

**RESPIRATORY HEALTH OF THE INFORMAL  
STONECRUSHERS IN DAR-ES-SALAAM TANZANIA**

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Master of Public Health (Occupational Medicine)**

**BY**

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**30 September 2010**



## DECLARATION

This Master of Public Health dissertation is my own work and all primary and secondary sources have been appropriately acknowledged. The dissertation has not been submitted to any other institution as part of an academic qualification.

This Dissertation is prepared in partial fulfilment of the requirement of the Master of Public Health degree at the School of Family and Public Health Medicine, Nelson R Mandela School of Medicine, University of KwaZulu-Natal, Durban South Africa.

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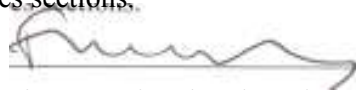
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It gives me great pleasure to dedicate this work to my beloved parents Mwl Mathias M  
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## **PUBLICATIONS OR PRESENTATIONS**

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5. Naidoo R, Kessy F, Mlingi L. Respiratory health of stonecrushers from the informal sector in Tanzania. Occupational Health Southern Africa. 2009 Dec; 15(6) 6-13

## ACRONYMS AND ABBREVIATIONS

<b>LFT</b>	-	Lung Function Test
<b>TOHS</b>	-	Tanzania Occupational Health Service
<b>NIMR</b>	-	National Institute of Medical Research
<b>MRCC</b>	-	Medical Research Coordination Committee
<b>SMEs</b>	-	Small and Medium Size enterprises
<b>PEF</b>	-	Peak Expiratory flow
<b>PEFR</b>		Peak expiratory flow rate.
<b>FEV<sub>1</sub></b>	-	Forced Expiratory Volume after one minute
<b>FVC</b>	-	Forced Vital Capacity
<b>COPD</b>	-	Chronic Obstructive Lung Diseases
<b>SADC</b>	-	South African Developing Countries
<b>US</b>	-	United States
<b>NIOSH</b>		National Institute of Occupational Safety and Health
<b>UK</b>	-	United Kingdom



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## **ABSTRACT**

### **Introduction**

Stone crushing in Dar-es-Salaam Tanzania is largely an informal occupational activity, with approximately 7000 workers exposed to varying level of respirable dust. A highly marginalized, self employed, informal stonecrusher is prone to multiple work related risks, particularly dust related respiratory diseases.

### **Aim**

This study, the first to be done among informal stone crushers in Southern Africa, aimed at determining the prevalence of dust related respiratory outcomes and relationships between these health endpoints and exposure to respirable dust in this sample of stonecrushers.

### **Methods**

This was primarily a cross-sectional descriptive study with analytic components. This study analysed a subset of data collected in a health survey of stone crushers in Kigamboni informal stone quarry in Dar-es-Salaam, Tanzania in 2007. All 200 workers working in the quarry were interviewed. A subset of 86 and 59 workers underwent exposure assessment and health assessments (spirometry and chest radiography) respectively. Associations were investigated between exposure measures and respiratory outcomes.

### **Results**

The average age of the workers was 36.3 years with 51.5% males participating in the study. Smoking was common with 30.1% male, 8.25% female smokers, with 2% ex-smokers. Personal dust sampling showed varying dust levels ranging from 0.5-2.8mg/m<sup>3</sup> with geometric mean of 1.2gm/m<sup>3</sup>. The exposure duration of workers in the quarry ranged from 1-62 years with mean of 7.8 years. No single worker was found to use personal protective equipment at work.

Reported prevalence of doctor diagnosed respiratory diseases was low: pulmonary tuberculosis (2%), chronic bronchitis (2%), asthma (3%), pneumonia (3%). In contrast, there was high prevalence of respiratory symptoms: chronic cough (13.5%), phlegm production (14.5%), productive cough (10%), wheezing (14%), mild breathlessness (9.5%) and coughing

blood (7.5%). Mean forced expiratory volume in one second (FEV1) and forced vital capacity (FVC) adjusted for age, height and sex was 2.6L/min and 3.7 L respectively, among males and 2.1L/min and 3.0L respectively among females.

Adjusted exposure odds ratios for symptoms were statistically significant for mild and moderate breathlessness with odds ratios of 3.4 and 3.1 respectively.

Linear regression showed statistically significant decline of 2.3mls in FEV1 with years of exposure while controlling for sex, age, height , doctor diagnosed TB and smoking showing that with prolonged exposure in the quarry, workers are at a risk of developing obstructive lung disease. This trend was not evident for FVC.

The majority of films were normal (60.9%), with 19.6% read as 1/0 and 19.9% as 0/1.

## **Discussion**

This study identified adverse respiratory outcomes among informal stonecrushers, particularly a high prevalence of respiratory symptoms and clinically important lung function deficits. These are in keeping with other environment studies where workers were exposed to respirable dust.

## **Recommendations**

Urgent policy initiatives for developing cost effective hazard control, engineering interventions to protect these marginalized self-employed informal sector stonecrushers [are](#) needed.

## CHAPTER I

### INTRODUCTION

#### **Background**

Little information is available on the quantitative risks of respiratory disease from quartz in airborne stone crushing quarries in Tanzania. However, respirable dust exposure is common among stone crushers and prolonged exposure is associated with diminished lung function(1). Crystalline silica is a major component of sand, rock, and mineral ores and is a common mineral in the earth's crust. Whenever the surface of the earth is disturbed, for example in mining or quarrying, or when sand, stones or rocks are drilled, moved, crushed or processed, potentially hazardous exposure to silica may occur.

Stone crushing in Tanzania is an activity done primarily by informal economy workers(2). The informal sector is characterized by low income, low level of literacy, limited land allocation and lack of availability of public health services(2). The stone crushing industry offers employment to more than 7000 workers in Dar-es Salaam city alone. Stone crushing involves several steps starting from rock blasting, excavation, crushing, sieving and loading crushed stones in the trucks. These activities are done manually where workers are exposed to numerous work related hazards. Crushed stones are used in different types of construction including making concrete, building houses and road construction(1). The stone crushing industry in Tanzania is dominated by women, most of whom bring their children to the quarry due to the lack of appropriate social infrastructure for these workers. Stone crushing has a wide range of work related hazards including silica dust, exposure to chemicals, poor work design, exposure to extreme heat and mechanical hazards(1, 2). These hazards predispose workers to a substantial risk of developing work related diseases and injuries. Both children and their parents are likely to contract work related diseases and accidents due to exposures in the quarry.

The Tanzania Occupational Health Service (TOHS), a non-governmental organization in Dar-es-Salaam, conducted a study among stone crushers from the Kigamboni Quarry in the city, as part of a much larger project investigating the occupational hazards experienced in the informal sector. This latter project described the health status of workers in different sub-sectors of the informal sector, including stone crushing, metal fabricating, saw milling and brick making. The project did not explore associations between workers' exposure and disease. For the purposes of this dissertation, data relevant to the research question was specifically extracted from the dataset of the stone crushers. This included data relevant to respiratory health and dust exposure data. This allowed for determining relationships between respiratory health outcomes and exposure to dust in the quarry.

The researcher (MPH student No.: 207528647) an employee of TOHS, participated in the primary surveys and obtained permission from the Director General of TOHS to use the data for the purposes of this study dissertation. Professor Rajen Naidoo (supervisor) acted as advisor to TOHS in the conducting of the above mentioned surveys among the informal sector workers.

### **Problem Statement**

Respiratory complaints such as coughing, sneezing, chest pains and chest tightness are common among stone crushers(1). These symptoms are considered to be associated with quartz containing respirable dust generated during the work processes of stone crushing(1). Silica-associated diseases remain an important public health concern because of its association with multiple diseases and increased mortality(3). The major adverse effects of exposure to crystalline silica include silicosis, silica-associated tuberculosis (TB) and non-tuberculosis mycobacterial disease (NTM), chronic obstructive pulmonary disease (COPD), lung cancer and certain connective tissue disorders(4). The limited value of treatment for these conditions lends urgency to their prevention(4). Silicosis which is an irreversible but preventable disease, results in permanent lung scarring and is a possible health risk among stone crushers.

There is little information known about the amount of respirable dust generated and the associated respiratory risks in the informal stone crushing industry generally. Additionally, this sector, which employs a significant number of workers, is deprived of preventive health services due to their inability to pay for these services(2). The main concern in this study was

that respirable dust exposure is common among stone crushers and prolonged exposure was likely to be associated with diminished lung function and other respiratory health outcomes including silicosis and silica related diseases. Unfortunately, there is no cure for silicosis, nor has any pharmacologic prophylaxis been adequately validated. Antimycobacterial agents can cure tuberculosis, but there is no cure for the other diseases associated with silica exposures. Thus, the single most important aspect of prevention of silicosis and other silica-associated diseases is control of exposure to respirable crystalline silica.

### **Purpose of the Research**

The purpose of this study was to understand the risk of adverse respiratory outcomes faced by informal stone crushers exposed to respirable dust in Dar-es-Salaam, Tanzania.

### **Overall Aim**

The aim of this study was to determine the prevalence of dust-related respiratory outcomes and relationships between these health endpoints and respirable dust among informal stone crushers in Dar-es-Salaam, Tanzania.

### **Specific Objectives**

1. To describe the respiratory health status of stone crushers by means of a standardised questionnaire, chest radiography and lung function testing.
2. To assess exposure to airborne respirable dust and total dust at the Tanzanian stone crushing quarry.
3. To determine the relationship between cumulative exposure to respirable dust and symptoms, lung function tests and chest radiography findings.
4. To propose interventions to minimize dust exposure to exposed workers.



## CHAPTER II

### BACKGROUND AND SIGNIFICANCE

The informal sector constitutes economic growth points in most developing countries including Tanzania(2). The informal sector is one of the most rapidly developing social phenomenon in response to challenging economic conditions internationally, but particularly in the developing countries. In Tanzania this sector is broad and it covers many sectors of the economy(2). It is estimated that almost 80% of the economy in Tanzania consists of informal sector activities. In Dar-es-Salaam, the economic centre of Tanzania, the informal sector infiltrates many corners of the city offering employment to roughly 60% to 70% of the youth. Rapid population growth (average 3.6% annually in many African countries), is restricting job opportunities for those within the age category of 15 to 64 years(2). The rise in the demand for employment constitutes one of the major causes of the expansion of the informal sector(2).

According to the latest national statistics, the Dar-es-Salaam region, with a population of over 3 million people and a per capita income of USD523 (2002), has an estimated labour force of 1.9 million people. Of these 376,000 are employed in the formal sector and around 1.06 million are employed in the informal sector while 465,000 are unemployed. The informal sector in Dar-es-Salaam hosts the vast majority of small and medium enterprises (SME's) which are dominated by sole proprietors, or the family businesses. The findings show that in every third household, there is an informal sector activity.

Dar-es-Salaam city has approximately 7000 informal stone crushers. Occupational lung diseases in stone crushing industry are due to exposure to quartz and crystalline silica dust. Occupational exposures to respirable crystalline silica are associated with the development of silicosis, lung cancer, pulmonary tuberculosis and other airways diseases(5, 6). Dust from crushed stones irritate the mucous membranes of the respiratory airways and this may lead to acute respiratory symptoms and reduction in PEF and FEV among the exposed workers(7). The exact mechanism of the acute changes in the ventilatory function observed among exposed

workers is unclear, but it depends on the chemical composition of the dust and its concentration.

Few studies have been done in Tanzania on exposure to crystalline silica. These include exposures in coal mines(8, 9) and cement factories(7, 10). The study among cement workers described increased risk of developing chronic respiratory symptoms and COPD related to cumulative dust exposure, independent of smoking history(10).

Internationally, only a limited number of studies among stone crushers have been reported. A study done in India to determine the prevalence of respiratory morbidity among agate stone workers showed a significantly higher prevalence of lung diseases among agate workers than among non exposed workers (63.4% vs. 35.5%,  $P < 0.001$ )(5). The prevalence of pneumoconiosis in agate workers (18.4%) was significantly higher than in those not exposed, among whom no case was found. Another study was done in India to determine the health effects of particulate matter from the stone crushing industry where both ambient concentrations and occupational exposure levels exceeded the Indian National Standards at most of the locations. Pulmonary function tests performed on workers showed that the average values of pulmonary function in these workers were significantly lower than the average values reported for normal South Indian healthy males(5).

An increased risk of tuberculosis (TB) among workers with silicosis has long been recognized(11, 12). Individuals with chronic silicosis have a three-fold higher risk of tuberculosis than similar individuals without silicosis(12). Workers working in mines, construction work, and stone-crushing and in other similar occupations where there is a greater level of exposure to silica dust are especially vulnerable to tuberculosis(13). The prevalence of TB has been reported to be 10.7% among stone crushers(13) – not as high as has been reported among other working populations, such as slate pencil workers (22.5%)(13) and among South African gold miners (89%)(14).

A Dutch study revealed that there is an association between radiographic abnormalities and cumulative exposure to quartz containing dust from construction sites after correction for potentially confounding variables(15). A study done at the Institute of Occupational Medicine, Edinburgh, Scotland, UK, to determine risks of respiratory disease in the heavy clay industry revealed that there are small risks of pneumoconiosis and respiratory symptoms in the clay

industry, although the frequency of pneumoconiosis is low in comparison to other quartz exposed workers(6).

### **Study Justification**

Many studies have been done worldwide about respiratory health among workers in underground mining, coal mining, and cement factories. Studies among stone crushers are limited – these have been reported from Malaysia, India, Bangladesh and United Kingdom. No study has been done among the informal stone crushers who are more exposed and less protected than workers in the formal stone crushing industry. Due to their small number and the low capital base, these informal entrepreneurs cannot afford pre-entry or periodic medical examinations which are very essential in identifying those most likely to be affected(2). Occupational risk assessments and hazard characterization are rarely done in such workplaces(2). This means that the level of exposure and prevalence of health effects among workers in informal stone crushing quarries are not known. Although the existing studies in Tanzania have described health status among formal industry like cement workers and coal miners, no single study specific for evaluation of health effects among informal stone crushers(9, 10) has been performed. There is a need to establish exposure status, assess the effects of exposure and propose cost effective interventions among informal stone crushers.

### **Description of study area**

The study was done in the Kigamboni small-scale aggregate limestone mining quarry. The quarry is labour intensive and involves male and female workers. Their family members, including children, are frequently found there. The work is done in open environment from 8.00 to 18.00 hours. The quarry is surrounded by residential areas. Kigamboni is located in Dar-es-Salaam which is the major business city in Tanzania.

### **Informal stone crushing in Tanzania.**

Informal stone crushing emerged as a result of multiple factors, one of them being effects of globalization(2). For various reasons people have migrated from rural communities to urban cities and towns in many developing countries, including Tanzania(2). In an attempt to survive in these towns, some people employed themselves in the informal sector(2). The informal sector in Tanzania is a sector which accounts for 80% of the economy and employs

approximately 60%-70% of the economically active population(2). The informal sector has the following characteristics

- Mainly family-owned enterprises with no clear employer-employee relationship.
- Operate with limited capital, land allocation and skills.
- Prone to multiple work-related hazards.
- Workers are prone to infections including HIV and tuberculosis.
- Is a marginalized sector whose workers have little or no formal education.

## **Stone Crushing Process Description**

### **1) Job categorization in the stone crushing quarry**

Workers are sub-divided into five sections. These are blasting, digging and carrying, crushing, sieving and sorting and loading. Since stone crushing is done in an informal setting, there is no strict division of the tasks. It is possible to find a worker performing all five tasks from time to time.

A worker can start by blasting, followed by breaking down large stones into small pieces. This is followed by assembling large pieces of stones to the crushing site, crushing them into small aggregates, sieving, sorting and lastly loading. There is no real specialization in the whole process, although workers perform predominantly one to two types of work. Female stone crushers are predominantly involved in manual crushing. Blasting is done by trained workers who move from one crushing site to another for blasting purposes.

### **2) Blasting**

In the informal stone crushing sites, rocks are loosened by blasting. In the preparation for blasting, hand drilling is done by punching through several holes on the rock. A special piece of iron steel bar of about two and half meters long and five centimeters in diameter is used. Holes are then loaded with explosives and blasting agents. After blasting, the rock is shattered into several big stones. During the blasting workers are given signal to stay away from the area so that they may not be hit by flying pieces of stone. However, they usually stay a short distance away from the explosion and thus still get exposed to the noise of the blast. After the explosion, they return to site a few seconds after the blast. They are, therefore, exposed to varying levels of dust. Blasting is usually undertaken by two workers experienced in the process.

### **3) Digging and carrying**

Following blasting, large pieces of stone need to be freed from the primary rock. This is done manually through digging. Digging is done using a piece of iron bar which is forcefully penetrated into the loosened part of rock at certain angle. Digging is done to loosen the rock as well as to reduce the large pieces of rock into a manageable size, allowing it to be carried from the blasing site to the crushing unit within the quarry. Carrying is usually done manually by men through placing stones on their heads or on their shoulders. Men assist women in digging the stones, breaking them down into moderate to small blocks of stone and moving them to the crushing sites. Workers are invariably exposed to dust during digging and carrying.

### **4) Crushing**

A crushing unit comprises of individuals or a group of people, usually family members. Crushing is done predominantly by women. It is done manually using hammers of varying sizes ranging from 1kg, 2kg through to 5kg. The main objective of crushing is to reduce the size of the stone to meet the requirements for construction. Final crushing is usually performed using small hammers about 1 to 1½ kg. At this stage stone aggregates of varying sizes are produced. These range from 2cm to 1.5cm. During crushing workers are exposed to high dust levels, poor work posture and exposure to ultraviolet radiation from the sun . Other hazards include high temperature, flying pieces of stone during crushing, long working hours etc. Injuries to fingers are common among the crushers.

### **5) Sieving and sorting**

Sieving of crushed stones is done predominantly by men while sorting is done by women. A wire mesh is used during sieving in order to separate dust from stone aggregates. After sieving, the stone aggregates are sorted/graded into varying grades depending on size (diameter) of aggregates. The sieving process generates dust. Sorting differentiates the final product into aggregates of 1.5cm, 2cm and 2.5cm in diameter.

### **6) Loading**

Loading is done by a group of workers who are paid per truck filled. These workers find themselves doing the same task most of the time. They do not stay in the quarry for the whole day. They come into the quarry when the trucks need to be loaded.

## **CHAPTER III**

### **METHODS**

#### **Overview**

This study analysed a subset of data collected in a health survey study of stone crushers in Kigamboni Stone Quarry in Dar-es-Salaam, Tanzania in 2007. The main study described the overall health status of the stone crushers by means of questionnaire, spirometry and chest radiography. Conditions described included the full range of cardio-respiratory, gastrointestinal, musculoskeletal, neurological, endocrinological and other conditions. The original study did not attempt to determine associations between exposure and health conditions. In this study, the focus is exclusively on respiratory health. It had analytic components where the relationship between exposures to dust and respiratory symptoms, respiratory diseases, chest radiography and lung function tests among stone crushers were determined. The methods described below were used in the conduct of the latter survey, as relevant to this study on respiratory health. No new data were collected in terms of this study. The researcher (MPH student No. 207528647), an employee of TOHS participated in proposal development, administration of questionnaire, lung function testing, radiographic assessment, working on ethical clearance and personal dust sampling.

#### **Study Design**

This was a cross-sectional study where the health status of the informal stone crushers was described in relation to the exposure status and their health outcomes. The study was descriptive, with a minor analytic component.

#### **Target Population**

The target population was the informal stone crushers in the city of Dar-es-Salaam, Tanzania.

### **Selection of study population**

The workers who participated in the survey were selected from one of the three stone crushing quarries in Dar-es-Salaam Tanzania. The three quarries in Dar-es-Salaam were each assigned a number and one was picked at random. The quarry selected was Kigamboni quarry. All 200 workers working at the Kigamboni Quarry participated in the survey. No random selection was done, as this was not considered necessary for the survey. This respiratory health study utilised the data of all those participating in the survey. Due to budget constraints, chest x rays and spirometry testing were not conducted on all 200 surveyed workers. Instead, workers were stratified according to their exposure duration, and a subset of 59 workers was chosen to undergo chest radiography and spirometry. All 200 workers were categorized into two groups depending on their duration at work. One category comprised of workers who have worked for ten years and above, while the other group comprised of workers who have worked for less than 10 years. Workers from each category were arranged alphabetically. Each name was assigned a corresponding numerical number starting from 1, 2, 3, etc. until the entire list was completed. 59 workers were selected from the two categories of workers.

Furthermore, a non-probabilistic sample of 86 workers was chosen from the same quarry to participate in the exposure assessment regardless of whether they participated in the health assessment or not.

### **Sample Size Consideration**

Because this is largely a descriptive study with a minor analytic component and using previously collected data, issues related to power and specific sample size were not relevant.

### **Collection of interview data**

Standardized, piloted questionnaires were administered by a team of trained interviewers to each participant (the questionnaire used in the survey is attached to this report – Appendix I). The interview was done at the quarry for convenience and to ensure good participation from workers. A quiet and relatively clean place close to the quarry with a table was used for interviews. The interviewers made repeated visits to the quarry until all 200 employed workers were interviewed. Items covered included demographics, general health status, respiratory symptoms, chest illnesses, detailed work histories (past and current employment details), tobacco use and family history.

The NIOSH Occupational History Questionnaire used in the US Coal Workers' X-ray Surveillance Program was modified for obtaining details on lifetime occupational histories. Respiratory symptoms and smoking histories were obtained by using a modified version of the questionnaire used in the Round 4 of the US National Study of Coal Workers' Pneumoconiosis. Measures of symptoms outcomes and doctor-diagnosed diseases were obtained from the questionnaire, and were defined as follows:

- Chronic cough longer than three months: answer yes to “do you usually cough like this on most days (or nights) for as much as three months each year?”
- Chronic phlegm production longer than three months: answer yes to “do you bring up phlegm like this on most days (or nights) for as much as three months each year?”
- Cough and phlegm longer than three weeks: answer yes to “have you had periods or episodes of (increased) cough and phlegm lasting for three weeks or more each year?”
- Severe breathlessness: answer yes to “do you have to stop for breath when walking at your own pace on level ground?”
- Moderate breathlessness: answer yes to “are you too breathless to leave the house or breathless on dressing and undressing?”
- Usual wheeze and whistling: answer yes to “does your chest sound wheezy or whistling on most days and nights?”
- Severe wheezing resulting in shortness of breath: answer yes to “have you ever had an attack of wheezing that has made you feel short of breath?”
- Doctor-diagnosed chronic bronchitis: answer yes to “have you ever been told by a doctor that you had chronic bronchitis?”
- Doctor-diagnosed emphysema: Answer yes to “have ever been told by a doctor that you had emphysema?”
- Doctor-diagnosed pneumonia: Answer yes to “have ever been told by a doctor that you had pneumonia?”
- Doctor-diagnosed chest tuberculosis: Answer yes to “have ever been told by a doctor that you had chest tuberculosis?”
- Doctor-diagnosed asthma: Answer yes to “have ever been told by a doctor that you had asthma?”



Questionnaires were administered in the Swahili language which was the workers' language of choice, but were available in English and Swahili. The English version of the questionnaire was translated and back translated by independent linguists before it could be piloted. The administrators chosen were fluent with the chosen language of the workers. Well trained supervisors did periodic supervision during administration of questionnaires. A pilot study was carried out prior to the main study to test the instruments. The questionnaire was pre-tested for consistency and clarity before use in the full study. During piloting of questionnaire, the interviewer recorded questions that were not understood and those which needed clarifications before the respondent could answer.

### **Lung Function Testing**

Lung function assessments were performed by a trained technician on the 59 stone crushers according to the American Thoracic Society criteria. A quiet and clean room in the TOHS hospital was used during the spirometry. The same equipment was used for all workers.. Equipment was volume-calibrated every four hours with a 3 litre calibrated syringe on the days of testing. Systems were checked for leaks as well. A minimum of 3 acceptable forced vital capacity (FVC) maneuvers were performed up to a maximum of 8. An end of test criteria of at least 2 seconds of no change in volume with an exhalation time of at least 6 seconds was used. Start of test criteria was taken as an extrapolated volume reading of less than 5% of the FVC or 0.1 litres, whichever was greater. The largest FVC and FEV<sub>1</sub> obtained from any acceptable curves were used for recording purposes. Reproducibility criteria were taken to be a less than 5% variation or 0.1L difference of the largest FVC and FEV<sub>1</sub>, and the next largest of these parameters among all acceptable curves. Internal standardization of spirometry was done using regression equations for height, age and cumulative exposure. Because of the substantial variation in lung function values between populations and the absence of an appropriate set of reference values for the population under study, external standardisation was not performed. However, internal standardisation was done through height, sex and age correction.

Failure to meet reproducibility criteria was not a basis for exclusion of the subject from the data analysis, as prior studies indicate that this can introduce a substantial selection bias. "Test failure" may be an indication of ill-health, as was shown in the study by Eisen et al(16) where subjects with persistent test failure had a greater longitudinal decline in FEV<sub>1</sub> than those without test failure(16). Subjects with test failure were identified separately in the analysis.

## **Chest Radiography**

Chest radiographs were obtained for all 59 workers who underwent spirometry. All radiographs were taken in accordance with the criteria set out by the International Labour Organisation. These x-rays were taken at the x-ray facilities of the Ocean Road Cancer Institute in Dar-es-Salaam-Tanzania. These radiographs were assessed according to the ILO Classification for Pneumoconioses. Each film was read independently by two experienced readers, blinded to exposure status. At least one of the readers was a NIOSH accredited “B” reader. A further 10 % of the films were re-read for quality control. In the case of disagreement, the two readers viewed the radiographs together for consensus. Evidence of pneumoconiosis was defined as ILO category 1/0 or greater.

## **Collection of exposure data**

Exposure to dust occurs at most stages of the production activities but varies in different stages of the process. Workers involved in sieving, loading and crushing are expected to have high exposure to total dust than the other job activities. In order to understand the variation in dust exposure and the risk for respiratory disorders in workplace, knowledge about the magnitude of variability in dust exposure from day-to-day (within-worker) and between workers is important. The magnitudes of variations were derived from repeated dust measurements collected from selected workers in the exposure groups. Since the aim was to quantify the dust levels in different subsections within the quarry, varying number of workers from each section were identified for this exercise. To ensure uniform representations of workers from blasting, excavating, crushing, sieving and loading, the National Institute of Occupational Safety and Health (NIOSH) sampling method number 0500 was used on a subset of 86 workers. Workers from the crushing section formed the highest representation followed by loading and then sieving. Those who participated in the exposure assessment were chosen regardless of whether they were involved in the health assessments or not. Industrial hygienists, together with well trained assistants, were subcontracted to do dust measurements. Although workers regularly change tasks over a working week, and occasionally during the course of the day, for the purpose of characterizing the exposures, workers were requested to perform the selected task for the full work shift of approximately eight hours. Each worker participating in exposure assessment was asked to fix the sampler at the lapel of the shirt as close to the nose as possible for 8 hours while at work. The weight of the filters was taken before and after measurements. The exposure variables measured were respirable dust and total dust.

Respirable dust was collected on cellulose acetate filters with a pore size of 0.8 microns placed in a 37-mm cyclone connected to a SKC pump with a flow rate of 1.9 l/min. Total dust were collected on cellulose acetate filters with a pore size 0.8 microns placed in a closed faced 37-mm cassette (Millipore, Millipore corporation, Bedford, MA, USA) connected to a SKC pump with a flow rate of 2.0 l/min. The same make of dust pumps was used for all workers. Samples were transported to a laboratory in a protective suitcase where gravimetric quantitative analysis was done using a Mettler microbalance with a detection limit of 0.01 mg. Field and laboratory black felters were used. Any gain or loss in weight on the black papers was used to determine expected changes on the final mass concentration on the sampled filters. Unfortunately the qualitative analysis for silica concentration of the dust was not done due to lack of an appropriate laboratory in Tanzania to analyse the filters.

Because of constant interchange of jobs on the quarry among workers, with many different tasks being done within a working week for varying periods of time, it was not possible to develop a more sophisticated exposure metric such as cumulative dust exposure based on the quantitative assessment that was conducted. A worker in the quarry could either do the following: stone digging, crushing, sieving, or sorting at varying moments within the same day. It was impossible to describe the various subsections within a quarry where an individual worker worked and the duration spent in this subsection over their period of engagement at the quarry. Therefore, the exposure metric used was “years of working in the quarry”.

Dust collected was suspected to contain silica. Dust levels were compared with the occupational exposure limits (OEL) in South Africa since Tanzania is yet to have her own Occupational hygiene standards.

### **Bias and Limitations**

This study was prone to selection, information bias and confounding bias. The selection bias and information bias were controlled for in the study design. The effects of confounding variables were adjusted for in the data analysis.

Since one quarry was randomly selected out of three major quarries in Dar-es-Salaam, and the fact that all workers in the selected quarry were studied, this study assumes that the sample studied is representative of the informal stone-crushers in the city. Despite the selection

process, we have no reason to believe that this quarry, and the workers within, differed significantly from the workers in the other quarries in the city.

This study used the modified version of the NIOSH Occupational History Questionnaire used in the US Coal Workers' X-ray Surveillance Program. Although the questionnaire has been used internationally and in other countries in Southern Africa, it was important to pilot the questionnaire in Tanzania before the study. The interviewers were trained and supervised during data collection. Since the questionnaire was in English and workers are Swahili-speaking, the questionnaire was translated and back translated by independent linguists and the two versions were compared for discrepancy to minimize information bias.

This study was prone to misclassification especially during reading and interpretation of the chest x ray films. To avoid this, films were read by two independent chest x ray readers, one of whom was NIOSH "B reader". The readings of the two readers were compared and when they differed the films were reviewed together for consensus. This study had a possibility of measurement bias during spirometry and in the exposure assessment. To minimize these the equipment used were calibrated at regular intervals. The same equipment was used each time during measurements of lung functions and during dust measurements. The measurements were done by experienced and trained technician.

The study was prone to common confounding variables which are age, sex and smoking. Other factors like social economical status and ethnicity were not important since the study was done in a cohort of workers (informal sectors) from the same social and ethnic group. Stratified and multivariate analysis were done to minimize the effect of confounding variables.

The study had the following limitations: The small sample limits the ability to study associations, but provided an opportunity to describe the health outcomes in this sample. The sample size was restricted by the size of the workforce. The workers in the quarry did not do exclusive jobs, but "multitasked" on a daily basis. This makes the calculation of individual exposures over the lifetime of work in the quarry almost impossible, despite our conduct of dust monitoring. This limits our ability to use quantitative dust measures for determining association between dust exposure and health outcomes. Instead, duration of working in the quarry was used to characterize the exposure.

There is an absence of standardised prediction equations for lung function for the people of East African origin, thus our ability to determine the difference from a “normal” lung function result was not possible. We therefore used internal standardisation to calculate likely observed lung function indices.

The lack of an analytic laboratory to conduct silica concentration in Tanzania restricted our ability to determine silica exposure among these workers. The absence of standard occupational exposure limits for respirable dust in Tanzania prevented us from relating our findings to a Tanzanian standard. Instead South African standards were considered.

### **Statistical Analysis**

Questionnaires were double-entered, with the validation procedures on EpiInfo which was used to ensure that data entry was accurate. The computer-based forms were developed such that ranges were examined for impermissible values, logic checks for ensuring answer validity and consistency and automated skip patterns were incorporated. All analysis was done using the SPSS version 15 statistical analysis package. Independent checks of range, consistency and missing data were performed before data analysis. No personal identifiers were present in the database. This information was kept in a secure filing system in a locked room.

Descriptive, bivariate and multivariate analytic techniques were used to describe the data. Before conducting formal statistical analyses, preliminary analysis was performed. Frequency distributions of categorical variables and means, standard deviations, and ranges of continuous variables collected were examined. This was followed by a bivariate analysis of outcome and exposure variables. Statistical analyses proceeded from univariate analyses, which were used to describe the characteristics of the study population and to examine the crude associations between variables of interests. Such analyses provided us with a rough picture of the data and were useful in the subsequent stratified and multivariate analyses. For categorical dependent variables, odds ratios were calculated. For continuous dependent variables, correlation coefficients were calculated. In order to consider the role of confounding or effect modification in the data, a stratified analysis was done for each potential confounder/modifier, and their role on the outcome and exposure variables was examined.

The primary outcome variables of interest were the lung function parameters FEV<sub>1</sub>, FVC and the ratio FEV<sub>1</sub>/FVC, as well as respiratory symptoms and diseases. Respiratory symptoms included chronic cough, phlegm production, wheezing and coughing blood. Respiratory diseases include doctor diagnosed asthma, chronic bronchitis, emphysema, chest tuberculosis and pneumonia. The primary exposure variable was years of exposure. Years of exposure was used as a continuous variable, and converted into low (<10years) and high (≥10 years) exposure categories. Covariates examined were smoking status and history of tuberculosis. Smoking status, history of tuberculosis, age and sex were likely confounders in this study.

Due to lack of valid lung function prediction equation for people of East African origin, internal standardisation was done while correcting for age, height and sex to obtain observed value for FVC and FEV<sub>1</sub>. **The correction for race was not considered necessary in this study.** Their corresponding percentage predicted values for FVC and FEV<sub>1</sub> were calculated using the following formula.

$$\text{Percentage predicted} = \frac{\text{observed value} * 100}{\text{“Predicted value”}}$$

Multivariable regression was conducted to determine relationships between years of exposure and lung function, while adjusting for likely confounders such as smoking, history of TB and sex. Logistic regression models for dichotomous outcomes (respiratory symptoms) and exposure variables were developed while controlling for sex, current and previous smoking status, doctor-diagnosed chronic bronchitis, asthma and chest tuberculosis. Because this sample included both men and women, stratification by sex was done during analysis.

## **Human Subjects Issues**

### **Institutional ethical clearance**

The survey of stone crushers conducted by TOHS was ethically approved by the Medical Research Coordinating Committee (MRCC) of National Institute for Medical Research Tanzania (NIMR) (the letter of approval is attached. – Appendix II). The respiratory study was submitted to, and received approval from, the Post Graduate Education Committee of the Nelson R Mandela School of Medicine and the Biomedical Research Ethics Committee of the University of KwaZulu-Natal South Africa (Appendices III and IV).

### **Permission and individual informed consent**

The permission to conduct the study at Kigamboni quarry was obtained from the respective local authority leaders and representative unions in the quarry. Because this is an informal sector, the permission from respective municipal council and ministry was not necessary. Individual informed consent was necessary for the participants. In this instance each participant was given a comprehensive explanation in a language of their choice. The content of this discussion included the aims of the research, the purpose of the interview, the tests that were to be conducted on them, use of their data and the confidentiality of all results. It was emphasized that participation was voluntary and withdrawal at any time was permitted. Each participant was asked to sign a consent form. No financial incentives were provided for participation in the study.

### **Participant's confidentiality**

All participant information was treated in the strictest of confidence, and no information was passed onto any other party, without the consent of the participant. All participants were individually given a copy of their results, together with interpretations of the data and, where applicable, a referral to an appropriate centre of their choice for further medical management. Those workers with features of compensable occupational disease were directed to assessment centers for compensation purposes. Individual results are strictly confidential and are only accessible to the research team. These results will be released to any clinician/guardian/agency should this be desired by the individual worker.

### **Publication of results and reports**

In the publication of research results, reports and in this dissertation, all data are treated as grouped, and thus no individual is identified from such documentations.

## CHAPTER IV

### RESULTS

#### Descriptive Statistics of the Study Population.

In the overall sample of 200 workers, 51.5% (n=103) were male while 48.5% (n=97) were female. Overall mean age was 36.3 years. The mean age of men was slightly less than that of females (35.5 vs. 37.2 years) while variation in terms of smoking habit was tremendous between male and female (31.1% vs. 8.2% smokers respectively). No worker was found to be using personal protective equipment while at work.

**Table 1. Demographic characteristics of the workers.**

Demographic variables	Full Sample (n=200)		Sub-sample (n=59)*	
	Male n=103	Female n=97	Male (n=28)	Female (n=31)
Age (years) (SD)	35.5 (14.5)	37.2 (12.3)	43.1 (16.4)	40.3 (10.0)
Years worked in the quarry (SD)	7.1 (9.3)	8.6 (7.3)	12.2 (11.3)	13.6 (6.7)
Height (cm) (SD)*			166.3 (6.4)	157.7 (5.1)
Weight (kg) (SD)*			60 (8.6)	61.1 (12.8)
Current smoker (%)	31 (30.1)	8 (8.3)	9 (32.1)	3 (9.7)
Never smoker (%)	70 (67.9)	88 (90.7)	19 (67.9)	27 (87.1)
Ex-smokers (%)	2 (1.9)	2 (2.1)	0	1 (3.2)

\*This data was available for those workers who underwent health assessment tests.n=59

#### Respiratory symptoms and doctor diagnosed diseases;

Reported prevalence of doctor-diagnosed respiratory diseases was relatively low, ranging from 0.97% (pulmonary tuberculosis) through to 6.8% (pneumonia). These low reports of doctor-diagnosed diseases contrasted with the prevalence of symptoms as reported by the participants, which ranged from 3.1% severe breathlessness through to 19.4% chronic cough (Table 2). Reporting of symptoms of mild breathlessness and wheeze did not differ markedly



between male and female. However, symptoms of chronic cough and chronic phlegm production did (Table 2). Men had a substantially higher reporting rate of chronic cough and cough with phlegm production (19.4% and 18.5% respectively), compared to females with rates of 7.2% and 10.3% for chronic cough and chronic phlegm production respectively. This may be reflective of the considerably higher proportion of male smokers than female smokers.

**Table 2. Reported prevalence respiratory symptoms and doctor-diagnosed diseases from stone crushers**

Symptoms and disease outcomes	MALE (n=103)(%)	FEMALE (n=97)(%)	TOTAL N=200 (%)
Doctor-diagnosed Pulmonary tuberculosis	1 (0.9)	3 (3.1)	4 (2)
Doctor-diagnosed Asthma	3 (2.9)	3 (3.1)	6 (3)
Doctor-diagnosed Pneumonia	7 (6.8)	4 (4.1)	11 (5.5)
Doctor-diagnosed Chronic bronchitis	4 (3.9)	2 (2.1)	6 (3)
Severe wheezing causing breathlessness	3 (2.9)	6 (6.2)	9 (4.5)
Wheeze or whistling	16 (15.5)	12 (12.4)	28 (14)
Moderate breathlessness	9 (8.7)	10 (10.3)	19 (9.5)
Severe breathlessness	4 (3.9)	3 (3.1)	7 (3.5)
Cough with hlegm production	19 (18.5)	10 (10.3)	29 (14.5)
Productive cough	14 (13.6)	6 (6.2)	20 (10)
Coughing blood	11(10.7)	4 (4.1)	16 (7.5)
Chronic cough	20 (19.4)	7 (7.2)	27 (13.5)

### **Lung function findings.**

Age, sex and height adjusted mean forced expiratory volume in one second (FEV<sub>1</sub>) and forced vital capacity (FVC) was 2.6L/min (SD: 0.95) and 3.67L (SD: 0.92) respectively, among the men and 2.1L/min (SD: 0.48) and 3.0L (SD: 0.6) respectively among women. FEV<sub>1</sub>/ FVC ratio was 69.86% and 70.61% for men and women respectively. (Table 3)

**Table 3. Lung functions indices**

Lung function variables	Male (n=28) Mean (SD)	Female (n=31) Mean (SD)
Forced Vital Capacity (FVC) (Litres)	3.7 (0.9)	3.0 (0.6)
Percentage predicted FVC (%)	100.1 (18.9)	103.2 (27.4)
Forced expiratory volume in 1st second (FEV1) (litres)	2.6 (0.9)	2.1 (0.5)
% predicted FEV (%)	85.7 (20.4)	84.9 (18.3)
FEV1/FVC ratio (%).	69.9 (15.8)	70.6 (8.9)

A substantial percentage of the workers had evidence of clinically important lung function deficits as determined by percentage predicted FVC <80%, percentage predicted FEV1<80% and the ratio of FEV1/FVC <70% (Table 4).

**Table 4. Clinically important lung function deficit, N=59**

Lung function parameters	Frequency (%)
<80% percentage predicted FVC	6 (10)
<80%percentage predicted FEVI	23 (39)
<70% FEV1/FVC%	24 (40.7)

### Chest radiography

The majority of films were normal (60.9%), with 19.6% as 1/0 and 19.9% as 0/1. No films were category II or above.

### Exposure assessment

There were substantial exposure differences among the different tasks within the quarry (blasting, digging and carrying, crushing, loading, sieving and sorting), with low mean levels recorded for tasks such as loading (0.1mg/m<sup>3</sup>) through to high exposures for tasks such as crushing and loading (2.8 mg/m<sup>3</sup>) (Table 5). At least 4 of the different tasks (sorting, crushing, lifting stones from pit and crushing and loading) were associated with exposures higher than 1mg/m<sup>3</sup>. The overall geometric mean of 1.2mg/m<sup>3</sup> has little value because of the non-random method of activity selection for sampling.

**Table 5. Dust concentration (GM in mg/m<sup>3</sup> and GSD) for various exposures groups and by job title in Kigamboni Tanzania**

Task	N	GM mg/m <sup>3</sup>	GSD	Range
loading	5	0.1	2.6	0.09-1.0
Digging	3	0.5	3.8	0.1-1.0
sieving	16	0.6	2.7	0.2-1.6
weighing	4	0.9	1.3	0.9-1.3
sorting	1	1.0	1.0	1.0
crushing	49	1.02	2.8	0.2-6.3
Lifting stones from pit	1	2.0	1.0	
Crushing and loading combined	4	2.8	4.4	0.8-19.9
<b>Overall</b>	<b>86</b>	<b>1.2</b>	<b>2.9</b>	<b>0.2-19.9</b>

#### **Health Outcomes and Exposure Relationship**

There was no statistically significant relationship between chest X ray categories and exposure in this study. Linear regression of lung function against years of exposure, adjusted for age, sex, height, smoking and doctor-diagnosed TB, showed statistically significant decline in 2.3mls in FEV1 for each year of exposure. This trend was also shown for FVC with a decline of 1.3mls, but this being a chance finding could not be excluded (Table 6).

**Table 6. Linear regressions of lung function indices against exposure adjusted for age, sex, smoking and doctor diagnosed TB**

	FVC (L)	FEV <sub>1</sub> (L)
Age (years)	-0.014 0.008 (-0.029-0.002)	-0.024 0.007 (-0.038- -0.011)
Sex (male=1; female=0)	0.28 0.19 (-0.11 – 0.69)	0.14 0.16 (-0.18 – 0.47)
Height (centimetres)	0.073 0.012 (0.050-0.097)	0.064 0.012 0.041-0.087
Work duration (years)	-0.013 0.012 (-0.04-0.01)	-0.023 0.011 (-0.05--0.002)
Pulmonary Tuberculosis	-0.7	-0.85
Doctor diagnosis of TB=1; no diagnosis=0)	0.36 (-1.44 – 0.02)	0.29 (-1.45 - -0.26)
Current Smoker (current smoker=1; never smoker=0)	-0.31 0.21 (-0.73 – 0.11)	-0.38 0.17 (-0.72 - -0.04)
Ex-smoker (ex-smoker=1; never smoker=0)	0.58 0.46 (-0.33 – 1.51)	-0.18 0.37 (-0.92 – 0.56)

Table shows coefficient estimate, standard error, 95% Confidence Interval

### Adjusted Exposure Odds Ratios for symptoms

Although there existed an excess exposure related risk for the symptoms of chronic cough, mild and moderate breathlessness, some were statistically significant while others were not. The results were statistically significant for mild and moderate breathlessness. The risk was elevated for all other symptoms, but not statistically significant (Table 7).

**Table 7 Adjusted Exposure Odds Ratios for symptoms from logistic regression model (N=200)**

Symptom	Odds ratio (95% CI)
Chronic cough	2.2 (0.8-6)
Chronic phlegm production	2.0 (1.7-11.5)
Mild breathlessness	3.4 (1.2-9.9)*
Moderate breathlessness	3.1 (1.4-6.8)*
Severe breathlessness	1.3 (0.2-7.3)
Wheezing	1.5 (0.6-3.9)
Severe wheezing	3.9 (0.8-18.7)
Coughing blood	1.3 (0.3-5.1)

\* indicates p value <0.05

Model adjusted for the following variables: age, sex, years of exposure and smoking.

## CHAPTER V

### DISCUSSION

This study is the first among stonecrushers in Tanzania and Southern Africa region. The results of this study, despite its limitations, is suggestive of dust related adverse respiratory outcomes among stonecrushers. The study documented a high prevalence of respiratory symptoms within a sample of workers, together with clinically important lung function deficits.

This dissertation is based on a larger project conducted among informal sector workers in Dar-es-Salaam and Maputo. The project focused on documenting the risks faced by these workers, and their overall health status. The data generated from the project provided an opportunity to describe the respiratory health of these marginalized workers, and to describe any exposure-outcome relationships. However, because the project was not *a priori* designed to address any specific epidemiological hypothesis, this restricted our ability to define any relationship with substantial confidence, if such relationships did exist.

Despite these shortcomings, stone crushers in this study had high prevalence of chronic respiratory outcomes such as chronic cough, cough with phlegm production, wheezing and moderate breathlessness similar to those which have been reported in other respirable dust-exposed workers(17, 18). Slightly higher prevalences than documented in this study have been reported in other studies among stone crushers in India: 50% for cough at night; 18% for wheezing anytime; and 40% for phlegm(19), compared to the findings in our study of 13.5%, 14% and 14.5% respectively. These differences are not surprising given the high level of exposure recorded among the Indian workers with respirable dust of 18.9mg/m<sup>3</sup> and 5% silica concentration(19). The respirable dust levels recorded in our study ranged from 0.1mg/m<sup>3</sup> – 2.8mg/m<sup>3</sup>, with a mean of 1.2mg/m<sup>3</sup>. On the contrary, doctor-diagnosed respiratory diseases like chronic bronchitis, asthma, and pneumonia among informal stone crushers were relatively low compared to the prevalence of respiratory symptoms. This is probably due to inadequacy of appropriate health facilities in this marginalized low resource setting where some diseases

are likely to be misdiagnosed or, because of the lack of such services, workers are not assessed by health professionals. The prevalence of respiratory diseases among agate stone workers exposed to respirable dust was higher (63.4%) than in this study(5). A rather unexpected finding in this study is low prevalence of doctor-diagnosed chest tuberculosis (2%). Given a substantial period of exposure to dust suspected to contain silica in the quarry, one would have expected the prevalence of pulmonary tuberculosis to have been higher given the low socio-economic status and exposure to silica dust. However, this was not the case in our study – probably due either to poor access to health services, or possibly the concentrations of silica in the respirable dust – an assessment we were not able to do.

Although lung function prediction equations have been proposed for persons of African origin,(20-21) there was a lack of confidence about the validity of these equations in this particular population: the available equations for females are from South Africa,(21) while the equations for men of East African origin have not been repeatedly tested across different populations.(20) For this reason, multivariable regression models for FEV<sub>1</sub> and FVC adjusted for age, height and gender were computed as described by Vollmer et al among a population-based sample of 2600 men and women.(22) The age, height and sex adjusted lung function parameters in our study were mean forced expiratory volume in one second (FEV<sub>1</sub>) and forced vital capacity (FVC) of 2.6L and 3.67L respectively, among the men and 2.1L/min and 3.0L respectively among women. FEV<sub>1</sub>/ FVC ratio was 69.86% and 70.61% for men and women respectively. These were similar to those seen in Indian stone workers where adjusted mean FVC and FEV<sub>1</sub> were 3.34L and 2.62L among males and 2.78L and 2.62L among females respectively(20). In this study, 10% of the workers have features of restrictive lung disease (percentage predicted FVC<80%), while 40.7% had FEV<sub>1</sub>/FVC ratio less than 70% suggestive of an obstructive defect. However, recent reports suggest that this parameter may not reliably describe obstructive lung function (26).

Our inability to perform quantitative analysis of the dust for silica was an important limitation of the study. Since the Kigamboni quarry is open to environment, the respirable dust levels are likely to be much lower than those seen in underground mine with a possible lower prevalence of adverse respiratory outcomes. This was not the case in this study where a substantial percentage of workers had respiratory symptoms such as cough, phlegm production and breathlessness. Workers were routinely exposed to high peak levels of dust during blasting, or working with rock without the necessary protective equipment or hazard controls, possible

exposure to high concentrations of respirable quartz, long hours of work and long duration of exposure. In this study, dust levels ranged from 0.5mg/m<sup>3</sup> to 2.8mg/m<sup>3</sup>. The respirable dust exposure of stone crushers was, therefore, moderately high with unknown silica content. Some tasks within the quarry exceeded internationally acceptable standards for respirable dust (blasting and loading), however, with levels much lower than levels quoted for other studies among stone crushers(1). Dust levels in this quarry do not differ much from levels found in Indian stone quarry (1-4mg/m<sup>3</sup> with mean of 2.7mg/m<sup>3</sup>)(23) but differ from levels found in Iranian stone crushers of 9.46mg/m<sup>3</sup>(24). Related studies in Indian quarries showed 8-hour time weighted average concentrations of total inhalable dust, respirable dust and respirable crystalline silica were 143 mg/m<sup>3</sup>, 39.7 mg/m<sup>3</sup> and 2.29 mg/m<sup>3</sup> respectively, which are 14, 10 and 23 times the UK workplace exposure limits, respectively(19). High dust levels in the stone crushing quarry have also been established in Southern India quarries where ambient air concentrations of dust ranging from 0.086 to 0.257mg/m<sup>3</sup> and 0.039 to 0.138mg/m<sup>3</sup>(1), compared to the UK where levels of 0.04-10mg/m<sup>3</sup> of respirable dust and quartz respectively was found (6). It is unclear why this difference existed in similar work environment.

As for any quarry, underground or opencast mine environment, respiratory symptoms and lung function loss could be attributable to silica exposure. For the silicosis to be evident, the exposure must be at least 12 years. We were not able to quantify the concentration of silica in the dust to which these workers were exposed. However, this study found no radiographic evidence of silicosis (above 1/0 according to international Labour Organization classification) despite exposure to respirable dust of a moderate degree (0.5mg/m<sup>3</sup> to 2.8mg/m<sup>3</sup>). Yet these workers were exposed to this dust for a considerable period of time (mean exposure 12.5 years). If the silica content of the dust was substantial, one would have expected several cases of silicosis since the exposure duration was enough to develop respiratory changes.

This study had a small sample size (N=200) which obviously compromised the power of the study to prove exposure-outcome relationships. Despite this shortcoming, an adjusted excess risk was found for the presence of mild breathlessness, moderate breathlessness, chronic cough and severe breathlessness with high exposure categories, although this was not statistically significant for severe breathlessness and chronic cough. Similarly, a statistically significant adjusted exposure-related dose-response loss in FEV1 was seen with increasing years of exposure to dust. The loss in lung function over 30-years working life is estimated at about 69ml. This loss is of marginal clinical significance. The dose-related loss in lung function



noted in this study is in keeping with study among Indian stone workers where a statistically significant decreasing trend in lung function was noted with increasing years of exposure, with 3.70L to 3.07L in FVC and 2.91L/min to 2.48L/min in FEV1(25).

## CHAPTER VI

### CONCLUSIONS AND RECOMMENDATIONS

In conclusion, this study identified adverse respiratory outcomes among informal stone crushers in Tanzania, particularly a high prevalence of respiratory symptoms and clinically important lung function deficits. The respirable dust exposures of this working population were moderately high, with unknown silica content. Some tasks exceed internationally acceptable standards for respirable dust. Silicosis was not evident in this study.

Innovative strategies for dust control and prevention need to be considered in this informal working environment. Because of low socio-economic status of the informal workers, limited options are available to these workers. Interventions need to include increasing awareness of dust-related hazards through training programmes to informal workers, provision of low cost dust control measures such as masks, wetting strategies and administrative controls such as leaving quarry during blasting and delayed return afterwards. However, all these require financial investment beyond the capability of these informal workers. State assistance is necessary to implement these or any hazard control strategy as well as regular medical surveillance to workers.

The study, despite being largely descriptive with a number of limitations, was able to establish dose-related relationship between exposure to respirable dust and the development of respiratory symptoms and loss of lung functions. This suggests the need for a study with substantial power to confidently characterise the exposure and establish dose-related relationships between exposure to respirable dust and health outcomes.

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## APPENDICES

## **APPENDIX I: QUESTIONNAIRE**

HEALTH SURVEY OF INFORMAL SECTOR WORKERS

A1. Date: \_\_\_\_\_ A2. Study \_\_\_\_\_  
 \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_  
 Day \_\_\_\_\_  
 Month Year \_\_\_\_\_

Identification No. 

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**This questionnaire should be addressed to the sampled worker at the place of work.**

<b>A3. Name of respondent:</b>	_____ First _____ Middle _____ Surname
<b>A4. Identity number:</b>	_____ -
<b>A5. Phone numbers:</b>	home: _____ work: _____ cell: _____
<b>A11. Interviewer's Name:</b>	_____ _____
<b>A12. Interview time started:</b>	Time: __:__ am/pm
<b>A13. [INTERVIEWER: Enter gender of respondent]</b>	<input type="checkbox"/> <sub>1</sub> Male <input type="checkbox"/> <sub>2</sub> Female

**[INTRODUCTION: INTERVIEWER READS TO RESPONDENT]**

The purpose of this questionnaire is to collect information about you, your health status, your lifestyle and your occupation. Your answers will help us figure out how to improve the health of people working in this industry. If there is a question you do not want to answer, please let me know and we can skip it. All of your responses are confidential and will not be shown to anyone outside the study team without your written consent.

### A. DEMOGRAPHICS

Now I'd like you to answer some questions about yourself.

<p><b>A14.</b> How old are you?</p>	<p>_____ years</p>
<p><b>A15.</b> What is your date of birth?</p>	<p>_____/_____/_____  day      month      year</p> <p><input type="checkbox"/><sub>9</sub> Refused</p>
<p><b>A20.</b> What is the highest grade or year of school you completed? <b>[READ CHOICES]</b></p>	<p><input type="checkbox"/><sub>1</sub> Never attended school or only pre-school</p> <p><input type="checkbox"/><sub>2</sub> Stand 1 – Std 7</p> <p><input type="checkbox"/><sub>3</sub> form 1 – form 4</p> <p><input type="checkbox"/><sub>4</sub> form 5 - form6</p> <p><input type="checkbox"/><sub>5</sub> College / university</p> <p><input type="checkbox"/><sub>9</sub> Refused</p>
<p><b>A21.</b> In which town, province and country were you born?</p>	<p>_____;</p> <p>_____ town _____ province</p> <p>country</p>

### C. YOUR HEALTH

*In this section we wish to obtain information about your health*

<p><b>A25.</b> Would you say your health in general is:</p>	<p><input type="checkbox"/><sub>1</sub> excellent</p> <p><input type="checkbox"/><sub>2</sub> very good</p>
---	---





condition?	
<b>A39.</b> Have you ever been told by a doctor that you had a stroke?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A41]</b>
<b>A40.</b> How old were you when you were first told that you had this condition?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A41.</b> Have you ever been told by a doctor that you had chronic bronchitis?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A44]</b>
<b>A42.</b> Do you still have it?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A43.</b> How old were you when you were first told that you had this condition?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A44.</b> Have you ever been told by a doctor that you had pneumonia?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A47]</b>
<b>A45.</b> Do you still have it?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A46.</b> How old were you when you were first told that you had this condition?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A47.</b> Have you ever been told by a doctor that you had emphysema?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A49]</b>
<b>A48.</b> How old were you when you were first told that you had this condition?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A49.</b> Have you ever been told by a doctor that you had hay fever?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A52]</b>
<b>A50.</b> Do you still have it?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A51.</b> How old were you when you were first told that you had this condition?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A52.</b> Have you ever been told by a doctor that you had chest tuberculosis	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A59]</b>

or TB?	
<b>A53.</b> How old were you when you were first told that you had TB?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A54.</b> How long did you take medication for TB? (First) episode of TB?	_____ months <input type="checkbox"/> <sub>0</sub> Did not take any medication
<b>A55.</b> Have you ever been told by a doctor that you had a second episode of TB?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A58]</b>
<b>A56.</b> How old were you when you were told that you had a second episode?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A57.</b> For how long did you take medication for this second episode?	_____ months <input type="checkbox"/> <sub>0</sub> Did not take any medication
<b>A58.</b> Do you still have TB?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <input type="checkbox"/> <sub>8</sub> Don't know
Have you ever had:	
<b>A59.</b> Any other chest illnesses as mentioned by a doctor?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A61]</b>
<b>A60.</b> If yes, please specify.	_____ _____
<b>A61.</b> Any chest operations?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A63]</b>
<b>A62.</b> If yes, please specify.	_____ _____
<b>A63.</b> Any chest injuries?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A65]</b>
<b>A64.</b> If yes, please specify.	_____ _____
<b>A65.</b> During the past three years have you had any chest illness which kept you from your usual activities for as	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A67]</b>

much as a week?	
<b>A66.</b> If yes to above: How many illnesses like this have you had in the past three years?	_____ number of illnesses
<b>A67.</b> Did you have any lung trouble before the age of 16?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A68.</b> Have you ever been told by a doctor that you had cataracts?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A70]</b>
<b>A69.</b> How old were you when you were first told that you had this condition?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A70.</b> Have you ever been told by a doctor that you had thyroid disease?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A73]</b>
<b>A71.</b> Do you still have it?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A72.</b> How old were you when you were first told that you had this condition?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A73.</b> Have you ever been told by a doctor that you had lupus?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A75]</b>
<b>A74.</b> How old were you when you were first told that you had this condition?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A75.</b> Have you ever been told by a doctor that you had gout?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A77]</b>
<b>A76.</b> How old were you when you were first told that you had this condition?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A77.</b> Have you ever been told by a doctor that you had skin cancer?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A79]</b>
<b>A78.</b> How old were you when you were first told that you had this condition?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know

<p><b>A79.</b> Have you ever been told by a doctor that you had any other cancer?</p>	<p><input type="checkbox"/><sub>1</sub> Yes  <input type="checkbox"/><sub>2</sub> No      <b>[GO TO A82]</b></p>
<p><b>A80.</b> How old were you when you were first told that you had this condition?</p>	<p>_____ years  <input type="checkbox"/><sub>8</sub> Don't know</p>
<p><b>A81.</b> Where was it when you were first told?</p>	<p><input type="checkbox"/><sub>1</sub> Bladder  <input type="checkbox"/><sub>2</sub> Breast  <input type="checkbox"/><sub>3</sub> Cervix (female only)  <input type="checkbox"/><sub>4</sub> Colon - rectum (large intestine)  <input type="checkbox"/><sub>5</sub> Prostate (male only)  <input type="checkbox"/><sub>6</sub> Uterus (female only)  <input type="checkbox"/><sub>7</sub> Bone  <input type="checkbox"/><sub>8</sub> Brain or nervous system  <input type="checkbox"/><sub>9</sub> Esophagus  <input type="checkbox"/><sub>10</sub> Gallbladder  <input type="checkbox"/><sub>11</sub> Hodgkin's Disease  <input type="checkbox"/><sub>12</sub> Kidney  <input type="checkbox"/><sub>13</sub> Leukemia  <input type="checkbox"/><sub>14</sub> Liver  <input type="checkbox"/><sub>15</sub> Lung  <input type="checkbox"/><sub>16</sub> Lymphoma  <input type="checkbox"/><sub>17</sub> Mouth or pharynx  <input type="checkbox"/><sub>18</sub> Ovary (female only)  <input type="checkbox"/><sub>19</sub> Pancreas  <input type="checkbox"/><sub>20</sub> Stomach  <input type="checkbox"/><sub>21</sub> Testicles (male only)  <input type="checkbox"/><sub>22</sub> Other, please specify:    <hr style="width: 100px; margin-left: 0;"/> <input type="checkbox"/><sub>88</sub> Don't know</p>
<p><b>DIABETES</b></p>	
<p><b>A82.</b> Have you ever been told by</p>	<p><input type="checkbox"/><sub>1</sub> Yes</p>

a doctor that you had diabetes or sugar diabetes?	<input type="checkbox"/> <sub>2</sub> No <b>[GO TO A88]</b> <input type="checkbox"/> <sub>8</sub> Don't know
<b>[If yes and male, SKIP the next two questions]</b>	
<b>A83.</b> Were you pregnant when you were told that you had diabetes?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A85]</b> <input type="checkbox"/> <sub>8</sub> Not applicable <b>[MALE - GO TO A85]</b>
<b>A84.</b> Other than during pregnancy, has a doctor ever told you that you had diabetes or sugar diabetes?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A88]</b>
<b>A85.</b> How old were you when you were first told that you had this condition? (not including during pregnancy)	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A86.</b> Are you <u>now</u> taking insulin?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A87.</b> Are you now taking diabetes pills to lower your blood sugar?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>HIGH BLOOD PRESSURE/CHOLESTEROL</b>	
<b>A88.</b> About how long has it been since you last had your blood pressure taken by a doctor or other health professional?	<input type="checkbox"/> <sub>1</sub> less than 6 months <input type="checkbox"/> <sub>2</sub> more than 6 months, but less than 1 year <input type="checkbox"/> <sub>3</sub> more than 1 year, but less than 5 years <input type="checkbox"/> <sub>4</sub> more than 5 years <input type="checkbox"/> <sub>5</sub> never <input type="checkbox"/> <sub>8</sub> don't know
<b>A89.</b> Have you ever been told by a doctor or other health professional that you had hypertension, also called high	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A98]</b>

blood pressure? <input type="checkbox"/>	
<b>A90.</b> Were you told on 2 or more different visits to a doctor or health professional that you had hypertension, also called high blood pressure?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A91.</b> Because of your high blood pressure, have you ever been told by a doctor or health professional to:	
<b>A92.</b> Take prescribed medication:	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A94]</b>
<b>A93.</b> If yes, are you <u>now</u> taking it?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A98.</b> Have you ever had your blood cholesterol checked?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <input type="checkbox"/> <sub>8</sub> Don't Know
<b>A99.</b> Have you ever been told by a doctor or other health professional that your blood cholesterol level was high? <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A105]</b>
<b>A100.</b> Because of your high blood cholesterol, have you ever been told by a doctor or health professional to take prescribed medication?:	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>CARDIOVASCULAR DISEASE</b>	
<b>A105.</b> Have you ever had pain or discomfort in your chest?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A112]</b>
<b>A106.</b> Do you get it when you walk uphill or hurry?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <input type="checkbox"/> <sub>3</sub> Don't walk uphill or hurry
<b>A107.</b> Do you get it when you	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No

walk at an ordinary pace on level ground?	
<b>A108.</b> What do you do if you get it while you are walking? Do you:	<input type="checkbox"/> <sub>1</sub> stop or slow down <input type="checkbox"/> <sub>2</sub> continue at the same pace
<b>A109.</b> If you stand still, is the pain or discomfort:	<input type="checkbox"/> <sub>1</sub> relieved <input type="checkbox"/> <sub>2</sub> not relieved
<b>A110.</b> How soon is the pain relieved?	<input type="checkbox"/> <sub>1</sub> 10 minutes or less <input type="checkbox"/> <sub>2</sub> more than 10 minutes
<b>A112.</b> Has a doctor ever told you that you had a heart attack?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A116]</b>
<b>A113.</b> How many heart attacks have you had?	_____ number <input type="checkbox"/> <sub>8</sub> don't know
<b>A114.</b> How old were you when you had your first heart attack?	_____ years <input type="checkbox"/> <sub>8</sub> don't know
<b>A115.</b> How old were you when you had your last heart attack?	_____ years <input type="checkbox"/> <sub>8</sub> don't know
<b>A116.</b> Have you ever had weakness or paralysis in one side of your face, an arm or a leg, lasting more than 5 minutes? <input type="checkbox"/>	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A117.</b> Have you ever had pronounced numbness, tingling or loss of sensation involving one side of your face or body and lasting more than 5 minutes? <input type="checkbox"/>	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A118.</b> Have you ever had an episode of marked loss of vision in one eye or pronounced blurring of vision in both eyes lasting more than 5 minutes? <input type="checkbox"/>	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A119.</b> Have you ever had an episode of severe dizziness lasting more than 5 minutes? <input type="checkbox"/>	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A120.</b> Have you ever had an	<input type="checkbox"/> <sub>1</sub> Yes



episode during which you experienced a problem with your ability to speak, or to understand what someone was saying to you?	<input type="checkbox"/> <sub>2</sub> No
<b>KIDNEY CONDITIONS</b>	
<b>A121.</b> Have you ever had kidney stones?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A122.</b> How many times have you had a bladder infection, also called a urinary tract infection (UTI) or cystitis?	<input type="checkbox"/> <sub>0</sub> Never or _____ times
<b>A123.</b> Have you ever had symptoms of a bladder infection (such as a pain in your bladder and frequent urination) that lasted more than 3 months?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <input type="checkbox"/> <sub>8</sub> Don't know
<b>A124.</b> Not including during pregnancy, how many times a night do you usually get up to urinate (pass water)?	<input type="checkbox"/> <sub>0</sub> none <input type="checkbox"/> <sub>1</sub> 1 <input type="checkbox"/> <sub>2</sub> 2 <input type="checkbox"/> <sub>3</sub> 3 or more times
<b>A125.</b> When you urinate (pass water) do you usually feel like you have not completely emptied your bladder?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A126.</b> Do you usually have trouble starting to urinate (pass water)?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>[IF FEMALE OR MALE UNDER 60 YEARS, GO TO A129]</b>	
<b>A127.</b> Has the force of your urinary stream or water decreased over the years?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A128.</b> Have you ever had surgery for your prostate not related to cancer?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No

<b>RESPIRATORY CONDITIONS AND ALLERGY</b>	
<b>Cough</b>	
<b>A129.</b> Do you usually cough on most days for 3 consecutive months or more during the year?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A130.</b> Do you usually cough first thing in the morning (on getting up*) in the winter?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A132]</b>
<b>A131.</b> Do you usually cough at all during the rest of the day or at night*?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>IGNORE AN OCCASIONAL COUGH</b>	
<b>A132.</b> For how many years have you had this cough?	_____ Number years
<b>*FOR INDIVIDUALS WHO WORK AT NIGHT</b>	
<b>Phlegm</b>	
<b>COUNT PHLEGM WITH FIRST SMOKE OR ON FIRST GOING OUT OF DOORS. EXCLUDE PHLEGM FROM THE NOSE. COUNT SWALLOWED PHLEGM.</b>	
<b>A133.</b> Do you usually bring up any phlegm/sputum/mucus from your chest first thing in the morning (on getting up*) in the winter?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A134.</b> Do you usually bring up any phlegm/sputum/mucus from your chest during the day (or at night*) in the winter?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A140]</b>
<b>A135.</b> Do you bring up phlegm like this on most days (or nights*) for as much as three months each year?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No

<b>A136.</b> Do you usually bring up phlegm at all on getting up or first thing in the morning?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A137.</b> For how many years have you had trouble with phlegm?	_____ years
<b>A138.</b> Have you ever coughed up blood?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A140]</b>
<b>A139.</b> Was this in the past year?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>*For individuals who work at night</b>	
<b>Episodes Of Cough And Phlegm</b>	
<b>A140.</b> Have you had periods or episodes of (increased) cough and phlegm lasting for 3 weeks or more each year?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>Breathlessness</b>	
<b>A141.</b> Are you troubled by shortness of breath when hurrying on level ground?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A142.</b> Do you get short of breath walking with other people of your own age on level ground?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A143.</b> Do you have to stop for breath when walking at your own pace on level ground?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A144.</b> Are you too breathless to leave the house or too breathless on dressing or undressing?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>Wheezing</b>	
<b>A145.</b> Does your chest ever sound	<input type="checkbox"/> <sub>1</sub> Yes

wheezy or whistling?	<input type="checkbox"/> <sub>2</sub> No [ <b>GO TO A150</b> ]
<b>A146.</b> When you have a cold?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A147.</b> Occasionally apart from colds?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A148.</b> Most days or nights?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A149.</b> For how many years has this been present?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A150.</b> How many episodes of wheezing or whistling have you had in the past 12 months?	<input type="checkbox"/> <sub>0</sub> None _____ number
<b>A151.</b> How many times in the past 12 months were you hospitalized overnight for these episodes of wheezing or whistling?	<input type="checkbox"/> <sub>0</sub> None _____ number
<b>A152.</b> Can you estimate the total cost of all these hospitalizations for the past year?  <b>[HELP RESPONDENT FIGURE OUT BY SUMMING ACROSS COST OF EACH HOSPITALIZATION</b>	<b>R</b> _____,_____  <input type="checkbox"/> <sub>8</sub> Don't know
<b>A153.</b> How many times in the past 12 months have you gone to a doctor's surgery or hospital emergency room for one of these episodes of wheezing or whistling?	<input type="checkbox"/> <sub>0</sub> None _____ number
<b>A154.</b> Can you estimate the total cost of all these visits for the past year?  <b>[HELP RESPONDENT</b>	<b>R</b> _____,_____  <input type="checkbox"/> <sub>8</sub> Don't know

<b>FIGURE OUT BY SUMMING ACROSS COST OF EACH HOSPITALIZATION]</b>	
<b>A155.</b> Have you ever had an ATTACK of wheezing that has made you feel short of breath?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A160]</b>
<b>A156.</b> How old were you when you had your first such attack?	_____ Age in years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A157.</b> Have you had 2 or more such episodes?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A158.</b> Have you ever required medicine or treatment for the(se) attack(s)?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A159.</b> Is/Was your breathing absolutely normal between attacks?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>Weather</b>	
<b>A160.</b> Does the weather affect your chest?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A163]</b>
<b>Only record "YES" if adverse weather definitely and regularly causes chest symptoms</b>	
<b>A161.</b> Does the weather make you short of breath?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A162.</b> What kind of weather?	_____
<b>Other Symptoms and Allergies</b>	
<b>A163.</b> During the past 12 months, have you had any episodes of:	
<b>A164.</b> Stuffy, itchy, running nose?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A165.</b> Watery, itchy eyes?	<input type="checkbox"/> <sub>1</sub> Yes

	<input type="checkbox"/> <sub>2</sub> No																		
<b>A166.</b> During the past 12 months, how many episodes of stuffy, itchy, running nose or watery, itchy eyes have you had?	<input type="checkbox"/> <sub>0</sub> none <input type="checkbox"/> <sub>9</sub> constantly/continuously _____ episodes																		
<b>A167.</b> Are ANY of the above symptoms (wheezing, whistling, runny nose, watery eyes etc), brought on by:																			
<b>A168.</b> Exercise or cold air?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No																		
<b>A169.</b> Animals?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No																		
<b>A170.</b> House dust?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No																		
<b>A171.</b> Strong odors?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No																		
<b>A172.</b> Air pollution?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No																		
<b>A173.</b> Work environment ( <b>PROBE:</b> do you feel better on days off)?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No																		
<b>A174.</b> Pollen?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No [ <b>GO TO A176</b> ]																		
<b>A175.</b> During which months of the year does pollen make your symptoms worse? [ <b>circle months that apply</b> ]	<input type="checkbox"/> <sub>98</sub> ALL months <table style="margin-left: 100px;"> <tr> <td></td> <td>J</td> <td>F</td> <td>M</td> <td>A</td> <td>M</td> </tr> <tr> <td>J</td> <td>J</td> <td>A</td> <td>S</td> <td>O</td> <td>N</td> </tr> <tr> <td>D</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		J	F	M	A	M	J	J	A	S	O	N	D					
	J	F	M	A	M														
J	J	A	S	O	N														
D																			
<b>ALLERGY</b>																			
<b>A176.</b> Within an hour after eating something, have you ever had a severe reaction, such as itching all over, trouble breathing, flushing, or swelling of the hands and feet?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No																		
<b>A177.</b> Within an hour after receiving	<input type="checkbox"/> <sub>1</sub> Yes																		

allergy shots or allergy tests, have you ever had a severe reaction, such as itching all over, trouble breathing, flushing, or swelling of the hands and feet?	<input type="checkbox"/> <sub>2</sub> No <input type="checkbox"/> <sub>3</sub> Never had allergy shots or tests <input type="checkbox"/> <sub>8</sub> Don't know
<b>A178.</b> Have you ever given up or had to avoid a pet because of allergies?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>SKIN PROBLEMS</b>	
<b>A179.</b> Have you ever had any kind of skin problem either at home or at work?	<input type="checkbox"/> <sub>1</sub> Yes [ <b>GO TO A180</b> ] <input type="checkbox"/> <sub>2</sub> No [ <b>GO TO A194</b> ]
<b>A180.</b> How old were you when you first noticed this skin problem?	_____ Age in years <input type="checkbox"/> <sub>8</sub> Don't know
<b>A181.</b> During the past 12 months have you had any skin problems that occurred 2 or more times?	<input type="checkbox"/> <sub>1</sub> Yes [ <b>GO TO A182</b> ] <input type="checkbox"/> <sub>2</sub> No [ <b>GO TO A190</b> ]
<b>A182.</b> If YES, which of the following problems did you have?	
<b>A183.</b> itchy or scratchy skin	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A184.</b> hives	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A185.</b> dry, scaly skin	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A186.</b> redness of the skin	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A187.</b> blisters or weeping skin	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A188.</b> burning skin	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A189.</b> Other?	<input type="checkbox"/> <sub>1</sub> other, please specify: _____
<b>A190.</b> Are you using any medicines, including any creams or ointments, for your skin problems at present?	<input type="checkbox"/> <sub>1</sub> Yes [ <b>GO TO A191</b> ] <input type="checkbox"/> <sub>2</sub> No [ <b>GO TO A192</b> ]
<b>A191.</b> Which medicines?	a. _____ b. _____ c. _____ d. _____

	e. _____
<b>A192.</b> Have you ever been told by a doctor that you had eczema?	<input type="checkbox"/> <sub>1</sub> Yes [ <b>GO TO A193</b> ] <input type="checkbox"/> <sub>2</sub> No [ <b>GO TO A194</b> ]
<b>A193.</b> How old were you when you were first told that you had this condition?	_____ years <input type="checkbox"/> <sub>8</sub> Don't know
<b>GENERAL HEALTH</b>	
<b>A194.</b> Do you think that your clothes are too large for you due to a loss of weight?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A195.</b> In the last three months, have you had diarrhea that lasted for more than three days?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A196.</b> In the last three months did you have fever for more than one month on end?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A197.</b> Have you had white sores in your mouth over the last three months?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A198.</b> Do you have swollen lymph nodes in your neck, under your arms or in your groin?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A199.</b> Have you had shingles (painful blisters or sores usually in a narrow band on one side of the head or body) over the last 12 months?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No

#### D. TOBACCO USE

<b>Cigarette use</b>	
<b>A200.</b> Have you smoked at least 100 cigarettes during your entire life (equivalent to about 5 packs)?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No [ <b>GO TO A212</b> ]
<b>A201.</b> How old were you when you first started smoking cigarettes fairly regularly?	_____ Age In Years
<b>A202.</b> Do you smoke cigarettes now?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No [ <b>GO TO A206</b> ]
<b>A203.</b> About how many cigarettes do you smoke per day?	_____ number
<b>A204.</b> For approximately how many years have you smoked this amount?	_____ years
<b>A205.</b> Was there ever a period of	<input type="checkbox"/> <sub>1</sub> Yes



a year or more when you smoked more than <b>[number in A203]</b> cigarettes per day?	<input type="checkbox"/> <sub>2</sub> No
<b>A206.</b> During the period when you were smoking the most, about how many cigarettes per day did you usually smoke?	<input type="checkbox"/> _____ } <input type="checkbox"/> <sub>1</sub> cigarettes per day number } <input type="checkbox"/> <sub>2</sub> packs per day <input type="checkbox"/> <sub>0</sub> less than 1 per day <input type="checkbox"/> <sub>98</sub> varied
<b>A207.</b> For how many years did you smoke that amount?	_____ years number
<b>A208.</b> Have you ever quit smoking for a period of one year or longer?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A209.</b> Since you first started smoking; how many years altogether have you stayed off cigarettes?	<input type="checkbox"/> <sub>0</sub> never quit smoking <input type="checkbox"/> <sub>77</sub> less than one year _____ years number
<b>A210.</b> About how old were you when you last smoked cigarettes (fairly regularly)?	_____ age <input type="checkbox"/> <sub>8</sub> don't know <input type="checkbox"/> <sub>98</sub> currently smoking <b>[GO TO A213]</b>
<b>A211.</b> About how many cigarettes per day did you usually smoke at that time?	<input type="checkbox"/> <sub>0</sub> less than 1 per day <input type="checkbox"/> _____ } <input type="checkbox"/> <sub>1</sub> cigarettes per day number } <input type="checkbox"/> <sub>2</sub> packs per day <input type="checkbox"/> <sub>98</sub> varied
<b>A212.</b> Did you quit smoking because you had a health problem that was caused or made worse by smoking?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <input type="checkbox"/> <sub>8</sub> Don't know
<b>Other Tobacco Use</b>	
<b>A213.</b> Have you ever smoked a pipe regularly? <b>YES means more than 350grams of tobacco in a lifetime</b>	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A215]</b>
<b>A214.</b> How much pipe tobacco are you smoking now? [On the average over the entire time you smoked pipes, how many grams did you smoke per week?]	_____ grams per week

<b>Cigar Use</b>	
<p><b>A215.</b> Have you ever smoked cigars regularly? <b>Yes means more than 1 cigar a week for a year</b></p>	<p><input type="checkbox"/><sub>1</sub> Yes <input type="checkbox"/><sub>2</sub> No [<b>GO TO A217</b>]</p>
<p><b>A216.</b> On the average over the entire time you smoked cigars, how many cigars did you smoke per week?</p>	<p>___ Cigars per week</p>

### **E. OCCUPATIONAL HISTORY**

These questions relate to your work experience.

<p><b>A221.</b> For whom do/did you work last in a full time job or business lasting two weeks or more?</p>	<p><input type="checkbox"/><sub>0</sub> Never employed <input type="checkbox"/> [<b>GO TO A235</b>] <input type="checkbox"/><sub>1</sub> Self-employed [<b>GO TO A223</b>] or Name _____ of _____ employer: _____ _____</p> <p><input type="checkbox"/><sub>9</sub> Refused</p>
<p><b>A222.</b> What kind of industry is/was this?</p>	<p><input type="checkbox"/><sub>1</sub> manufacturing <input type="checkbox"/><sub>2</sub> chemical <input type="checkbox"/><sub>3</sub> mining <input type="checkbox"/><sub>4</sub> public service, including teaching <input type="checkbox"/><sub>5</sub> commercial and retail <input type="checkbox"/><sub>6</sub> agricultural and farming <input type="checkbox"/><sub>7</sub> self employed professional (doctor, lawyer, accountant etc) <input type="checkbox"/><sub>8</sub> other, please specify: _____</p>
<p><b>A223.</b> What kind of work do/did you do?</p>	<p><input type="checkbox"/><sub>1</sub> general assistant <input type="checkbox"/><sub>2</sub> clerical/administrative <input type="checkbox"/><sub>3</sub> machine operator <input type="checkbox"/><sub>4</sub> farm assistant</p>

	<input type="checkbox"/> <sub>5</sub> supervisor/manager <input type="checkbox"/> <sub>6</sub> engineering, designer or planning <input type="checkbox"/> <sub>7</sub> other, please specify:
<b>A224.</b> What are/were the most important duties associated with this job?	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
<b>A225.</b> For how long (have you worked/did you work) at that job? (in months)	<input type="checkbox"/> <sub>1</sub> 12 months or less _____ months <input type="checkbox"/> <sub>2</sub> More than 12 months _____ months
What is your current job	<hr/>
What are/were the most important duties associated with this job?	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
<b>A225.</b> For how long (have you worked/did you work) at that job?	<input type="checkbox"/> <sub>1</sub> 12 months or less _____

(in months)	<input type="checkbox"/> <sub>2</sub> More than 12 months _____ months
<b>A226.</b> In your job, do you ever wear following equipment?	
<b>A227.</b> Safety glasses, goggles, or other eye protection such as face shields or welding hoods?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A228.</b> Protective gloves (other than gloves for cold weather)?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A229.</b> Dust mask?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A230.</b> Respirator?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
Protective boots	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A231.</b> Thinking of all the paid jobs or businesses you ever had, what kind of work were you doing the longest?	<input type="checkbox"/> <sub>1</sub> _____ occupation
<b>A232.</b> Considering all your employers, for how long did you do this kind of work?	<input type="checkbox"/> <sub>1</sub> less than 1 year _____ years number
<b>A233.</b> What kind of business or industry did you work in the longest period of time as a <b>[JOB IN A231]</b> ?	_____ _____ industry
<b>A234.</b> What were your main job activities or duties when you were a <b>[JOB IN A231]</b> ?	_____ _____ _____ _____
<b>A235.</b> What were you doing most of the past 12 months, working at a job or business, retired, keeping house, going to school, or something else?	<input type="checkbox"/> <sub>1</sub> working at a job or business <input type="checkbox"/> <sub>2</sub> looking for work <input type="checkbox"/> <sub>3</sub> retired <input type="checkbox"/> <sub>4</sub> keeping house <input type="checkbox"/> <sub>5</sub> going to school or full time studying <input type="checkbox"/> <sub>6</sub> other, please specify: _____
<b>A236.</b> Are you limited in the kind or	<input type="checkbox"/> <sub>1</sub> Yes

amount of work you can do because of any impairment or health problem?	<input type="checkbox"/> <sub>2</sub> No
<b>A237.</b> Are you limited in the kind or amount of housework you can do because of any impairment or health problem?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A238.</b> Are you limited in any way in any activities because of an impairment or health problem?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A239.</b> Have you ever changed your job, stopped working, or made any changes in your housework because of a disability or health problem?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
Did you	
<b>A240.</b> Change permanently to an easier job?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A241.</b> change temporarily to an easier job?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A242.</b> cut down to part-time work only?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A243.</b> have to stop working for a few months?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A244.</b> retire because of a disability?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A245.</b> have to cut down on housework?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A246.</b> stop doing all housework?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A247.</b> make some other change?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No specify: _____
<b>Hazardous Occupations and Occupational Exposures</b>	
<b>RECORD ON LINES THE NUMBER OF YEARS IN WHICH THE SUBJECT HAS WORKED IN ANY OF THE BELOW LISTED INDUSTRIES.</b>	
Have you ever worked:	
<b>A248.</b> In a quarry?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No _____ years number
<b>A249.</b> In a foundry?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No

	_____ years number
<b>A250.</b> In a pottery?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No _____ years number
<b>A251.</b> In a cotton, flax, or hemp mill?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No _____ years number
<b>A252.</b> With asbestos?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No _____ years number
<b>A253.</b> With diesel or diesel exhaust?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No _____ years number
<b>A254.</b> In sandblasting?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No _____ years number
<b>A255.</b> In tunneling?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No _____ years number
<b>A256.</b> In drilling?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No _____ years number
<b>A257.</b> In any other dusty jobs?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No _____ years number  Specify _____
<b>A258.</b> TOTAL NO. OF YEARS	_____ years number
<b>A259.</b> Have you ever been exposed to gas or chemical fumes in your work?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A262]</b> _____ years number
<b>A260.</b> Specify job/industry	_____ □□□□industry  _____ □□□□job
<b>A261.</b> Was chemical/gas exposure	<input type="checkbox"/> <sub>1</sub> Mild <input type="checkbox"/> <sub>2</sub> Moderate <input type="checkbox"/> <sub>3</sub> Severe

## F. ALCOHOL AND DRUG USE

These next questions are about drinking alcoholic beverages and are about your experience with drugs. Alcoholic beverages include beer, ale, wine, wine coolers, liquor such as whiskey, gin, rum, or vodka, and cocktails and mixed drinks containing liquor.

<b>A325.</b> In your entire life, have you had at least 12 drinks of any kind of alcoholic beverage? Do not count small tastes.	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A330]</b> <input type="checkbox"/> <sub>9</sub> Refused
<b>A326.</b> In the past 12 months did you have at least 12 drinks of any kind of alcoholic beverage?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A327.</b> In the past 12 months, how many days per week, month or year did you drink any alcoholic beverages?	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">_____</div> <div style="margin-right: 10px;">number</div> <div style="margin-right: 10px;"> <input type="checkbox"/> <input type="checkbox"/> </div> <div style="font-size: 3em; margin-right: 5px;">}</div> <div style="display: flex; flex-direction: column; gap: 5px;"> <div><input type="checkbox"/><sub>2</sub> week</div> <div><input type="checkbox"/><sub>3</sub> month</div> <div><input type="checkbox"/><sub>4</sub> year</div> </div> </div> <input type="checkbox"/> <sub>8</sub> don't know
<b>A328.</b> On the average, on the days that you drank alcohol, how many drinks did you have a day? (By a drink, I mean a 12-oz beer, a 4-oz glass of wine, or an ounce of liquor.)	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">_____</div> <div style="margin-right: 10px;">number</div> <div style="margin-right: 10px;"> <input type="checkbox"/> <input type="checkbox"/> </div> <div style="margin-right: 10px;">drinks per day</div> </div> <input type="checkbox"/> <sub>8</sub> don't know
<b>A329.</b> Was there ever a time or times in your life when you drank 5 or more drinks of any kind of alcoholic beverage almost every day?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <input type="checkbox"/> <sub>8</sub> Don't know
<b>A330.</b> Have you ever used marijuana (dagga)?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A333]</b> <input type="checkbox"/> <sub>9</sub> Refused
<b>A331.</b> About how many times in your lifetime have you used marijuana (dagga)? <b>[USE HAND CARD AQ-3]</b>	<input type="checkbox"/> <sub>1</sub> 1 or 2 times <input type="checkbox"/> <sub>2</sub> 3 to 10 times <input type="checkbox"/> <sub>3</sub> 11 to 99 times <input type="checkbox"/> <sub>4</sub> 100 or more times
<b>A332.</b> During the past month, on how many days did you use marijuana (dagga)?	<input type="checkbox"/> <sub>0</sub> none in the past month <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">_____</div> <div style="margin-right: 10px;">number</div> <div style="margin-right: 10px;">days</div> </div>
<b>A333.</b> Have you ever used crack or cocaine in any form?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A336]</b> <input type="checkbox"/> <sub>9</sub> Refused

<p><b>A334.</b> About how many times in your lifetime have you used crack or cocaine (in any form)?  <b>[USE HAND CARD AQ-3]</b></p>	<p><input type="checkbox"/><sub>1</sub> 1 or 2 times  <input type="checkbox"/><sub>2</sub> 3 to 10 times  <input type="checkbox"/><sub>3</sub> 11 to 99 times  <input type="checkbox"/><sub>4</sub> 100 or more times</p>
<p><b>A335.</b> During the past month, on how many days did you use crack or cocaine (in any form)?</p>	<p><input type="checkbox"/><sub>0</sub> none in the past month  _____ days  number</p>

**G. REPRODUCTIVE HEALTH**

<p><b>ASK THE FOLLOWING QUESTIONS ONLY IF THE RESPONDENT IS FEMALE, IF NOT, SKIP TO NEXT SECTION</b></p>	
<p>The next questions ask about your periods or menstrual cycle and pregnancy history.</p>	
<p><b>A336.</b> How old were you when your or menstrual cycles (periods) started?</p>	<p>_____ years  age <input type="checkbox"/>  <input type="checkbox"/><sub>8</sub> don't know</p>
<p><b>A337.</b> Were you younger than 10, 10 to 12, 13 to 15, or 16 or older?</p>	<p><input type="checkbox"/><sub>1</sub> younger than 10  <input type="checkbox"/><sub>2</sub> 10 - 12  <input type="checkbox"/><sub>3</sub> 13 - 15  <input type="checkbox"/><sub>4</sub> older than 15  <input type="checkbox"/><sub>8</sub> don't know</p>
<p><b>A338.</b> Have you ever been pregnant? Please include miscarriages, stillbirths, tubal pregnancies, abortions, live births, and current pregnancy.</p>	<p><input type="checkbox"/><sub>1</sub> Yes  <input type="checkbox"/><sub>2</sub> No <b>[GO TO A396]</b></p>
<p><b>A339.</b> How many times have you been pregnant? Again, be sure to count all your pregnancies whether they ended in miscarriage, stillbirth, tubal pregnancy, abortion, or live birth. (Include current pregnancy.)</p>	<p>_____ pregnancies  number</p>
<p><b>A340.</b> What is the total number of live births (live-born children) you have had?</p>	<p><input type="checkbox"/><sub>0</sub> none <b>[GO TO A344]</b>  <input type="checkbox"/><sub>1</sub> one live birth  _____ live births  number</p>
<p><b>A341.</b> How old were you at the time of your last live birth? (yrs)</p>	<p>_____ age</p>
<p><b>A342.</b> How old were you at the time of your first live birth? (yrs)</p>	



	_____ age
<b>A343.</b> Did you breastfeed (your child/any of your children)?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <input type="checkbox"/> <sub>3</sub> No children
<b>A344. Ask age of female respondent</b>	<input type="checkbox"/> <sub>1</sub> Female greater than or equal to 50 years old <b>[GO TO A352]</b> <input type="checkbox"/> <sub>3</sub> Female less than 50 years old <b>[continue with following questions]</b>
<b>A345.</b> Are you now pregnant?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A348]</b> <input type="checkbox"/> <sub>8</sub> don't know <b>[GO TO A348]</b>
<b>A346.</b> Which month of pregnancy are you in?	_____ months number
<b>A347.</b> (Besides this pregnancy) have you been pregnant in the past 2 years?	<input type="checkbox"/> <sub>1</sub> Yes, has been pregnant in the past two years <b>[do not include current pregnancy]</b> <input type="checkbox"/> <sub>2</sub> No, current pregnancy only <b>[GO TO A349]</b> <input type="checkbox"/> <sub>3</sub> No, has not been pregnant in the last two years <b>[GO TO A349]</b>
<b>A348.</b> How many months ago did your (last) pregnancy end?	<input type="checkbox"/> <sub>1</sub> less than four months ago <input type="checkbox"/> <sub>2</sub> more than four months, less than seven months <input type="checkbox"/> <sub>3</sub> more than seven months, less than 10 months <input type="checkbox"/> <sub>4</sub> 10 – 12 months ago <input type="checkbox"/> <sub>5</sub> 13 – 24 months ago
<b>A349.</b> Are you now breastfeeding a child?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No
<b>A350.</b> Have you had a period in the past 12 months?	<input type="checkbox"/> <sub>1</sub> Yes <input type="checkbox"/> <sub>2</sub> No <b>[GO TO A352]</b> <input type="checkbox"/> <sub>8</sub> don't know <b>[GO TO A352]</b>
<b>A351.</b> About how long ago was your last period?	<input type="checkbox"/> <sub>1</sub> having it now <b>[GO TO A354]</b> <input type="checkbox"/> <sub>2</sub> less than 2 months ago <b>[GO TO</b>

	<p><b>A354]</b></p> <p><input type="checkbox"/><sub>3</sub> 2-3 months <b>[GO TO A354]</b></p> <p><input type="checkbox"/><sub>4</sub> 4-6 months ago <b>[GO TO A354]</b></p> <p><input type="checkbox"/><sub>5</sub> 7-9 months ago <b>[GO TO A354]</b></p> <p><input type="checkbox"/><sub>6</sub> 10-12 months ago <b>[GO TO A354]</b></p>
<p><b>A352.</b> About how old were you when you had your last period?</p>	<p>_____ years</p> <p>age <input type="checkbox"/></p> <p><input type="checkbox"/><sub>8</sub> don't know</p>
<p><b>A353.</b> Were you younger than 20, 20 to 29, 30 to 39, 40 to 44, 45 to 49, 50 to 54, or 55 or older?</p>	<p><input type="checkbox"/><sub>1</sub> younger than 20</p> <p><input type="checkbox"/><sub>2</sub> 20 - 29</p> <p><input type="checkbox"/><sub>3</sub> 30 - 39</p> <p><input type="checkbox"/><sub>4</sub> 40 - 44</p> <p><input type="checkbox"/><sub>5</sub> 45 - 49</p> <p><input type="checkbox"/><sub>6</sub> 50 - 54</p> <p><input type="checkbox"/><sub>7</sub> older than 55</p> <p><input type="checkbox"/><sub>8</sub> don't know</p>
<p><b>IF RESPONDENT IS CURRENTLY PREGNANT, SKIP, OTHERWISE ASK</b></p>	
<p><b>A354.</b> Have you had a hysterectomy? <b>Define if necessary:</b> Has your uterus/womb been removed?</p>	<p><input type="checkbox"/><sub>1</sub> Yes</p> <p><input type="checkbox"/><sub>2</sub> No <b>[GO TO A356]</b></p> <p><input type="checkbox"/><sub>8</sub> don't know <b>[GO TO A356]</b></p>
<p><b>A355.</b> How old were you when you had your (hysterectomy/uterus/womb removed)?</p>	<p>_____</p> <p>age</p>
<p><b>A356.</b> Have you had one or both of your ovaries removed (either when you had your uterus removed or at another time)?</p>	<p><input type="checkbox"/><sub>0</sub> not removed <b>[GO TO A358]</b></p> <p><input type="checkbox"/><sub>1</sub> one</p> <p><input type="checkbox"/><sub>2</sub> both</p> <p><input type="checkbox"/><sub>8</sub> don't know <b>[GO TO A358]</b></p>
<p><b>A357.</b> How old were you when you had your (ovary/ovaries) removed?</p>	<p>_____ years</p> <p>age <input type="checkbox"/></p> <p><input type="checkbox"/><sub>8</sub> don't know</p>
<p><b>A358.</b> Have you had a tubal ligation?</p>	<p><input type="checkbox"/><sub>1</sub> Yes</p> <p><input type="checkbox"/><sub>2</sub> No</p> <p><input type="checkbox"/><sub>8</sub> don't know</p>

<p><b>A359.</b> How old were you when you had a tubal ligation?</p>	<p>_____ age <input type="checkbox"/>  <input type="checkbox"/>_8 don't know</p>
<p>Now I'm going to ask you about your past and current use of female hormone pills, including birth control pills and estrogen pills.</p>	
<p><b>A360.</b> Have you ever taken birth control pills for any reason?</p>	<p><input type="checkbox"/>_1 Yes  <input type="checkbox"/>_2 No <b>[GO TO A362]</b></p>
<p><b>A361.</b> How old were you when you began taking birth control pills?</p>	<p>_____ years  age</p>
<p><b>A362.</b> Have you ever used an intrauterine device (IUD) for birth control?</p>	<p><input type="checkbox"/>_1 Yes  <input type="checkbox"/>_2 No <b>[GO TO A364]</b></p>
<p><b>A363.</b> How old were you when you had this inserted?</p>	<p>_____ years  age</p>
<p><b>A364.</b> Have you ever had birth control medication inserted under your skin?</p>	<p><input type="checkbox"/>_1 Yes  <input type="checkbox"/>_2 No <b>[GO TO A366]</b></p>
<p><b>A365.</b> How old were you when you had this medication inserted under your skin?</p>	<p>_____ years  age</p>
<p><b>A366.</b> Have you ever taken estrogen or female hormone pills by mouth other than oral contraceptive pills?</p>	<p><input type="checkbox"/>_1 Yes  <input type="checkbox"/>_2 No <b>[GO TO A368]</b>  <input type="checkbox"/>_8 don't know <b>[GO TO A368]</b></p>
<p><b>A367.</b> How old were you when you first took the estrogen or female hormone pills?</p>	<p>_____ years  age <input type="checkbox"/>  <input type="checkbox"/>_8 don't know</p>

Thank you for your time for these questions.

We may need to contact you again to obtain additional information. Please give me the name, address and telephone number of two relatives or friends who would know where you could be reached in case we have difficulty in contacting you.

Name of first contact person:

\_\_\_\_\_

Telephone number of first contact person:

\_\_\_\_\_

Address of first contact person:

\_\_\_\_\_

\_\_\_\_\_

House No.

Road/Street

\_\_\_\_\_

\_\_\_\_\_

Suburb/Township

Postal Code

Relationship of contact person to you:

\_\_\_\_\_

Name of second contact person:

\_\_\_\_\_

Telephone number of second contact person:

\_\_\_\_\_

Address of second contact person:

\_\_\_\_\_

\_\_\_\_\_

House No.

Road/Street

\_\_\_\_\_

\_\_\_\_\_

Suburb/Township

Postal Code

Relationship of contact person to you: \_\_\_\_\_

**THANK YOU FOR COMPLETING THIS QUESTIONNAIRE!**

END: Thank you for helping us!

Interview completed at:

Time: \_\_ \_\_: \_\_ \_\_ am / pm

**[INTERVIEWER: Indicate quality of interview**

<sub>1</sub> reliable

<sub>2</sub> unreliable]

**APPENDIX II**  
**ETHICS APPROVAL FROM THE MEDICAL RESEARCH**  
**COORDINATING COMMITTEE (MRCC) OF NATIONAL INSTITUTE**  
**FOR MEDICAL RESEARCH TANZANIA (NIMR)**

THE UNITED REPUBLIC OF  
TANZANIA



National Institute for Medical Research  
P.O. Box 9653  
Dar es Salaam  
Tel: 255 22 2121400/390  
Fax: 255 22 2121380/2121360  
E-mail: [headquarters@nimr.or.tz](mailto:headquarters@nimr.or.tz)

Ministry of Health  
P.O. Box 9083  
Dar es Salaam  
Tel: 255 22 2120262-7  
Fax: 255 22 2110986

NIMR/HQ/R.8a/Vol. IX/532

15<sup>th</sup> March 2007

Dr F Kessy  
Tanzania Occupational Health Services  
P O Box 3520  
DAR ES SALAAM

**CLEARANCE CERTIFICATE FOR CONDUCTING  
MEDICAL RESEARCH IN TANZANIA**

This is to certify that the research entitled: Occupational health of informal sector stone crushers in Dar es Salaam, (F Kessy), whose Principal Investigator is F Kessy, has been granted ethics clearance to be conducted in Tanzania.

The Principal Investigator of the study must ensure that the following conditions are fulfilled:

1. Progress report is made available to the Ministry of Health and the National Institute for Medical Research, Regional and District Medical Officers after every six months.
2. Permission to publish the results is obtained from National Institute for Medical Research.
3. Copies of final publications are made available to the Ministry of Health and the National Institute for Medical Research.
4. Any researcher, who contravenes or fails to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine.

Name: Dr Andrew Y Kitua

Name: Dr Zakaria A. Berege

Signature

CHAIRMAN  
MEDICAL RESEARCH  
COORDINATING COMMITTEE

Signature

AG CHIEF MEDICAL OFFICER  
MINISTRY OF HEALTH, SOCIAL  
WELFARE

CC: RMO  
DMO

## **APPENDIX III: PROTOCOL APPROVAL**





10 June 2010

Professor R Naidoo  
Occupational & Environmental Health  
Howard College

Dear Professor Naidoo

**PROTOCOL: "Respiratory Health of Informal Stone Crushers in Dar Es Salaam, Tanzania," Kessy F, M-PH, Student Number 207528647**

The Postgraduate Education Committee ratified the approval of the above mentioned study on 01 June 2010.

Please note:

- The Postgraduate Education Committee must review any changes made to this study.
- The study may not begin without the approval of the Biomedical Research Ethics Committee.

May I take this opportunity to wish the student every success with the study.

Yours sincerely

**PROFESSOR SJ BOTHA**  
**DEAN: INTERNATIONAL STUDENTS**

CC: Florian Kessy

**Postgraduate Education Administration**  
**Medical School Campus**

Postal Address: Private Bag 7, Congella, 4013, South Africa

Telephone: +27 (0)31 260 4639    Facsimile: +27 (0)31 260 4723    Email: [ramlalm@ukzn.ac.za](mailto:ramlalm@ukzn.ac.za)    Website: [www.ukzn.ac.za](http://www.ukzn.ac.za)

Founding Campuses:    ■ Edgewood    ■ Howard College    ■ Medical School    ■ Pietermaritzburg    ■ Westville

**APPENDIX IV: BIOMEDICAL ETHICS APPROVAL**



**UNIVERSITY OF  
KWAZULU-NATAL**

**BIOMEDICAL RESEARCH ETHICS ADMINISTRATION**  
Research Office, Westville Campus  
Govan Mbeki Building  
Private Bag X 54001  
Durban  
4000  
KwaZulu-Natal, SOUTH AFRICA  
Tel: 27 31 2604769 - Fax: 27 31 2604609  
Email: [BREC@ukzn.ac.za](mailto:BREC@ukzn.ac.za)

Website: <http://research.ukzn.ac.za/ResearchEthics11415.aspx>

**19 November 2009**

Dr Florian Kessy  
c/o Department of Occupational and Environmental Health  
Nelson R. Mandela School of Medicine  
University of KwaZulu- Natal

Dear Dr Kessy

**PROTOCOL: Respiratory Health of Informal Stone Crushers in DAR ES SALAAM  
Tanzania. Dr. F Kessy, Department of Occupational and Environmental Health.  
REF:BE020/09.**

## **EXPEDITED APPLICATION**

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application dated 06 February 2009.

The study was approved pending appropriate responses to queries raised. Your responses received on 12 October 2009 to queries raised on 30 September 2009 have been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have now been met and the study is given full ethics approval and may begin as from today; **19 November 2009.**

This approval is valid for one year from **19 November 2009.** To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2004), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at <http://research.ukzn.ac.za/ResearchEthics11415.aspx>.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be **RATIFIED** at a full sitting Research Ethics Committee meeting to be held on **08 December**

We wish you well with this study. We would appreciate receiving publications arising out of this study.

Yours sincerely

A handwritten signature in black ink, appearing to read 'D.R. Wassenaar', written in a cursive style.

**Professor D.R. Wassenaar**  
**Chair: Biomedical Research Ethics Committee**