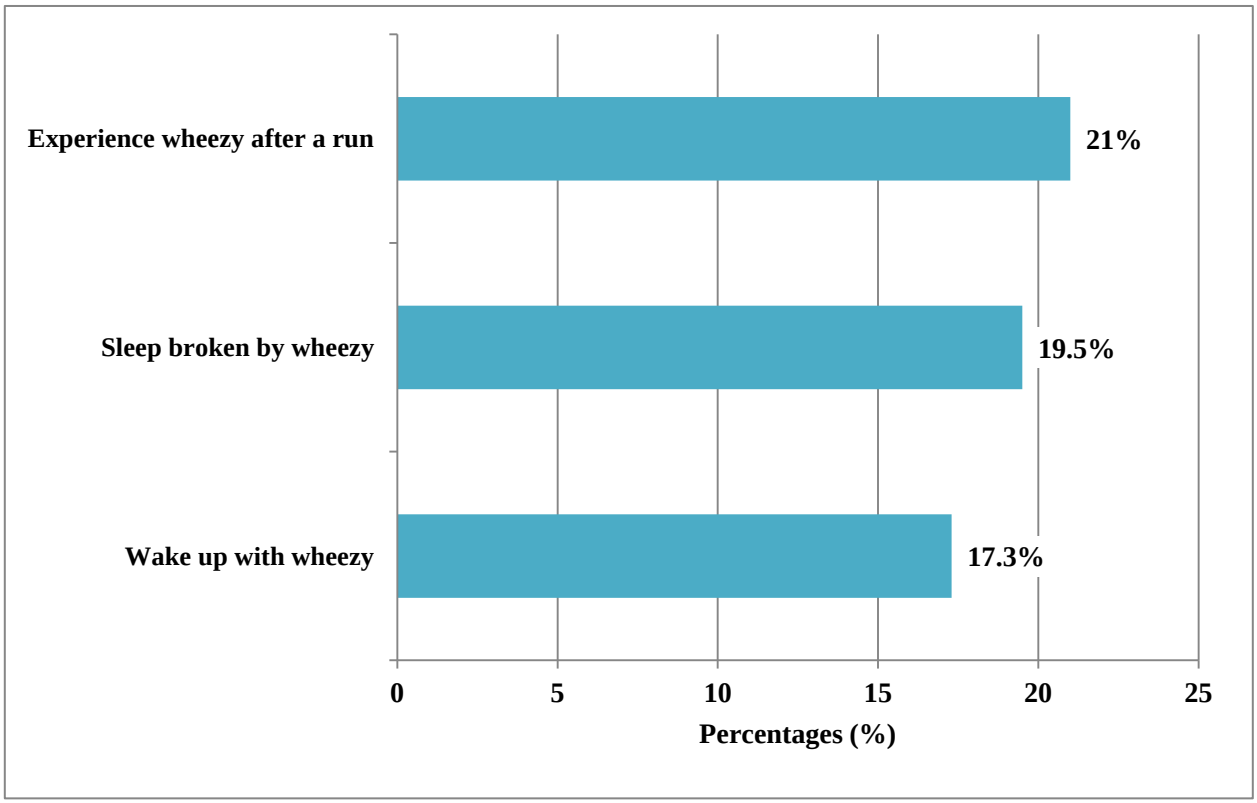



**Figure 2: Bar graph showing severity wheezing among painters**

Proportionally, about forty Automobile spray painters (65.6%) reported to experience the improvement of respiratory symptoms like wheezing and SoB on weekends. Fifty eight painters (26.4%) had self-reported to experience cough first thing in the morning whereas a less proportional 38 (17.3%) had self-reported to experience cough during the day or at night. About 46 (21.3%) of painters reported to experience phlegm first thing in the morning whereas 32 (14.9%) had experienced phlegm during the day or at night, the table 3 summaries the findings.

**Table 2: Duration of Coughing and Phlegm among automobile small scale industry spray painters**

| | Duration of symptoms | |
|---|---|---|
| | First thing in the morning | During the day or at Night |
| Experience Cough | 58 (26.4) | 38 (17.3) |
| Experience Phlegm | 46 (21.3) | 32 (14.9) |

Results shows About 34 (16%) of painters reported to experience excessive cough and phlegm where as 44 (20.7%) had experiences the same problem more than once (Table 4).

**Table 3: Periods of Cough and Phlegm**

| **Periods** | **Frequency (n)** | **Percent (%)** |
|---|---|---|
| In the past three years, have you had a period of (increased) cough and phlegm lasting for three weeks or more? | | |
| Yes | 34 | 16 |
| Experienced more than one episodes | | |
| Yes | 44 | 20 |

Among the top 10 respiratory disease and condition (s) which were assessed among Automobile spray painters, Flu 26% (n=32) was high reported followed by regular cough 14% (n=20), pneumonia 8.5 % (n=17) and asthma 5.4% (n=12) and the least was 2.3% (n=5). Table 5 summaries the findings

**Table 4: Prevalence of Respiratory diseases (n=220)**

| Disease / conditions | Frequency (n) | Percent (%) |
|---|---|---|
| Chest operation/Injury | 8 | 3.7 |
| Heart Problems | 5 | 2.3 |
| Bronchitis | 13 | 5.9 |
| Pneumonia | 17 | 8.5 |
| Pleurisy | 9 | 4.5 |
| Asthma | 12 | 5.4 |
| Chest problems | 10 | 4.9 |
| Hay fever | 6 | 3 |
| Flu | 32 | 26 |
| Regular coughing | 20 | 14 |

### 4.3 Differences in prevalence of Respiratory symptoms among small scale industry spray Painters and Office workers

Office workers had experienced less prevalence of Respiratory symptoms ranging from wheezing 2.7 % (n =6), SoB 4.5% (n=10), Cough 5.5% (n=12) Phlegm 7.3% (n=16) and Chest illness 13.2% (n =29) compared to painters who had higher proportion in all the symptoms (Table6).

**Table 5: Differences in prevalence of Respiratory symptoms among small scale industry spray Painters and Office workers**

| Symptom | Office workers (n=220) | Painters (n=220) | *p- value |
|---|---|---|---|
| Difficulty in breathing | 10 (4.5) | 58 (26.6) | <0.01 |
| Wheezing | 6 (2.7) | 67 (30.5) | <0.01 |
| Cough | 12 (5.5) | 68 (30.9) | 0.001 |
| Phlegm | 16 (7.3) | 54 (24.5) | <0.01 |
| Cough and phlegm | 12 (5.5) | 34 (16) | 0.002 |
| Chest illness | 29 (13.2) | 33 (15.1) | 0.99 |

**Chi-square test*

In table 7, painters had 8 likelihood 95 % CI (3.8 – 16.5) of experiencing Shortness of breath as compared to Office workers ($p< 0.01$). Moreover, they had demonstrated 14.5 likelihood 95% CI (6–31.7) of experiencing wheezing as compared to Office workers ($p< 0.01$). As for Cough, Painters had 3.8 odds 95% C1 (1.7-8.6) of experiencing it compared to Office workers ($p< 0.01$). Moreover, Automobile spray painters had 5.1 likelihood, 95% C1 (2.7 – 9.8) of experiencing Phlegm as compared to Office workers ($p<0.01$) and for Cough with phlegm, Painters had 3.1 odds 95% CI (1.4 – 6.3) of experiencing it compared to office workers ($p=0.002$). However, experiencing of other chest illnesses showed no difference ($p=0.99$) in its likelihood of occurrences in between Painters and Office workers, OR = 1.01, 95% CI (0.56 – 1.7).

**Table 6: Logistic regression on Respiratory symptoms among the Automobile Spray Painters and office workers adjusted to Age and Previous history of smoking**

| Symptom (s) | CRUDE OR | 95% CI | ADJUSTED OR | 95% CI | *p*- value |
|---|---|---|---|---|---|
| **Difficulty in breathing** | | | | | |
| Office workers | 1 (Reference) | | 1 (Reference) | | |
| Painters | 7.3 | 2.7 – 18.9 | 8 | 3.8 – 16.5 | <0.01 |
| **Wheezing** | | | | | |
| Office workers | 1 (Reference) | | 1 (Reference) | | |
| Painters | 11.9 | 2.8 – 31.2 | 14.5 | 6 – 31.7 | <0.01 |
| **Cough** | | | | | |
| Office workers | 1 (Reference) | | 1 (Reference) | | |
| Painters | 2.9 | 1.2 – 6.9 | 3.8 | 1.7 – 8.6 | 0.001 |
| **Phlegm** | | | | | |
| Office workers | 1 (Reference) | | 1 (Reference) | | |
| Painters | 3.9 | 1.7 – 9.1 | 5.1 | 2.7 – 9.8 | <0.01 |
| **Cough and phlegm** | | | | | |
| Office workers | 1 (Reference) | | 1 (Reference) | | |
| Painters | 4.2 | 1.8 – 7.4 | 3.1 | 1.4 – 6.3 | 0.002 |
| **Other Chest illness** | | | | | |
| Office workers | 1 (Reference) | | 1 (Reference) | | |
| Painters | 0.9 | 0.6 – 1.8 | 1.01 | 0.56 – 1.7 | 0.99 |

**4.4 Peak expiratory flow rate among the Automobile spray Painters and Office workers**

The values for peak expiratory flow rate ware taken for both Automobile spray Painters and Office workers. The mean value for Painters was less 381.6 L/min ± 88.3 compared to that of Office workers, 470.03 L/min ± 72.4 and the observed difference in mean was found to be statistically significant ($p<0.01$). The peak expiratory flow rate readings were still low for Painters at 25 percents 296 L/min compared to 385 L/min for Office workers and at 75 percentile, 580 L/min compared to 610 L/min for Office workers (Table 8).

**Table 7: Difference in peak expiratory flow rate values among automobile spray painters and office workers**

| **Occupation** | **Mean Value ± SD (L/min)** | ***p*-value** | **Percentiles** | |
|---|---|---|---|---|
| | | | **25** | 75 |
| Automobile Spray Painters | 381.6 ± 88.3 | <0.001 | 296 | 580 |
| Office workers | 470.03 ± 72.4 | | 385 | 610 |

** Independent sample t-test, statistical analysis on difference in mean between painters and Office workers*

### 4.5 Use of PPE among the Automobile Spray painters

The use of personal protective equipment (PPE) at work place was reported by 45% (n= 99) of interviewed painters. About three quarter 74 (74.7%) reported to be using a piece of cloth (*Vitambaa*) whereby mask reported to be worn by a quarter 25% (n = 25) of interviewed Painters.

**Table 8: The use of personal Protective equipment among the Automobile spray Painters (n=220)**

| Item | Frequency (n) | Percent (%) |
|---|---|---|
| **Do you use any protective equipment on your working place?** | | |
| Yes | 99 | 45 |
| **What device do you use?** | | |
| Mask | 25 | 25.3 |
| A piece of cloth | 74 | 74.7 |

# CHAPTER FIVE

## 5.0 DISCUSSION

Respiratory symptoms were found to be more prevalent in automobile spray painters than office workers with a higher likelihood of occurrence. The mean peak expiratory flow rate value for painters was less 381.6 L/min ± 88.3 compared to office workers, 470.03 L/min ± 72.4 and the observed difference in mean was statistically significant ($p$<0.01). The use of relevant Personal Protective Equipment (PPE) was found to be very low 25.3 % among the Automobile Spray Painters.

### 5.1 Small scale industrial workers (SSIW) setting of spray painters

The characteristics of these SSWIs are different from those found in large-scale industries in developed countries. Most of the industries are located alongside the roads. No exposure control equipment, such as exhaust ventilations as the work area is an open space. Most tasks are done manually from a pealing-off of old paint, scratching, smoothing and painting. Normally each experienced painter has 2 or 3 painters under him and 1 or 2 students who are trained in the job by doing the actual tasks.

### 5.2 Prevalence of respiratory symptoms among Automobile small scale industry spray painters

This part discusses the findings on the respiratory symptoms among painters and office workers from Ilala, Kinondoni and Temeke district. Various respiratory symptoms were assessed and findings had shown high prevalence of respiratory symptoms among painters including cough, phlegm, and shortness of breath and Wheezing. This shows that the experience of respiratory symptoms being common among painters in Dar es Salaam like in other areas as shown by other similar study by Pronk and colleagues in Netherland on respiratory symptoms and exposure response relationship among automobile spray painters, (2007) revealed that the prevalence of respiratory symptoms was significantly higher in spray painters than in the controls office workers for phlegm, shortness of breath, wheezing and cough similar to the findings of the present study. Another study done in Algeria by Ould-kadi

and fellows among industrial workers exposed to different classes of occupational agents including 106 spray-painters from the shipbuilding company in the same year had prevalence of chronic cough 22 (4%) among spray painters which is lower compared to what was found in the present study 68 (30.9%); Furthermore, spray painters exposed to isocyanates in solvents had an odds ratio of 3.43 (95% CI: 1.09–11.6; p = 0.037) for bronchial hyper-responsiveness compared with the reference group The similarities in results could have been due to minimal use and inappropriate protective gears that were found in both studies. Siddanagoudra and colleagues (2012) conducted a study on respiratory morbidity in spray painting workers in an automobile sector in India and their findings are in harmony with those found in this study having nearly similar prevalence of respiratory symptoms. (Table6)

Apart from the observed prevalence of SoB among painters, the effect have got different severity in painters experiencing SoB while walking, stopping to breath experience and SoB after a run as shown in figure 1. The persistence of symptoms such as Wheezing was reported causing exposed painters to have their sleep broken and having waked up in the morning with wheeze. This indicates increased severity of reported symptoms however spray painters have self reported improvement of respiratory symptoms during weekends which could explains the role of exposure in exacerbating respiratory symptoms. Moreover, higher prevalence of symptoms that were found in the present study can be explained compared to low values found in the control, non-exposed office workers group as what was found in Algeria (Ould-kadi et al 2007).

### 5.3 Differences in prevalence of Respiratory symptoms among the automobile spray Painters and Office workers

The present study gives the evidence of the exposure-response relationship for exposure to automobile spray paint. Results of analysis of this study confirm the prediction in which high prevalence of respiratory symptoms among painters as compared to office workers as shown in table 6. The prevalence of respiratory symptoms was significantly ($P$<0.001) greater among the exposed painters group than the comparison non exposed Office workers group for Cough, Shortness of breath, Wheezing, Phlegm and Cough with Phlegm. In harmony to this, a study

by Hashim and fellows in 2006 concluded the exposure to spray paints having significantly influenced respondents' respiratory health as indicated by higher prevalence of respiratory symptoms among the exposed Spray painters. Moreover the findings are very similar to that done by Pronk and colleagues (Pronk, A et al 2006), who demonstrated higher prevalence of Respiratory symptoms among exposed Spray painters compared to non-exposed Office workers with difference being statistically significant. This explains the fact of harmfulness of spray contents as has been associated with precipitating Respiratory symptoms.

Automobile spray paint is well known to contain isocyanides, compound responsible for precipitating respiratory symptoms. Together with the above respiratory symptoms, participated painters also reported to have suffered a number of respiratory diseases such as Pleurisy and Asthma; this implies the long term standing effects on respiratory symptoms due to the exposure.

Occupation asthma was reported to be 5.4% of all workers which is quite different from what was found on the similar previous study found to be 33.6% that demonstrated higher prevalence of occupational asthma who assessed asthma like symptoms. The observed difference could be a result of different setting of the industries whereby the subjects in this study had their garages in the open spaces on the streets. The present study had shown high likelihood of developing respiratory symptoms and significant among painters, Shortness of breath OR=8, Phlegm OR=5.1, Cough OR=3.8 and lastly painters were three times likely to experience Cough with phlegm being OR=3.1compared to Office workers. Occupational risk of being a painter was found to be a dependent predictor of Respiratory symptoms. These finding comply with the fact of high and long-term exposure among Automobile painters. Although this study also demonstrates that there was no strong relationship on the likelihood of painters to experience chest illnesses compared to office workers.

### 5.4 Utilization of Personal Protective Equipment (PPE)

Results have shown minimal utilization of PPE, however the type of equipment used were mask and piece of cloth (*Vitambaa*), these findings of this study are in line with other findings from many studies in developing countries which demonstrated low utilization of PPE to be common among industrial workers. The low utilization may also account for the high prevalence of Respiratory symptoms observed. Eventually the actual work is done in open spaces (outdoor) but the possibility of exposures still remains high. Low level of utilization could be due to the work setting of small scale automobile spray industries that are not under regular supervision on occupational safety. Together with the use of protective gears (45%) that was found, industrial settings is the basis of observed differences in respiratory symptoms that was found in previous studies done in developed countries.

### 5.5 Results from Peak expiratory flow rate

The peak expiratory flow rate results showed mean values to be low among automobile spray painters compared to office workers. Statistical values on percentile were also indicative on the observed differences being highly statistically significant. The PEF measurements were taken between 8 and 10 in the morning for all the areas data were collected. In assessing the difference in PEF values between the two group of the study age and smoking history as factors that could have a confounding effect were controlled. It cannot be ruled out from this study that whether the PEFRs has have changed or not due to absence of comparison data specifically in Dar-es-salaam of previous studies regarding PEFR and their associated factors. However these finding are different from a study done by Revathy et al (2012) who investigated the effects of pulmonary function in short duration exposed automobile spray painters with a statement there was no statistically significant (P =0.13) reduction in pulmonary function tests among the Spray painters. The reason for this, insignificance could be lesser duration of employment that was studied and highly usage of respiratory protective equipment that was found, difference in sample size used could also explain the observed differences in findings. Other previous literatures that have studied the differences in Peak expiratory flow rate among exposed painters and non exposed group had the findings that

support what has been found in the present study, Peak expiratory flow rate values, despite of being suggestive of problems in the respiratory system among automobile spray painters, present findings can be explained mostly by the higher prevalence of self reported respiratory symptoms of painters and minimal use of protective gears at work place.

# CHAPTER SIX

## 6.0 CONCLUSION

There was high prevalence of respiratory symptoms among automobile spray painters. Peak expiratory flow rate values were significantly lower in painters as compared to office workers, the materials equipments used were inappropriate in protecting respiratory airways.

## 6.1 RECOMMENDATIONS

From the findings of the study, the following are recommended.

I. Local Government Authorities in corroboration with OSHA should start considering providing inspections and consultancy services to workers in the small scale industries.
II. The present study should be used as a section for further studies to determine the situation of occupation health and safety in other small scale industries in the country.
III. Ministry of health through relevant organizations such as OSHA, NSSF should address concerns and direct efforts towards creating a healthier environment for the workers in the sector.
IV. Awareness raising among painters on the importance and usefulness of appropriate protective gears should be emphasized to reduce cases of Respiratory symptoms and diseases.
V. The Small scale industry automobile spray paint owners should be advised on the importance of ensuring the heath and safety condition of their subordinates

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# APPENDICES

## Appendix I: Questionnaire – English Version

**RESPIRATORY QUESTIONNAIRE**

**Respiratory Questionnaire**

Questionnaire based on the MRC (UK) Respiratory Questionnaire 1986, which has been extensively validated. This questionnaire is intended to be completed by an interviewer rather than by the respondent. Additional questions have been added to cover clinical aspects of bronchial hyper responsiveness validated by the Department of Occupational and Environmental Medicine, National Lung Institute[1]

**Preamble**

I am going to ask some questions, mainly about your chest. I would like you to answer **Yes** or **No** whenever possible.

If the subject is disabled from walking from any condition other than heart and lung disease, please begin questionnaire at **Question 5** and mark the adjacent box ☐

**Title**: **RESPIRATORY SYMPTOMS AND PEAK EXPIRATORY FLOW RATE AMONG WORKERS IN AUTOMOBILE SPRAY PAINTING INDUSTRIES IN DAR-ES-SALAAM.**

Questionnaire number: ……

Name of small scale industry/Office: …….

| SECTION A: DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS | | |
|---|---|---|
| **Question number** | **Questions** | **Response** |
| A1 | How old are you? | …… years |
| A2 | Gender of respondent? | 1. Male<br>2. Female |
| A3 | What is your marital status? | 1. Single<br>2. Married<br>3. Divorced/separated<br>4. Cohabiting |
| A4 | What is your highest level of education? | 1. Never been to school<br>2. Primary<br>3. Secondary<br>4. Certificate |
| A5 | What is your area of practice? | 1. Supervisor<br>2. Painter<br>3. Student<br>4. Others |

**Shortness of breath and Wheezing**

During the last month:

**1.** Are you troubled by shortness of breath when hurrying on level ground or walking up a slight hill? Yes ☐ No ☐

**If Yes to 1:**

**2.** Do you get short of breath walking with other people of your age on level ground? Yes ☐ No ☐

**If Yes to 2:**

**3.** Do you have to stop for breath when walking at your own pace on level ground? Yes ☐ No ☐

**4.** If you run, or climb stairs fast do you ever

a. Cough? Yes ☐ No ☐

b. Wheeze? Yes ☐ No ☐

c. Get tight in the chest? Yes ☐ No ☐

**5.** Is your sleep ever broken…?

a. By wheeze? Yes ☐ No ☐

b. Difficulty in breathing? Yes ☐ No ☐

**6.** Do you ever wake up in the morning (or from your sleep if a shift worker)

a. With wheeze? Yes ☐ No ☐

b. Difficulty with breathing? Yes ☐ No ☐

**7.** Do you ever wheeze…?

a. if you are in a smoky room? Yes ☐ No ☐

b. if you are in a very dusty place? Yes ☐ No ☐

**If Yes to either Q5, Q6, Q7:**

**8.** Are your symptoms better

a. at weekends (or equivalent if shift worker)? Yes ☐ No ☐

b. when you are on holidays? Yes ☐ No ☐

If **Yes** to **Question 8** please record details of any occupational exposure to respiratory hazards eg isocyanates, wood dust, aluminum pot room.

---

**Cough**

**9.** Do you usually cough first thing in the morning in winter? Yes ☐ No ☐

**10.** Do you usually cough during the day – or at night – in the winter? Yes ☐ No ☐

**If Yes to Q9 or Q10. :**

**11.** Do you cough like this on most days for as much as Three months each year? Yes ☐ No ☐

**Phlegm**

**12.** Do you usually bring up phlegm from your chest first thing in the morning in winter? Yes ☐ No ☐

**13.** Do you usually bring up any phlegm from your chest during the day – or at night – in winter? Yes ☐ No ☐

**If Yes to Q12. or Q13 :**

**14.** Do you bring up phlegm like this on most days for as much as three months each year? Yes ☐ No ☐

**Periods of cough and phlegm**

**15.** In the past three years, have you had a period of (increased) cough and phlegm lasting for three weeks or more? Yes ☐ No ☐

**If Yes to Q15:**

**Q16.** Have you had more than one such episode? Yes ☐ No ☐

**Chest Illnesses**

**17.** During the past three years, have you had any chest illness that has kept you from your usual activities for as much as a week? Yes ☐ No ☐

**If Yes to Q17:**

**18.** Did you bring up more phlegm than usual in any of these illnesses? Yes ☐ No ☐

**If Yes to Q18:**

**19.** Have you had more than one illness like this in the past three years? Yes ☐ No ☐

**Past Illnesses**

**20.** Have you ever had, or been told that you have had:

a. An injury, or operation affecting your chest? Yes ☐ No ☐

b. Heart trouble? Yes ☐ No ☐

c. Bronchitis? Yes ☐ No ☐

d. Pneumonia Yes ☐ No ☐

e. Pleurisy? Yes ☐ No ☐

f. Asthma? Yes ☐ No ☐

g. Other chest trouble? Yes ☐ No ☐

h. Hay fever? Yes ☐ No ☐

**Tobacco Smoking**

**21.** Do you smoke? Yes ☐ No ☐

**If No to Q21:**

**Q22.** Have you ever smoked as much as one Cigarette a day for as long as one year? Yes ☐ No ☐

If **No** to **Question 21 or 22**, omit remaining questions on smoking.

**23.** How old were you when you started smoking regularly? _____

**24a.** Do (did) you smoke manufactured cigarettes? Yes ☐ No ☐

**If Yes to Q24a:**

How many do you (did) you usually smoke per day? _____

**Q24b.** On weekdays? _____

**Q24c.** At weekends? _____

**25.** Do you smoke any other forms of tobacco? Yes ☐ No ☐

**If Yes to Q25:**

**Record details under Additional Notes**

**For ex-smokers**

**Q26.** When did you give up smoking altogether? Month _____Year _____

Peak flow meter readings 1……2……3……..

**Appendix II: Questionnaire – Swahili Version**

**DODOSO LA KASORO KATIKA MFUMO WA UPUMUAJI**

Hili dodoso limetokana na dodoso  lililotengenezwa na MRC(UK)1986 Ambalo limehakikiwa vyakutosha.Dodoso hili liazaminiwa kutumika na muhojaji/mtafiti na si mgonjwa. Maswali ya ziada yameongezwa kujumuisha taarifa nyingine muhimu dodoso hili limehakikishwa na idara ya afya ya mazingira a mahala pa kazi.

**UTANGULIZI**

Nitakuuliza maswali machache kuhusu matatizo katika mfumo wa upumuaji. Kama mgonjwa hawezi kutembea kutokana hali yoyote tofauti na ugonjwa wa mapafu na  moyo tafadhali anzia na swali 5 na ujaze kisanduku cha pembeni.

| **DALILI ZA MAGONJWA KATIKA MFUMO WA UPUMUAJI NA KUPUMUA MIONGONI MWA WAFANYAKAZI WA SEKITA ISIYO RASIMI YA UPULIZIAJI RANGI** | | |
|---|---|---|
| | **KIFUNGU A** | |
| A1 | Unao umri wa miaka mingapi? | …….. |
| A2 | Jinsia ya mhojiwa | 1. Mume<br>2. Mke |
| A3 | Hali ya ndoa ya mhojiwa? | 1. Hajaolewa/hajaoa<br>2. Ameolewa/ameoa<br>3. Wameachana<br>4. Wanaishi pamoja bila ndoa |
| A4 | Umefikia kiwango gani cha juu cha elimu? | 1. Elimu ya msingi<br>2. Elimu ya sekondari<br>3. Cheti<br>4. Stashahada<br>5. Shahada |
| A5 | Unafanya kazi gani katika karakana hii? | 5. Msimamizi<br>6. Fundi rangi<br>7. Mwanafunzi<br>8. Nyingine |

**KIFUNGU B:**

**KUSHINDWA KUPUA NA KUTOA SAUTI NYEMBAMBA WAKATI WA KUPUMUA KATIKA MWEZI MMOJA ULIOPITA**

| | | | |
|---|---|---|---|
| 1. | Je unapata shida ya kupumua wakati wa kutembea kwa haraka kwenye aridhi tambare au au unapopanda kilima kifupi | NDIO | HAPANA |

**KAMA JIBU NI NDIO SWALI 1**

| | | | |
|---|---|---|---|
| 2 | Je unapata shida ya kushindwa kupumua wakati unapotembea na watu wengine wa umri wako kwenye ardhi tambarare | NDIO | HAPANA |
| | | | |

Kama ndio kwa swali la 1 na 2

| | | | |
|---|---|---|---|
| 3 | Je inakubidi usimame ili upumue wakati unapotembea katika mwendo wako katika ardhi tambarare | NDIO | HAPANA |
| | | | |

4. kama ukikimbia au kupanda ngazi kwa haraka je huwa unatokezewa na yafuatayo

| | NDIO | HAPANA |
|---|---|---|
| a)kukohoa | | |
| b)kutokwa na kisauti chembamba wakati wa kupumua | | |
| c)unahisi kubanwa kifua | | |

5. Je usingizi wako huwa unakatishwa na

| | NDIO | HAPANA |
|---|---|---|
| a) kutoa sauti ya mkwaruza wakati wa kupumua | | |
| b)kushindwa kupumua vizuri | | |

6. je huwa ukiamka asubuhi (au kutoka usingizini kama ni mfanyakazi na shift)

| | NDIO | HAPANA |
|---|---|---|
| a) kutoa sauti ya mkwaruza wakati wa kupumua | | |
| b) kushindwa kupumua vizuri | | |

7 je huwa una toa sauti ya mkwaruza wakati wa kupumua wheeze

| | NDIO | HAPANA |
|---|---|---|
| a)kama uko kwenye chumba cha moshi | | |
| b)kama uko kwenye vumbi sana | | |

Kama jibu ni ndio kwa swali la 5,6,&7

8. je dalili za matatizo ya mfumo wa upumuaji  hupungua

| | NDIO | HAPANA |
|---|---|---|
| a)wakati wa wikiendi ( wakati wa mapumziko kama ni mfanyakazi na shift) | | |
| b)wakati upo likizo | | |

Kama jibu ni ndio kwa swali la 8 tafadhali rekodi taarifa kuhusu uwepo na visababishi vya matatizo ya mfumo wa upumuaji mahala pa kazi mfano isocyanites, vumbi la mbao, vumbi la aluminium na kadhalika

**KIFUNGU C: KIKOHOZI**

| | | | |
|---|---|---|---|
| 9. | je huwa uamkapo tu asubuhi unakohoa wakati na msimu wa baridi | NDIO | HAPAN A |
| 10 | Je huwa unakohoa kipindi cha mchana or  usiku wakati na msimu wa baridi | | |

Kama jibu ni ndio kwa swali la 9 au 10

| | | | |
|---|---|---|---|
| 11. | je huwa unakohoa kama hivi karibu siku zote kwa muda karibu miezi mitatu kila mwaka | NDIO | HAPANA |

**KIFUNGU D: MAKOHOZI**

| | | | |
|---|---|---|---|
| 12. | Je huwa unatoa makohozi mara tu uamkapo asubuhi kipindi cha msimu na baridi | NDIO | HAPANA |

| | | | |
|---|---|---|---|
| 13 | Je huwa unatoa makohozi yoyote wakati wa mchana au usiku kipindi cha msimu wa baridi | NDIO | HAPANA |

Kama jibu ni ndio kwa swali la 12 & 13

| | | | |
|---|---|---|---|
| 14. | Je huwa unatoa makohozi karibu siku zote kwa muda na karibu miezi mitatu kila mwaka | NDIO | HAPANA |

**KIFUNGU E: VIPINDI VYA KIKOHOZI NA KUTOA MAKOHOZI**

| | | | |
|---|---|---|---|
| 15. | Katika kipindi cha miezi mitatu iliyopita. Umewahi kupata kipindi cha kuongezeka kukohoa na kutoa makohozi vilivyodumu kwa siku tatu au zaidi. | NDIO | HAPANA |

**KAMA JIBU NI NDIO KWA SWALI LA 15**

| | | | |
|---|---|---|---|
| 16. | je umeshawahi kupata hali hiyo kwa zaidi ya mara moja | NDIO | HAPANA |

**KIFUNGU G: MAUMIVU YA KIFUA**

| | | | |
|---|---|---|---|
| 17. | Katika kipindi cha miaka mitatu iliyopitaje umewahi kupata kuumwa kifua ambacho kilikufanya usiende kwenye shughuli zako za kawaida kwa muda karibu na wiki . | NDIO | HAPANA |
| 18 | je uliwahi kupata kutoa makohozi zaidi ya kawaida katika kipindi chochote cha kuumwa kwako | | |
| 19. | Je uliwahi kumwa zaidi ya mara moja katika kipindi cha miaka mitatu | | |

**KIFUNGU H: TAARIFA YA MAGONJWA YA MFUMO WA UPUMUAJI**

| | | | |
|---|---|---|---|
| 21. | Je umewahi kuumwa au kuambiwa kuwa unaumwa magonjwa kati ya haya | NDIO | HAPANA |
| | a) Ajali au upasuaji unaoathili kifua chako | | |
| | b)Matatizo ya moyo | | |
| | c)Bronchitis | | |
| | d)Pneumonia | | |
| | e)Pleurisy | | |
| | f)Pumu | | |
| | g)Matatizo mengine ya kifua | | |
| | h)Hay fever | | |

**KIFUNGU I: UVUTAJI SINGARA**

| | | | |
|---|---|---|---|
| 21. | Je wewe unavuta sigara | NDIO | HAPANA |
| 22. | Je umewahi kuvuta sigara angalau moja kwa sikuau kipindi cha angalau mwaka mmoja | | |
| 23. | Je ulikuwa na umri gani ulipoanza kuvuata singara | | |

24a) Je

Kama jibu la 24a) ni ndio je huwa unavuta sigara ngapi kwa siku? .....

24b)siku za kazi? ……....

24c)siku za wikiendi? ……..

| | | | |
|---|---|---|---|
| 25. | Je unavuta aina nyingi ya tumbaku? | NDIO | HAPANA |

.Kama jibu ni ndio la swali la 1-25

Jaza maelezo kwenye kisanduku kifuatacho

……

26.Je ni lini ulicha sigara kabisa mwezi…….mwaka……

Kipimo cha peak flow meter 1……2……3……

**Appendix III: Informed Consent – English Version**

**Consent form**

**Title:** Respiratory Symptoms and Peak Expiratory Flow Rate among Male Workers in Automobile Spray Painting Industries in Tanzania.

My name is Idris Sekibo, a resident from Muhimbili University of Health and Allied Sciences. I am currently conducting a study titled "Respiratory Symptoms and Peak Expiratory Flow Rate among Workers in Spray Painting Industries in Tanzania".

Results from this study will be an important source of information to policy makers, small scale industry workers and other stakeholders on the burden of exposures, respiratory symptoms and their determinants among SSI workforce. The information will also raise awareness to SSI workers on how they should behave while at work to get rid or reduce the levels of exposures. The Ministry of Health and Social Welfare and Occupational Safety and Health Authority are expected to use the information to set up possible solutions about the problem.

We ask for your participation in the study because you are among the SSI workers and you are regarded as a group of at risk of exposures as a result of your job. If you agree to participate in the study you will be interviewed on your previous exposure status, your age, your job experience and other relevant information inherent in your current job in this hospital.

All information obtained from you will be treated as confidential and will be used only for the intended purposes of this research. The research team will compile a report that will contain information about all SSI workers interviewed while maintaining confidentiality. We do not expect any harm to you as a result of your participation in the study.

You have the right to participate or not to participate in the study without giving any reason for your decision. When you have decided to participate you are also free to terminate your participation at any time in the course of the study.

If you have any questions about this study you are free to contact, the principal investigator, Idris Sekibo (0784940140) or idrissekibo@yahoo.com.

If you have any questions/concerns about your rights as a participant you may contact Chairman of MUHAS Research and Publications Committee. P.O.BOX 65001 Dar es Salaam. Telephone number: 2150302-6

If you agree to this interview, please sign this consent form.

I …… have read and understood the contents of the consent form and my questions have been answered adequately. I therefore consent for the interview regarding the study.

Signature of the interviewee ……..... Date ……

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

**Appendix IV: Informed Consent – Swahili Version**

**Fomu ya Ridhaa Kushiriki Katika Utafiti**

**Kichwa: Dalili za magonjwa ya kifua na uwezo wa kupumua miongoni mwa wafanyakazi wa sekta ndogo ya upuliziaji rangi tanzania**

Naitwa Idris Sekibo, mtafiti kutoka chuo cha afya na sayansi shirikishi Muhimbili. Kwa sasa nafanya utafiti ili kutambua Dalili za magonjwa ya kifua na uwezo wa kupumua miongoni mwa wafanyakazi wanaume wa sekta ndogo ya upuliziaji rangi tanzania .

Matokeo ya utafiti huu yatakuwa ni rasilimali muhimu sana kwa watunga sera, wafanyakazi wa sekta ndogondogo na wadau wengine kwa sababu matokeo haya yatatoa picha halisi juu ya ukubwa wa tatizo na sababu mbalimbali zinazopelekea tatizo hili kuwepo kwa wafanyakazi katika mazingira ya kazi. Taarifa hizi zitaongeza uelewa wa wafanyakazi wenyewe juu ya jinsi gani wajikinge na madhara ya kuumia kazini na hatimaye kupunguza tatizo au kulimaliza kabisa. Wizara ya Afya na Ustawi wa Jamii na Mamlaka ya Usalama na Afya Mahala pa kazi wanatazamiwa kutumia matokeo haya kuandaa mikakati thabiti kwa ajili ya kudhibiti tatizo hili.

Tunaomba ushiriki wako katika utafiti huu maana wewe ni mmojawapo wa wafanyakazi wa sekta hii ambao ni kundi linalotambuliwa kuwa katika hatari ya kupata athari wakati ukiendelea na kazi katika mazingira ya kazini. Ukikubali kushiriki utaulizwa maswali kuhusu hali ya athari hapa kazini kwa kipindi kilichopita. Utaulizwa pia kuhusu umri wako na muda ambao umekuwa ukifanya kazi pamoja na taarifa nyingine kuhusiana na kazi yako.

Taarifa zote utakazotoa zitakuwa siri na hazitatumika kwa matumizi mengine mbali na utafiti huu. Timu ya utafiti itachambua taarifa hizi na kutoa taarifa ambayo haitatoa siri yoyote kuhusu wewe kwa kuwa majina au taarifa inayomlenga mtu binafsi haitakusanywa katika utafiti huu.

Katika utafiti huu hatutegemei madhara yoyote kwa mhojiwa kwa kipindi chote cha utafiti au hata baada ya utafiti huu. Unao uhuru wa kushiriki katika utafiti huu au kutokushiriki pasipo kutoa sababu yoyote juu ya hatua utakayokuwa umechukua. Ukishakubali kushiriki katika utafiti huu na ukaona kwamba huwezi kuendelea unao uhuru wa kusitisha ushiriki wako muda wowote wa utafiti.

Kama utakuwa na swali lolote kuhusu utafiti huuunaweza kuwasiliana na kiongozi wa utafiti huu ambaye ni Idris Sekibo simu- 0784940140 au barua pepe- idrissekibo@yahoo.com. Kama utakuwa na swali juu ya haki yako kama mshiriki unaweza kuwasiliana na, Mwenyekiti wa kamati ya utafiti ya chuo cha afya Muhimbili kwa anuani S.L.P 65001 Dar es Salaam. Simu ya mezani: 2150302-6

Kama umekubali kuhojiwa, tafadhali saini hapa:

Mimi ……., nimesoma na kuelewa kilichoelezwa kwenye fomu hii na maswali yangu yamejibiwa kiufasaha. Hivyo ninakubali kuhojiwa kwa ajili ya utafiti huu.

Sahihi ya mhojiwa …….. Tarehe ……..

Sahihi ya mhoji…… Tarehe……