ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

Assessment Of Prevalence And Asociated Factors Of Work Related Musculoskeletal Disorders Among Cobble Stone Workers In Addis Ababa, Ethiopia.

By: Samerawit Teklu.

Advisor : Yifoker Tefera(Msc, Bsc)

A thesis to be submitted to the school of public health for the partial fulfillment of the requirement for master's degree in public health (MPH).

June 2017

Addis ababa, Ethiopia

ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

SCHOOL OF PUBLIC HEALTH

Name of investigator	Samerawit Teklu
Name of Advisor(s)	Yifoker Tefera (Bsc,Msc)
Full title of the research project	Assessment of prevalence and associated factors of work related musculoskeletal disorders among cobble stone workers in Addis Ababa, Ethiopia
Duration of project	December 2016- June 2017
Study Area	Addis Ababa
Total Cost of the project	40,733 Eth birr
Address of investigator	Tel: 0913465829 Mail: Alukonjo@gmail.com

Table of contents

Contents

Acknowledgement IV

List of tables and figures V

Abbreviations VI

Abstract VII

Chapter one 1

1. Introduction 1

1.1. Back ground of the study 1

1.2. Statement of the problem 3

1.3. Rationale and significance of the study 5

Chapter two 6

2. Literature review 6

2.1. General overview 6

2.2. Global magnitude of work related musculoskeletal disorder 6

2.3. Magnitude of WMSDs in construction and related works 7

2.4. Factors for work related musculoskeletal disorder 8

2.4.1. Sociodemographic factors 8

2.4.2. Psychosocial , behavioral and individual factors 9

2.4.3. Occupational factors 10

2.4.4. Ergonomic related factors 11

2.5. Conceptual frame work 12

Chapter three 14

3. Objective 14

3.1. General objective 14

3.2. Specific objectives 14

Chapter four 15

4. Methods 15
4.1. Study area 15
4.2. Working conditions 15
4.3. Study design and period 16
4.4. Populations 16
4.5. Inclusion and exclusion criteria 16
4.6. Sample size 16
4.7. Sampling procedure 18
4.8. Data collection tools 19
4.8.1. Nordic musculoskeletal questioner 19
4.8.2. Quick exposure cheek 19
4.9. Data collection procedure 20
4.10. Variables 20
4.11. Data quality control 20
4.12. Operational definitions 21
4.13. Data analysis procedures 22
4.14. Data management 23
4.15. Ethical consideration 23
4.16. Dissemination of results 23
Chapter five 24
5. Results 24
5.1. Sociodemographic characteristics 24
5.2. Behavioral and psychosocial characteristics 25
5.3. Occupational and work place characteristics 26
5.4. Working posture 27
5.5. Prevalence of WMSD 28
5.6. Number of body parts affected 29
5.7. Ergonomic hazard exposure assessment 29
5.8. Bivariate analysis 33
5.8.1. Sociodemographic factors 33

5.8.2. Psychosocial and individual factors 33
5.8.3. Occupational and ergonomic factors 34
5.9. Multivariable analysis 37
Chapter six 39
6. Discussions 39
6.1. Strengths and limitation 41
7. Conclusions and recommendations 42
7.1. Conclusion 42
7.2. Recommendation 42
8. Reference 43
Annex 1 47
Information Sheet and consent form of study participants 47
Annex 2 49
Questionnaire for assessment of magnitude and associated factors of musculoskeletal disorder among cobble stone workers 49
Annex 3 56
Quick exposure cheek method and score table for assessment of prevalence and associated factors musculoskeletal disorder among cobble stone workers 56
Annex IV Amharic version of information sheet and consent form 58
Annex V Amharic version of questionnaire 59

Acknowledgement

First of all I would like to thank the almighty God who helped me throughout my work. My deepest gratitude goes to my advisor Yifoker Tefera (Bsc, Msc) for his unlimited support, essential guidance, warmth welcome and sincerity while working on this thesis.I am also grateful To Dr Abera Kumie for his constructive advices and valuable commentes and unreserved sharing of proffetional knowledge.

I would like to thank the Norwegian Program for Capacity Development in Higher Education and Research for Development (NORHED) for providing finicial support for this study.

I would like to gratitude the staffs of cobble stone project cooperation office, the coordinators of Gewasa, Lemi, and Gelan and Katila cobble stone sites for their cooperation during data collection. Last but not least my special thanks goes to all the data collectors and those who participated in the study.

List of tables and figures

List of figure

Figure 1 Schematic representation of conceptual frame work 13
Figure 2 13
Figure2 Task flow chart of cobble stone production..16
Figure 3 Schematic representation of sampling procedure..18
Table 1:Ergonomic hazard exposure level categories by Quick exposure cheek 23
Table 2: Sociodemographic characteristics of cobblestone workers in Addis Ababa ,Ethiopia,2017 24
Table 3: Individual and psychosocial characteristics of cobblestone workers in Addis Ababa Ethiopia,2017 25
Table 4: Occupational and working environment factors among cobblestone workers in Addis Ababa Ethiopia,2017 26
Table 5: Ergonomic and work place factors among cobble stone workers in Addis Ababa ,Ethiopia,2017 27
Figure 4: 12 month and 7 day prevalence of WRMSD among cobblestone workers in Addis Ababa Ethiopia,2017 28
Table 6: Ergonomic exposure level determined by using quick exposure cheek (QEC) of chiseling activity of cobblestone workers in Addis Ababa, Ethiopia(n=56)...30
Figure 5: photo of chiseling activity at cobblestone production site in Addis Ababa..............................31
Figure 6: photos of chiseling activity at cobblestone sites in Addis Ababa 32
Table 7: Bivariate analysis of sociodemographic factors with WMSD among cobblestone workers in Addis Ababa Ethiopia...33
Table 8: Bivariate analysis of psychosocial and individual factors with WRMSD among cobblestone workers in Addis Ababa Ethiopia 34
Table 9: Bivariate association of occupational and ergonomic factors with WMSD among cobblestone workers in Addis Ababa Ethiopia...36
Table 10: Multivariate logistic regression of factors associated with WRMSD among cobble stone workers in Addis Ababa Ethiopia,2017 38

List of tables

Figure 1 Schematic representation of conceptual frame work 13
Figure2 Task flow chart of cobble stone production..16
Figure 3 Schematic representation of sampling procedure..18
Table 1:Ergonomic hazard exposure level categories by Quick exposure cheek 23
Table 2: Sociodemographic characteristics of cobblestone workers in Addis Ababa ,Ethiopia,2017 24
Table 3: Individual and psychosocial characteristics of cobblestone workers in Addis Ababa Ethiopia,2017 25
Table 4: Occupational and working environment factors among cobblestone workers in Addis Ababa Ethiopia,2017 26
Table 5: Ergonomic and work place factors among cobble stone workers in Addis Ababa ,Ethiopia,2017 27
Figure 4: 12 month and 7 day prevalence of WRMSD among cobblestone workers in Addis Ababa Ethiopia,2017 28
Table 6: Ergonomic exposure level determined by using quick exposure cheek (QEC) of chiseling activity of cobblestone workers in Addis Ababa, Ethiopia(n=56)...30

FIGURE 5: PHOTO OF CHISELING ACTIVITY AT COBBLESTONE PRODUCTION SITE IN ADDIS ABABA..............................31
FIGURE 6: PHOTOS OF CHISELING ACTIVITY AT COBBLESTONE SITES IN ADDIS ABABA 32
TABLE 7: BIVARIATE ANALYSIS OF SOCIODEMOGRAPHIC FACTORS WITH WMSD AMONG COBBLESTONE WORKERS IN ADDIS ABABA ETHIOPIA...33
TABLE 8: BIVARIATE ANALYSIS OF PSYCHOSOCIAL AND INDIVIDUAL FACTORS WITH WRMSD AMONG COBBLESTONE WORKERS IN ADDIS ABABA ETHIOPIA 34
TABLE 9: BIVARIATE ASSOCIATION OF OCCUPATIONAL AND ERGONOMIC FACTORS WITH WMSD AMONG COBBLESTONE WORKERS IN ADDIS ABABA ETHIOPIA..36
TABLE 10: MULTIVARIATE LOGISTIC REGRESSION OF FACTORS ASSOCIATED WITH WRMSD AMONG COBBLE STONE WORKERS IN ADDIS ABABA ETHIOPIA,2017 38

Abbreviations

BMI –Body Mass Index

BOLSA-Beuro Of Labour And Social Affairs

CPCO- Cobblestone Project Coordination Office

CI –Confidence Interval

Eth- Ethiopian Birr

ILO –International Labor rganization

MSD –Musculoskeletal Disorder

MSDs –Musculoskeletal Disorders

NMQ- Nordic Musculoskeletal Questionnaire

OR –Odds Ratio

OSHA –Occupational Safety And Health Authority

QEC – Quick Exposure Cheek

SPSS – Statistical Package For Social Science

UK – United Kingdom

WHO –World Health Organization

WRMSD –Work Related Musculoskeletal Disorders

Abstract

Background- Cobblestone production is highly labor intensive and physically demanding work that exposes workers for musculoskeletal disorders. Evidences on measuring exposure level are limited in this area. As a result studying the magnitude and factors incorporating the ergonomic hazard exposure level measurement is crucial.

Objective- The main objective of the study is to assess the prevalence and associated factors of work related musculoskeletal disorders among cobble stone workers.

Methods- Cross-sectional study was conducted from December 2016-June 2017 among cobble stone workers in Addis Ababa with a sample size of 537 using Nordic muscoloskletal disorder assessmet questionnaire and 56 paicipants using quick exposure cheek ergonomic hazard assessment tool. The data were collected by interviewing participants by trained six data collectors and three supervisors. The data were entered and cleaned using epi info version 7 and imported to statistical package for social science software version 20 for analysis. The data were analyzed using descriptive statistical method for magnitude and using bivariate and multivariable logistic regression models to identify factors associatiated with work related musculoskeletal disorder.

Results- A total of 512 respondents included in this study, with 95% response rate.Over all 12 month prevalence 417(81.4%) of work related musculoskkletal disorder were obtained. From different body parts lower back is 65.5%, wrist 51.6%, shoulder 47.9% and neck 24.2% were found. Job stress (OR=1.75), working days (OR=3.38), awkward working posture (OR=3.29), lack of break time (OR=2.2) and ergonomic training (OR=2.9) found to be have statistically significant association with work related musculoskeltal disorder.The result obtained from quick exposure cheek reveals that exposure level of very high for back,high and very high for shoulder and wrist and moderate for neck.

Conclusion and recommendation- Work related musculoskletal disorder among cobblestone workers are characterized with very high prevalence with high and very high ergonomic hazard exposure level for majority of body parts. Work load, twisting bending position, lack of break and lack of ergonomic training are factors for the development of work related musculoskletal disorders therefore ergonomic training mainly focusing on manual handling should be provided.

Chapter one

1. Introduction

1.1. Background of the study

A work-related musculoskeletal disorder (WRMSD) is an injury of the muscles, tendons, ligaments, nerves, joints, cartilage, bones, or blood vessels in the arms, legs, head, neck, or back that is caused or aggravated by work tasks such as lifting, pushing,pulling, repetitive task, awkward posture. Symptoms include pain, stiffness, swelling, numbness, and tingling. Lifting and moving, and other repetitive tasks create a high risk for back injury and other musculoskeletal disorders(1).

Globally WRMSDs are characterized in higher prevalence estimated to account around 37% of the global work related illness and injuries(2).United State bureau of labor statistics reported the overall incidence rate of nonfatal occupational injury and illness cases requiring days away from work to recuperate to be 107.1 cases per 10,000 full-time workers in 2014 in which WRMSD accounts 32%(3).

Factors that are frequently mentioned along with WRMSD studies could broadly classified as physical, psychosocial, individual,workplace and ergonomic factors(4). Psychosocial and individual factors include job stress, job satisfaction, comfort of working environment, familial and co worker relation ,substance use, physical exercise, body mass index (BMI) (5).Occupational and ergonomic factors includes working posture, physical load, workers awareness of posture ,working time ,rest breaks ,working activities and task pace(6).

Exposure measurement of WRMSD using posture analysis methods is common in epidemiological studies. There are posture analysis methods like Rapid entire body assessment(REBA),Rapid Upper Limb Assessment (RULA), Ovako Working posture Analysis System (OWAS), Quick exposure cheek method (QEC) that are developed and validated by professionals (7). These posture analysis methods have their own weakness and strength. The quick exposure cheek method (QEC) has been used in variety of tasks including stone processing and other industries. QEC is a validated tool among variety of tasks and tested to have high

sensitivity and usability and chosen frequently for its simplicity, time saving and free availability(8, 9).

Cobble stone work production was first introduced in Ethiopia hundred years back during the construction of Ethio-Djibouti rail way. The project was well organized and introduced in regions of Ethiopia in very recent time; it was introduced in Addis Ababa by the year 2008 (10).The organizational set up of cobblestone project functions both at city and sub city level. The cobble stone project coordination office coordinates and harmonizes the overall activities of the project in different sub-cities. It has developed beneficiary's selection criteria targeting unemployed women and youth, people with disability, technical and vocational school(TVET) graduates and Homeless people. Male dominates the overall working population being around 75% of the total.

Activities within construction trades require the use of hand tools and power tools, requiring the use of multiple body regions, constant movement in awkward positions, and repetitive, forceful, use of the back and upper and lower extremities which exposed workers for high risk of WRMSD(11).Cobble stone work is a type of job in the construction which involves tasks of extracting raw materials cutting, shaping activities that involve manual handling in most of the activities but sometimes supports by machineries.

Stone and masonry works are among the first from lists of highly hazardous occupations in terms of injury and WRMSD(12, 13). It involves processing rough and ready stone into masses and blocks by cutting, shaping, breaking, processing, polishing, removal of sections, etc into desirable sizes, patterns and degrees of finishing; this is done by using manual and mechanical work tools, for the purpose of building, decorating, creation of statues and similar goals (13). Activities in cobble stone production sites are highly labor intensive; working conditions engages four main step by step activities, the process of extracting raw stone(quarrying),cutting stone in to smaller sizes, production of 10 X 10 sized stone(chiseling) and layering of roads with prepared stone(paving).

The need for expansion of urban road coverange would also increase the demand for healthy human power in the road construction sectors. Therefore this study will assess work related musculoskeletal disorder and associated factors among construction workers.

1.2. Statement of the problem

Cobblestone production process is highly labor intensive starting from extracting raw stone to shaping, resizing and layering. Most activities are done manually using mechanical hand tools which need forceful exertion and repetitive hand movement maintaining static posture for prolonged time that have greater risk of developing WRMSD(12). The prevalence of WRMSD reported from epidemiological studies of different countries among construction workers with similar working activities with cobble stone workers record large magnitude. A prevalence study done in India among small scale manual metal sheet workers reported 45% of overall WRMSD prevalence(14).Study done in India among stone cutters reported that occupation-related discomfort mostly affecting the lower back (97%), knees (85%) and shoulders (77%)(15).

Scientific studies provided evidence of an association between musclosketal disorders(MSDs) and work-related physical factors with high levels of exposure and combination with exposure to more than one physical factor(16). The parts of the body affected and the extent of the injury are different for different kinds of working condition(17).Workers specifically from unorganized sectors tend to be more exposed to the development of WRMSD due to demanding, aggressive nature of the work though the level and extent of injury varies for different working groups(17).Construction works, mining; stone quarry and cutting sectors are highly exposed to work related musculoskeletal disorders. A ten year follow up in Germany study shows that increased risk and disability from musculoskeletal disorders in the construction sector(18).

In Ethiopia there is lack of evidence on musculoskeletal disorder specifically among cobble (2, 3)stone workers,only one study done in Gonder among different construction workers shows a significantly high prevalence(64%) of WRMSD(19).However the prevalence of WRMSD of high risk workers in construction sector like cobblestone workers never had been studied, the prevalence of WRMSD studied among different working groups are available. Garment workers reported 51.7% and 45%, for neck and shoulder respectively(20). Prevalence study reveals 57.1% annual prevalence of WRMSD among nurses(21). These studies are also limited on exposure measurement of WRMSD using exposure measurement tools.

Addis Ababa, a fast growing city have a growing demand in road construction as a result an increasing demand for raw materials and productive man power. According to Addis Ababa road construction authority report the road coverage in the city is 12.21% and should be raised to

urban city standard road coverage, i.e. 25%. The cobble stone project is an emerging and main contributor to fulfill the road demand of the city(10).

There are more than 20000 workers involved in cobble stone production in Addis Ababa. Workers involved in cobble stone road construction are highly engaged in high physical demanding works with awkward position, repetitive works and over exertion. The stressful and competitive nature of the work explained as the workers have to produce the stone as many as possible because they are paid per the amount of stone they produce(22).

The situation that these cobble stone workers are working outside and are exposed to environmental conditions, manual material handling, lifting heavy load, uncomfortable work environment could result in risk of WRMSD(23). Payment conditions that creates competitive nature of the work (as workers are paid per the amount of stone produced) that in turn increases work pace is also another condition for risk of WRMSD for cobble stone workers(22).

Workers engaged in cobble stone production tends to be vulnerable groups, a previous study done on nutritional status of among cobble stone workers reports nutritional deficiencies(24). Another study done in Addis Ababa among cobble stone workers on cardio respiratory functions also revels significant cardiac and respiratory limitations that are related to unsafe working conditions(25). Studies on health problems associated with the working conditions of coble stone workers is limited on few areas and not studied adequately incorporating exposure measurement, there for the study will mainly focus on magnitude of WRMSD and associated factors among cobble stone workers along with exposure measurement in the intention of adding up knowledge on health problems of cobble stone workers.

1.3. Rationale and significance of the study

Workers health and safety is an important issue among different industries world wide due to the increase and emerging nature of work related health problems. WRMSDs are one of common occupational related problem globally. This indicated the need for addressing the problems and generating scientific evidence; however in Ethiopia there is dearth of evidence despite the fact that workers specifically construction sectors like cobblestone are exposed to high risk condition and the expanding of road construction sector with remarkable high rate.The magnitude and associated factors of musculoskeletal disorders among this specific working group is not studied previously.

Addressing and dissimination of the research results to the stakeholder will make the problem perceptible by respective stake holders like regional and Woreda health office, governmental and non governmental organizations working on preventing and controlling work related health problems.

It also provides evidence for planning and designing interventional programs in preventing and controlling of work related musculoskeletal disorders as a result reducing morbidity from WRMSDs. The result of the research will as well serve as base line information for further research on the area.

Chapter two

2. Literature review

2.1. General overview

The literature review is guided based on the objectives of the study. The center of the study is to determine the magnitude and associated factors of WMSD among cobble stone workers and estimating the exposure level.

Work-related musculoskeletal disorders (WRMSDs) are a group of painful disorders of muscles, tendons, and nerves. Carpal tunnel syndrome, tendonitis, thoracic outlet syndrome, and tension neck syndrome are examples. For the purpose of developing injury prevention strategies, many health and safety agencies include only disorders that develop gradually and are caused by the overuse of the above constituents of the musculoskeletal system. The traumatic injuries of the muscles, tendons and nerves due to accidents are not considered to be WRMSDs or are considered separately. However, there are organizations, such as the European Agency for Safety and Health at Work, that include acute traumas and fractures within in the WRMSD group Pain is the most common symptom associated with WRMSDs. In some cases there may be joint stiffness, muscle tightness, redness and swelling of the affected area(1).

WRMSDs are emerging and increasing health problems in both industrially developing and developed countries incurring national economical and social costs(2, 26). Musculoskeletal disorders account for nearly 70 million physician office visits in the United States annually, and an estimated 130 million total health care encounters including outpatient, hospital, and emergency room visits(6).Factors that influence the occurrence of WRMSD those are related to physical, environmental and psychological exposures are identified trough epidemiological studies.

2.2. Global magnitude of work related musculoskeletal disorder

Work related musculoskeletal disorders are common in working populations and an emerging public health problem globally. According to the international labor organization (ILO) estimates, globally, around 2.2 million people die from work related illnesses and injuries. Global burden of musculoskeletal disorders that are attributed to occupational exposures for low

back pain is estimated to be 37% with higher male contribution and causes 818,000 daily adjusted life years (DALYs) lost from LBP in the year 2000 (2).

Work related musculoskeletal disorders statistics of Great Britain reports from the total work related illness MSD accounted 44% and an estimated 9.5 million working days were lost due to WRMSDs, an average of 17 days lost for each case (27). Similarly a ten year cohort study in Germany claims musculoskeletal disorders to be the major cause of disability (45%) in the work place(18). Musculoskeletal disorder in Africa is rising public health problem and contributing to the global burden. A systematic review reported average one year prevalence and average life time prevalence of 50% and 62% respectively among adults in Africa(26).

2.3. Magnitude of WMSDs in construction and related works

Epidemiological studies on prevalence of WMSD are available among different parts of the world. A nationwide study in India estimated 33% among the general population and 77% prevalence among construction workers, the result of the study also imply WMSD have impact on social, mental and emotional wellbeing of workers(28).Similarly incidence study in UK of occupational and work related illness reported an incidence among road construction operatives (6.1; 95% CI: 3.8–9.6) and among Bricklayers and masons (1.7 ; 95% CI: 0.9–2.9)(28).Many epidemiological researches revealed Work related musculoskeletal disorders among different working groups with a significantly higher magnitude among construction workers (28-30)

Prevalence study of work related musculoskeletal symptoms from Malaysian construction workers stated that The prevalence of musculoskeletal symptoms are 16.7% for neck, 28.3% for shoulder, 10% for elbow, 15% for wrist or hand, 13.3 for upper back, 45% for lower back, 8.3% for hip or thigh, 13.3% for knee and 5% for ankle or feet(29). Similarly unacceptable high overall WMSD prevalence of 82% and 65% low back prevalence among US mason tenders has been recorded(12).

An Ergonomics Study on Posture-Related Discomfort and Occupational-Related Disorders among Stonecutters of West Bengal, India revels that stonecutters work in unfavorable working conditions with continuously awkward postures consequently; they suffered from discomfort in different parts of their body, specifically in the lower back (97%), knees (85%) and shoulders (77%). The study also shows that dust particles emitted during stonecutting could have affected lung capacity(15).Another cross sectional study in India of children aged 17 years and below

involving 198 cases and 107 controls in two different cities shows a prevalence of musculoskeletal disorder related pain and discomfort experienced by 73 % of working children. The odds ratio suggests that working children were eight times more likely to experience trouble or body pain compared to non working(17). Similarly cross-sectional study assessing occupational health problems of brick field workers in west Bengal India reported a prevalence of MSD in different body parts, lower back (98%), hands (93%), knees (86%), wrists (83%) and shoulders (76%)(31).

Epidemiological evidences are also available among African countries on work related musculoskeletal disorders.Cross-sectional study among quarry workers in Nigeria reported an overall prevalence of WRMSDs to be 83.3%. From this overall prevalence lower back pain is the prevalent (78%) followed by wrist (59.6%), upper back (8.8%) and hip (8.8%) (10). Similar study of Nigerian construction workers reveals relatively lower prevalence of 39.25% (32).another cross sectional study from Botswana reported 75% of overall prevalence of MSD and most prevalent affected area being lower back pain(33).

A survey conducted on occupational exposures and related health effects among construction workers in Ethiopia, Gonder town reported observed musculoskeletal prevalence of 81.8% of the female and 54.17% of the male workers were suffering from shoulder-ache or back pain or both. Usually, such complaints were more frequent at the end of the day’s work. The study also provides magnitude of Respiratory problemsamong the workers, 27.30%of the female and 22.9% of the male workers complained of difficulty in breathing(19).

2.4. Factors for work related musculoskeletal disorder

There are commonly mentioned factors for the development of MSD which can be broadly categorized as sociodemographic, psychosocial,lifestyle, and ergonomic and occupational factors.

2.4.1. Sociodemographic factors

Sociodemographic factors for WMSD like age, sex and year of experience are documented in literatures. A gender specific analysis for indicated that the risks of WMSD are different based on types and activities of occupations. The results from the study implies that highest risk imposed for female are nursing/midwifery and teaching professionals and for male building frame and related trades workers (34, 35). A study carried out on the incidence WMSD on

repetitive movement identified that the role of biomechanical hazards, shows difference in results for men and women(36). Prospective study of gender difference for WRMSD shows that males are more vulnerable for many of work related physical factors with gender ratio ranging between 0.50 and 0.68 for equal exposure (37).

Studies suggest that the risk of development on WMSD increases with increasing age implying that Age is not an independent risk factor for work related MSDs however older workers are more susceptible to work-related MSDs than younger workers ,between the ages of 51 and 62 years, the prevalence of musculoskeletal disorders may increase as much as 15% among workers, with more pronounced increases occurring in physically demanding occupations(38, 39).

A study in Nigeria reported that there is significant positive association observed between years of working experience and prevalence of WRMSDs (2= 0.308, p= 0.000) ,but not significant association for age groups (10). Another study among solid waste collectors in Egypt and Saudi Arabian construction workers shows strong statistically significant association of MSD symptoms with the year of employment(40, 41). Indian construction workers show three times higher risk of WMSD for workers with > 10 years of experience comparing with lower year of experience (42). Similar result reported from American carpenters(43). A study among Ethiopian garment workers also reported significant association for year of experience with AR of 1.5 and 4.7 for 6-11 and >16 years of experience(20).Surprisingly a prospective study among brick layers reveals that subjective responses and impairments show an increasing pattern with increasing age while a decreasing Patten for length of employment of the same age(44).

2.4.2. Psychosocial , behavioral and individual factors

A two year follow up study in India about effects of BMI on the development of musculoskeletal disorder reports significant association (p < 0.001) among high BMI subjects with their increase scores of musculoskeletal discomfort and occupational stress(45). prevalence study in Ethiopia among nurses also shows a significant association between self reported musculoskeletal pain and BMI of the workers with adjusted OR of 3.52: 95%CI (1.02, 12.04)(21).

A national survey of WMSD in Taiwan of different industries implies important psychosocial factors. The result of the study suggests that workers in the construction industry with high job

stress have two times higher risk of MSD (OR= 2.5, CI 1.7, 3.9) while the relationship with co worker and supervisor increases risk of MSD threefold (OR=3.3, CI 1.7,6.7) (5).

Another study from Sweden on dose response association between symptoms of MSD and psychosocial risk factors shows that there is significant association for sleeping problems, work hazard anxiety and hurrying but not for job satisfaction, support from supervisor (46). Similarly A cross-sectional study of musculoskeletal disorder among female brick field workers in India reveals a significant association of MSD with some psychosocial factors: job satisfaction, inadequate income, poor relationship with manager andindicates an increased risk(47). Study of MSD among Nigerian construction workers also reports significant increase in prevalence with OR=2 for those workers with high psychological stressors(32).

Individual factors incorporating mainly lifestyle related conditions such as cigarette smoking, alcohol drinking and habit physical exercise significantly affects MSD. Saudi Arabian construction works shows two times increased prevalence of MSD among smokers than non smokers(40). Similarly Nigerian construction workers reports higher risk of MSD among smokers and alcohol users with OR of 1.63 and 1.88 respectively(32).

2.4.3. Occupational factors

Occupational and work place environmental conditions that are related to working activities such as energetic load, lifting, carrying, repetitive work, breaks and working time pose risk for MSD specially among workers of physically demanding jobs (41, 48-50).

The factors mentioned above are magnificent among construction workers. An incidence study carried out on the incidence MSD on repetitive identifies working with arms above shoulder level, Repetitive use of a handheld tool and repetitive forceful movements have a strong association with the incidence of musculoskeletal disorders.(36) A follow up study reported that the following physical factors posed workers with higher incidences of MSD Carrying and lifting (64%), Working with arms above shoulder height (59%) and Kneeling and stooping (55%) (30) working posture among brick layers and manufactures in awkward and static postures identifies an association with musculoskeletal disorder(51). Similarly a systematic review on Occupational demands and health effects for bricklayers and construction supervisors identifies after reviewing 60 different articles able to determine energetic load, load on the lower back, repetitive force

exertions, frequent bending with trunk flexion as factors contributing for MSD among brick makers and sorter(11). A study Nigerian male construction worker shows four times higher risk of MSD for fast work pace and high exertion (32).

Other occupational factors such as rest breaks and working duration and payment conditions that leads to increasing work pace and missing rest breaks,also have undesirable contributionon musculoskeletal disorders(22, 52). Indian brick manufactures reported that 2 times higher prevalence of MSD among those working 7 days a week than those working less (42).

2.4.4. Ergonomic related factors

The role of ergonomic and work place factors in the development of MSD is well documented in epidemiological ergonomic and occupational studies. Ergonomic and posture study of stone cutters in India correlated the contribution of ergonomic factors like working in an awkward and knelling posture for a prolonged period of time with a repetitiveness of the work with the higher prevalence of back pain, shoulder, knee and feet pain among stone cutters (15). Similarly study among construction workers documented evidence on working in awkward posture (stooping, twisted, kneeling) have three times higher risk for musculoskeletal disorders(46).

A study of work place conditions related to ergonomic factors among Indian brick field workers identifies working in bent back (72%, 128/179), Carrying and lifting (64%, 115/179), Working with arms above shoulder height (59%, 106/179) and Kneeling and stooping (55%,98/179) as risk factors that courses or aggravates symptoms of MSD (30). Another study on factors associated with musculoskeletal problems indicates factors for distal upper limb MSDs such as manual handling, work repetitiveness(6). Ergonomic study for miners from Zambia also identifies working with the back bent without support was significantly associated with both upper and lower back injuries. Significant associations were also found between wrist/hand injuries and grasping unsupported objects weighing 5 kg or more per hand or grasping with a forceful grip and grasping objects with the wrist bent (53).

Study on assessment of work position based on quick exposure cheek method among Indonesian brick manufacturing industries identifies high risk working activities that potentially lead to work-related musculoskeletal disorders (WMSDs) in workers requiring immediate improvement with the exposure level of 73.8% and 71.5% and immediate repair in the near future(54). Similar

study among workers in Iranian rubber factory reported a QEC score of high and very high in about 85.5% of the workers, the result also reveals a significant association between QEC score and MRSDs symptoms(55).

2.5. Conceptual frame work

The conceptual frame work is developed based on the review of literatures intending to be used as guide. It incorporates sociodemographic factors like age, sex and educational status of the workers that have impact on psychosocial conditions of the workers which in turn have impact on the life style of workers. The other factors ergonomic factors and occupational factors have direct relationship with the development of WMSD. Studies conducted among construction workers support that other than physical factors; psychosocial factors like work health hazard anxiety, hurrying without reason, and sleeping problems, showed associations with musculoskeletal disorders in all body locations with musculoskeletal disorder suggesting psychosocial factors could contribute to musculoskeletal pain.(4, 5, 46) Physical and work environment factors like task repetitiveness, heavy physical lifting, awkward and static posture, work design have strongerassociation and likely to have direct association with the out of interest(10).Prospective studies also support the above mentioned a physical factor contributes for WMSD.(30, 56)

Conceptual frame work

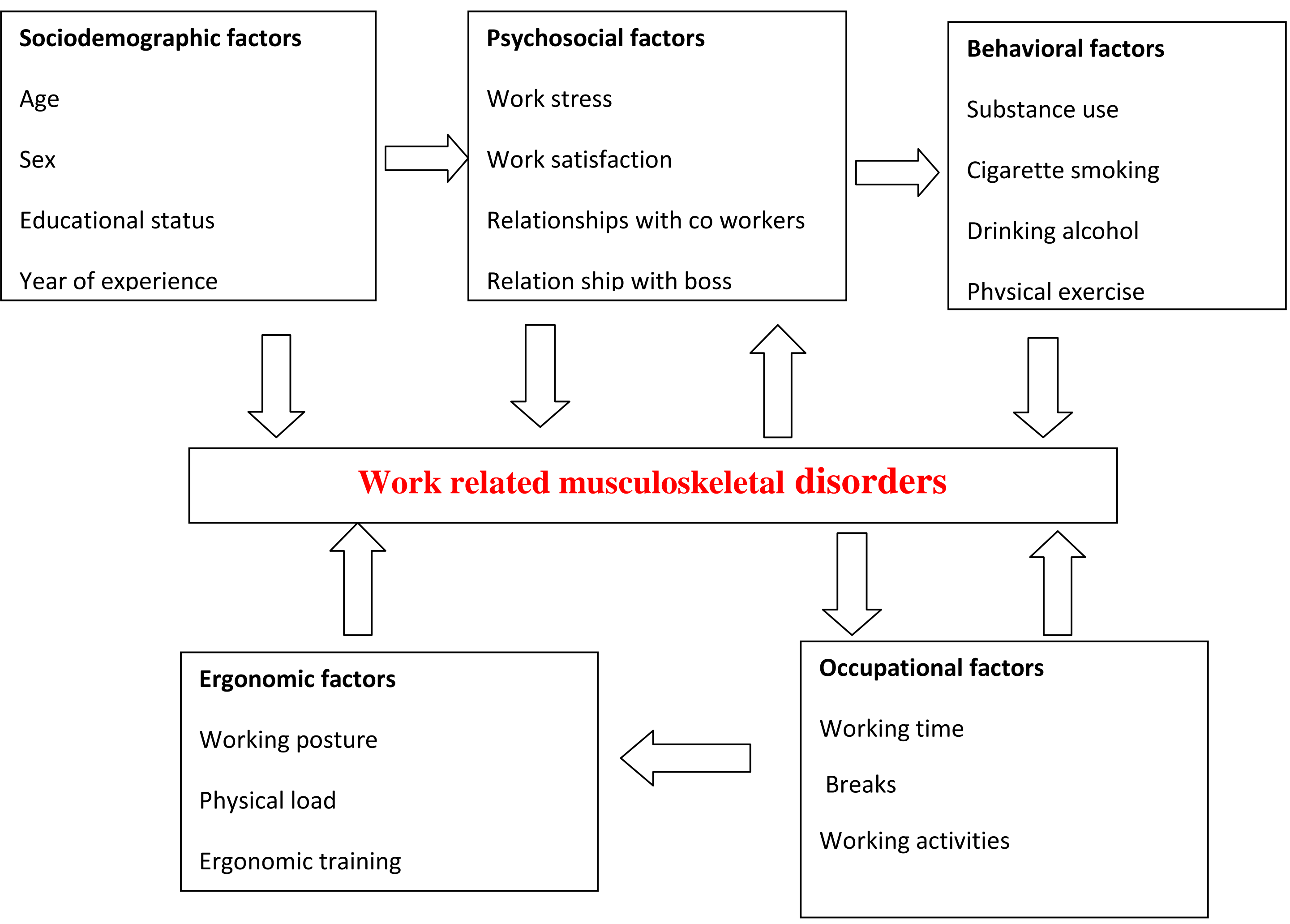


Figure 1 Schematic representation of conceptual frame work

Chapter three

3. Objective

3.1. General objective

- To assess work related musculoskeletal disorders and associated factors among cobble stone workers in Addis Ababa

3.2. Specific objectives

- To determine the prevalence of work related musculoskeletal disorders.
- To identify associated factors for work related musculoskeletal disorders.
- To determine the ergonomic hazard exposure level of cobble stone work to the different body parts.

Chapter four

4. Methods

4.1. Study area

The study was conducted in Addis Ababa city, capital city of Ethiopia .There are seven sites of cobble stone production in Addis Ababa namely Hana Mariam, Bole Lemi, Gelan,Arabsa,Gewasa, Chefea and katila sites.

4.2. Working conditions

According to the cobble stone project coordination office report of 2015/16 reported total of 325,727,006 cobble stone is produced and hoard from the seven cobble stone production site. The average weekly production is estimated around 8,000,000 cobble stone**.**

Payment conditions are based on the amount of stone produced, paved and quarry stone extracted. The current market price of cobblestone looks the following for each sub-sector:Chiseling (10x10x10 Cobblestone) is 2.30 Eth. Birr, Paving (For 1m^2 paved areas) is 13.10 Eth. Birr and for Quarry area (For 1m^3 raw stone) is 48.00 Eth. Birr.

The organizational set up of cobblestone project functions both at city and sub city level.The project coordination office coordinates and harmonizes the overall activities of the project in different sub-cities. At Sub-City Level, the cobble stone project office is accountable to the chief executive body of the sub-city who leads the routing committee.

Quarrying and chiseling are the two main activities at the cobble stone production sites. **Quarrying** the process of digging out raw stone, though the most activities are done manually by the workers, it is also supported by machineries.

Chiseling is the process of preparing 10 X 10 cm chiseled cobblestones for pavers. This activity is handled manually in sitting position with the support of small hand tool made of metal. The workers use the hand tool to break and shape the stone using repeated hand force. The activity is passive because it’s mainly dependent on force exerted from the hand for hammering the stone trough out the work course. Similar working conditions had been observed from previous studies among carpenters, household furniture workers and some forms of agricultural harvesters.

Paving is the activity of laying roads with cobble stone this is mainly done manually in squatting and kneeing position with the help of simple hand tools.

Cobble stone work flow Process

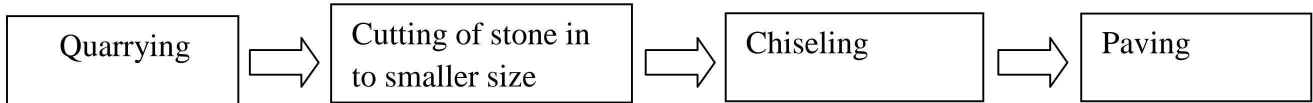


Figure2 Task flow chart of cobble stone production

4.3. Study design and period

A cross-sectional study was conducted among cobble stone chisel workers in Addis Ababa from December 2016 to June 2017.

4.4. Populations

The study was conducted among cobble stone workers specifically on those engaged in chiseling activities. The selection of the group to be included in the study is based on the situation that the three activities are different both in exposure status and population diversity so studying the three groups at the same time will not be feasible due to time and resource limitation. Chiseling activity is assumed to impose relatively higher exposure for risk MSD due its nature of highly dependent on manual handling.

4.4.1. ***Source population*** –The source population was all cobble stone workers engaged in chiseling activity in Addis Ababa.

4.4.2. ***Study population***-The study population were the selected samples of cobble workers engaged in chiseling activity using appropriate sampling procedure.

4.5. Inclusion and exclusion criteria

4.5.1. **Inclusion criteria:**All cobble stone workers who have been involving in chiseling activity for at least 12 month were included in the study.

4.5.2. **Exclusion criteria:**Workers who are absent during data collection period were excluded from the study prior to data collection.

4.6. Sample size

The sample size calculation for the first specific objective is using one population proportion formula using the following assumption and formula.

P= 50% (Expected prevalence of MSD due to lack of previous studies with similar working condition in similar countries so to obtain maximum sample size P is taken as 50%)

$Z /2$= critical value of Z score at 95% confidence interval of certainty

D=margin of sampling error tolerated (desired precision), 5 %(0.05)

$$n = \frac{(Z /2)^2 * p * q}{d^2}$$

,n=385 Plus 10% non response rate the final sample size will be,n=422

The sample size calculation for the second specific objective is using two population formulas for the different determinants using the following assumptions and formula.

For determinates

It was assumed 13% difference is expected between exposed and non exposed for determinants with OR 1.7 (due to lack of evidence for the factors with exactly similar working conditions and similar counties.)

OR=1.7, P1=50%,P=the pooled prevalence

$Z /_2$ = 1.96 critical value of Z score at 95% confidence interval

Z (1-) = 0.84, value of the standard normal distribution Corresponding to the desired level of power (0.84 for a power of 80%),

$$N = \frac{Z_{\alpha} \sqrt{2P(1-P)} + Z_{1-\beta} \sqrt{P_1(1-P_1)+P_2(1-P_2)}^2}{(P1-p2)^2}$$

Therefore the sample size was 488, as calculated using statcalc of epi info vertion 7

From the sample size calculated above the larger was considered that is 488 plus 10% non response rate the final sample size was 537.

Sample size for Exposure measurement

For exposure assessment 56 participants that are 10% of the final sample size was included.participants were selected by randomly by lottery method from the subset of those who participate in the Nordic questioner.

4.7. Sampling procedure

Simple random sampling technique was used to select the subjects. Due to the similarity in terms of working condition and organizational structure among the seven sites of cobblestones production in Addis Ababa, three sites (approximately 50%) were selected randomly using lottery after clustering sites with similar areas. Finally the subjects from chiseling group were proportionally allocated for the total sample sizeas follows.

$$n = \frac{\text{Total population of selected site * Total sample size calculated}}{\text{Sum of total population of selected sites (N)}}$$

To select the actual participants randomly after setting a sampling frame, computer generated random numbers were used.

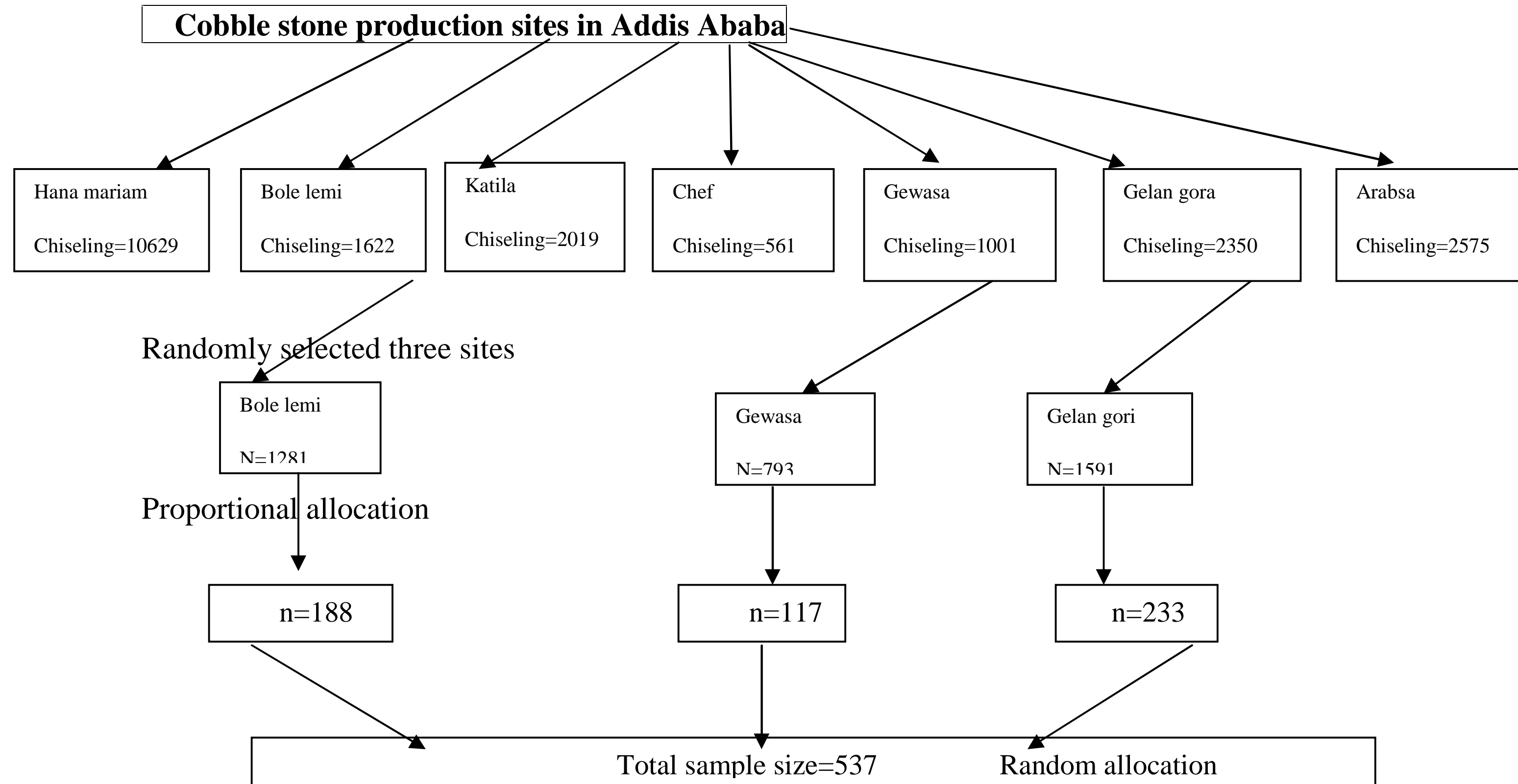


Figure 3 Schematic representation of sampling procedure

4.8. Data collection tools

4.8.1. Nordic musculoskeletal questioner

The standardized Nordic questioner (NMQ) was used to collect data on WMSD symptoms on different body part. The questioner was developed by support of the Nordic council minister project undertaken to develop and test standardized questioner on general, low back, neck and shoulder complaints. NMQ has forced answer question that identify affected body area which is guided by body map indicating the nine anatomical areas low back, wrist/hand ,hip/thigh, knee and ankle/feet. It assesses the prevalence of symptoms in the last 12 month and 07 days. The sensitivity and specificity of the tool has been tested ranging between 66-92% and 71-88% respectively. The validity and reliability of the tool also been cheeked in wide range of occupations. The limitations of this questioner are that it could be affected by the experience of the person, more recent and serious problems tend to be remembered and the environmental condition at the time of data collection could also affect(57, 58). For measuring psychosocial factors job stress score were used. The work place job stress scale is developed by the Marlin Companyband the American Institute of Stress.It has eight closed ended questions that measures different work place stressors with options provided in choise for frequency of existing like never, rarely, sometimes, often and very often. The frequency is given by likert scale measurement score the total score is obtained by adding up of each ikert scale measurement.(59)

4.8.2. Quick exposure cheek

The quick exposure cheek was used for exposure assessment. QEC is selected above other tools because of its simplicity and no need of high skilled expertise required. This exposure assessment method considers different risk factors on selected body parts, the back, shoulder/arm, wrist/hand and neck regarding their posture and repetitive movement. In QEC task duration, maximum weight handled, hand force exertion, visual demand of the task, vibration and subjective response of the task obtained from the workers respond. The magnitude of each assessment items is classified in to exposure level, and the combined exposure between different risk factors for each body parts is calculated by using a score table. The score table classification is as low,moderate .high, very high for Back static, Back (moving), Shoulder/arm, Wrist/hand and Neck. The strength of using this method is it combines and analyzes the investigator

observation and workers subjective response that minimizes investigator observation bias. The limitation of QEC method is that it is not able to assess lower extremity exposure.(7-9)

4.9. Data collection procedure

The data were collected by well trained six data collectors and three supervisors of BSc nurses for the Nordic musculoskeletal questionnaire through face to face interviewing of participants. the data using QEC exposure assessment method were collected by the principal investigator from 56 subjects that make 10 % of the total sample size. First the participants were observed while performing their normal working activities then they were interviewed for their subjective response.

4.10. Variables

Dependent variables – work related musculoskeletal disorder

Independent variables

- Sociodemographic factors-age , sex ,year of experience
- Psychosocial factor- job stress ,job satisfaction ,relationship with others
- Individual/lifestyle factor – smoking ,BMI ,physical exercise ,alcohol use
- Work place and ergonomic factors – repetitive task ,rest break time ,awkward posture ,work load ,manual material handling

4.11. Data quality control

Standardized and validated data collection tool were used. To assure the quality of data that will be generated the data collectors were trained properly before data collection. Prior to the actual data collection the questionnaire were tested among pilot group that will make 5% of the study participants and possible amendments were taken. During data collection closer supervision was assured by the supervisor and completeness of the questionnaires was cheeked and feedback was given to the data collectors for the next day of data collection. After data collection the questioner was rechecked by the investigator for consistency and completeness and missed variables ware re interviewed.

4.12. Operational definitions

Musculoskeletal disorder: is defined as any subjective complaint of back (lower/upper), shoulder, neck, arm/wrist or leg/foot reported by cobble stone worker that result in any limitation or discomfort at work in past 12 month.

Work related musculoskeletal disorder:is perceived pain, ache or discomfort for at least 2-3 work days in last week or last 12 months in any part of body segments (neck, shoulder, upper back, lower back, hip /thigh, knee/leg and ankle/foot and wrist /hand) caused, aggravated or exacerbated by work place exposures.

Getting medical attention:seeking medical attention for reasons of musculoskeletal pain or symptoms.

Absent from work:being absent from work one or more days for reasons associated with musculoskeletal pain.

Injury: is defined as any physical injury occurred while on work that results in pain , discomfort or disability on work in past 12 month.

Awkward posture: working with the neck bent more than 30 degrees without support, working with a bent wrist, working with the back bent without support, squatting and kneeling continuously for two or more hours.

Repetitive work: Work involving repeating the same activity with less than 30 seconds or no variation every few seconds for two or more hours.

Heavy manual material handling: The maximum weights handle by the worker of 11 or more Kg as reported by cobble stone workers.

Cigarette smoking: It is practice of smoking cigarette by cobble stone workers for at least one sticks of cigarette per day.

Alcohol drinking: it is a consumption of any kind of alcohol by cobble stone workers at least for two times per week for different purposes.

Body mass index: weight in kilograms divided by the square of the height in meters
(Kg/ m^2).Underweight= BMI <18.50,Normal range= BMI b/n 18.50-24.99,Overweight = BMI b/n 25.00-29.99,Obese= BMI 30.00

Job stress: A score measured using the workplace stress scale of (16 to 40) as moderate to severe job stress and a score measured using the workplace stress scale (less than or equal 15) as no job stress.(59)

Ergonomic hazard exposure level- Is determined by the total score as calculated by the QEC tool and determined using the QEC score table.(9) QEC score able is presented in data analysis section of ergonomic hazard exposure level in this document.

4.13. Data analysis procedures

The data was analyzed using spss version 20 software. OR with 95% confidence interval was used to measure the association between WMSD and determinants, p value less than 0.05 was used to define statistically significant association.

For the first objective: Descriptive statistics was undertaken to determine magnitude of WMSD as well as to explain sociodemographic characteristics, psychosocial, individual/lifestyle and ergonomic factors using ratios, percentages and mean.

For the second objective: Bivariate logistic regression was held to explain association between two factors and present with crude OR at 95% CI. For those bivariate associations with p value less than 0.2 were included in multivariable logistic regression model and analyzed for the independent association of one factors controlling the other factors and present as adjusted OR at 95% CI. All variables were cheeked for colliniarity and correlation coficient of all variables were less than 0.75.The data was reduced and presented using appropriate tables, graphs and charts as well as text description as needed.

For the third objective: The analysis was based on QEC score calculated for back, shoulder/arm, wrist/hand and neck then the exposure level were obtained for each body region from the predifiened QEC exposure level category table as shown below.(Table 1)

Table 1:Ergonomic hazard exposure level categories by Quick exposure cheek

Score	Exposure level			
	Low	**Moderate**	**High**	**Very high**
Back(static)	8-15	16-22	23-29	29-40
Back(moving)	10-20	21-30	31-40	41-45
Shoulder/arm	10-20	21-30	31-40	41-46
Wrist/hand	10-20	21-30	31-40	41-46
Neck	4-6	8-10	12-14	16-18

4.14. Data management

The data was entered using epi info version 7 after fitting with data entry template. Data cleaning was done by using epi info software by running simple frequencies, cross tabulation and sorting to cheek for missing value and outliers and missed values were rechecked from the questioners. Finallythe cleaned data was imported to spss version 20 software for analysis.

4.15. Ethical consideration

Ethical clearance and permission conduct was obtained from Addis Ababa university school of public health. Informed oral consent was obtained from each participant before collecting information. The privacy and confidentiality of the respondents was assured; codes were assigned for each respondent instead of their names. Separated and comfortable area was selected where respondents fill the questioner to assure confidentiality of the information. The information obtained was disclosed only for the research team.

4.16. Dissemination of results

The result of the study will be disseminated for the following listed stake holders, Addis Ababa university school of public health, Addis Ababa small and medium scale enterprises, Addis Ababa cobble Stone project Coordination office and to Addis Ababa health office and BOLSA.

Chapter five

5. Results

5.1. Sociodemographic characteristics

A total of 512 subjects were included in the study with response rate of 95%.410(80.1%) were male. Majority 322(63%) of participants were young age <25 years. Most of the respondent were 299(58.4%) single, 328 (64.4%) were orthodox., 244(44.3%) completed primary education and 413(80.7%) worked 1-2 years.(Table 2)

Table 2: Sociodemographic characteristics of cobblestone workers in Addis Ababa ,Ethiopia,2017

Variables	Frequency(N=512)	Percent (%)
Sex		
Male	410	80.1
Female	102	19.9
Age group(Years)		
20	104	20.3
20-24	218	42.6
25-29	153	29.9
≥30	37	7.2
Marital Status		
Single	304	59.4
Married	208	40.6
Religion		
Orthodox	330	64.5
Protestant	157	30.7
Muslim	25	4.9
Educational status		
No formal education	37	7.2
Primary education	227	44.3
Secondary education	207	40.4
Higher education	40	7.8
Monthly Income		
1000 ETB	181	35.4
1000-2000 ETB	196	38.3
2000 ETB	135	26.4
Workexperience(Years)		
2	413	80.7
>2	99	19.4

5.2. Behavioral and psychosocial characteristics

Only 7(1.4%) of cobblestone workers have habit of Cigarette smoking while 104(20.3%) drinks alcohol at least one times per week. 444(86.7%) of respondents have normal BMI, 90(17.6) have habit of doing exercise.69(13.5%) have history of chronic illness.349(68.2%) reported to have job stress (score of ≥15) while 219(42.8%) of respondents reported to have job satisfaction (score of ≥32).(Table 3)

Table 3: Individual and psychosocial characteristics of cobblestone workers in Addis Ababa Ethiopia,2017

Variables	Frequency (N=512)	Percent (%)
Cigarette smoking		
Yes	7	1.4
No	505	98.6
Drinking Alcohol		
Yes	104	20.3
No	408	79.7
Physical exercise		
Yes	90	17.6
No	422	82.4
BMI		
Underweight(<18.5)	56	10.9
Normal (18.5-24.99)	444	86.7
Overweight (25-29.99)	12	2.3
Chronic illness		
Yes	69	13.5
No	443	86.5
Relationship with colleagues		
Good	422	82.4
Fair	90	17.6
Have boss		
Yes	492	96.1
No	20	3.9
Relationship with boss (n=492)		
Good	400	78.1
Fair	92	18.0
Job stress		
Yes	349	68.2
No	136	31.8

5.3. Occupational and work place characteristics

Working hour characteristics is explained as 176(34.4%) of the respondents worked 8-10 hour and 188(36.7%) works more than 10 Hours per day.489(95.5%) of the respondents works ≥ 6 days per week.182(35.5%) of respondents produce 100-200 cobblestone per day while 192(37.5%) of them produces more than 200 cobblestone per day.275(53.7%) of participants reported fair work place condition while 119(23.2%) of them claims uncomfortable work place air condition.(Table 4)

Table 4: Occupational and working environment factors among cobblestone workers in Addis Ababa Ethiopia,2017

Variables	Frequencies (n=512)	Percent (%)
Working hour per day		
8	148	28.9
8-10	176	34.4
10	188	36.7
Working days		
≤5 days	37	7.2
>5 days	475	92.8
Number of cobblestone production per day		
100	138	27
100-200	182	35.5
200	192	37.5
Breaks other than lunch break		
Yes	75	14.6
No	437	85.4
Duration of breaks(n=75)		
≤20 minutes	25	33.3
>20 minutes	50	66.7
Air condition at work place		
Comfortable	118	23
Fair	275	53.7
Not comfortable	119	23.2

5.4. Working posture

Workers of cobblestone production reported that 165(32.8%) works standing for 2-5 hours per day while 492(96.1%) attains static position due to working condition.Significant number of the respondents, 89.5% and 95.9% reported Awkward position and repetitive work respectively.Majority of participants 498(90.7%) reported no comfortable working chair at their work place. 462(90.2%) of participants have never take ergonomic or related trainings. (Table 5)

Table 5: Ergonomic and work place factors among cobble stone workers in Addis Ababa ,Ethiopia,2017

Variables	Frequencies (n=512)	Percent (%)
Standing Work		
Yes	418	81.6
No	94	18.4
Duration of work standing(n=418)		
2 hour	195	38.1
2-5 hour	165	32.2
5 hour	56	10.9
Awkward position		
Yes	458	89.5
No	54	10.5
Repetitive work less than 30 sec		
Yes	491	95.9
No	21	4.1
Static position		
Yes	492	96.1
No	20	3.9
Comfortable seat		
Yes	14	2.7
No	498	97.3
Ergonomics training		
Yes	50	9.8
No	462	90.2

5.5. Prevalence of WMSD

Over all 12 month prevalence of 417(81.4%) of WRMSD were obtained from chisel workers of cobblestone production. From the different body parts lower back (65.5%) take the highest value while neck prevalence (24.2%) were the lowest. Regarding 7 day prevalence lower back pain were 51.6%.(Figure 4)

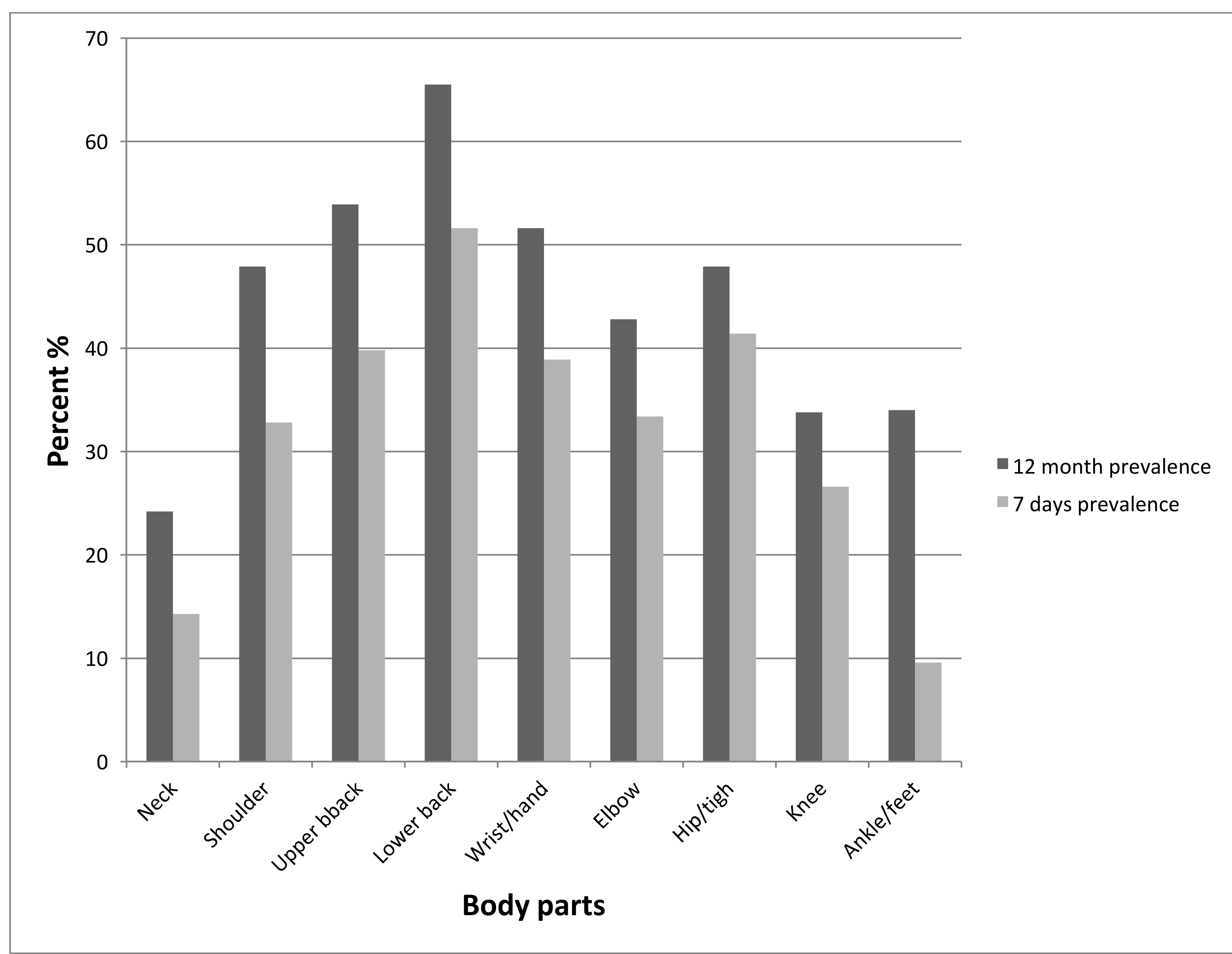


Figure 4: 12 month and 7 day prevalence of WRMSD among cobblestone workers in Addis Ababa Ethiopia,2017

5.6. Number of body parts affected

Workers of cobblestone production reported to experience multiple body part affected to WRMSD in the past 12 months.From the total 417 reported to had WRMSD, 300 (71.9%) of them had three or more body parts affected.Majority 68 (16%) have 5 and 4 different body part affected followed by 64(15%) who had two body parts being affected.(Figue 5)

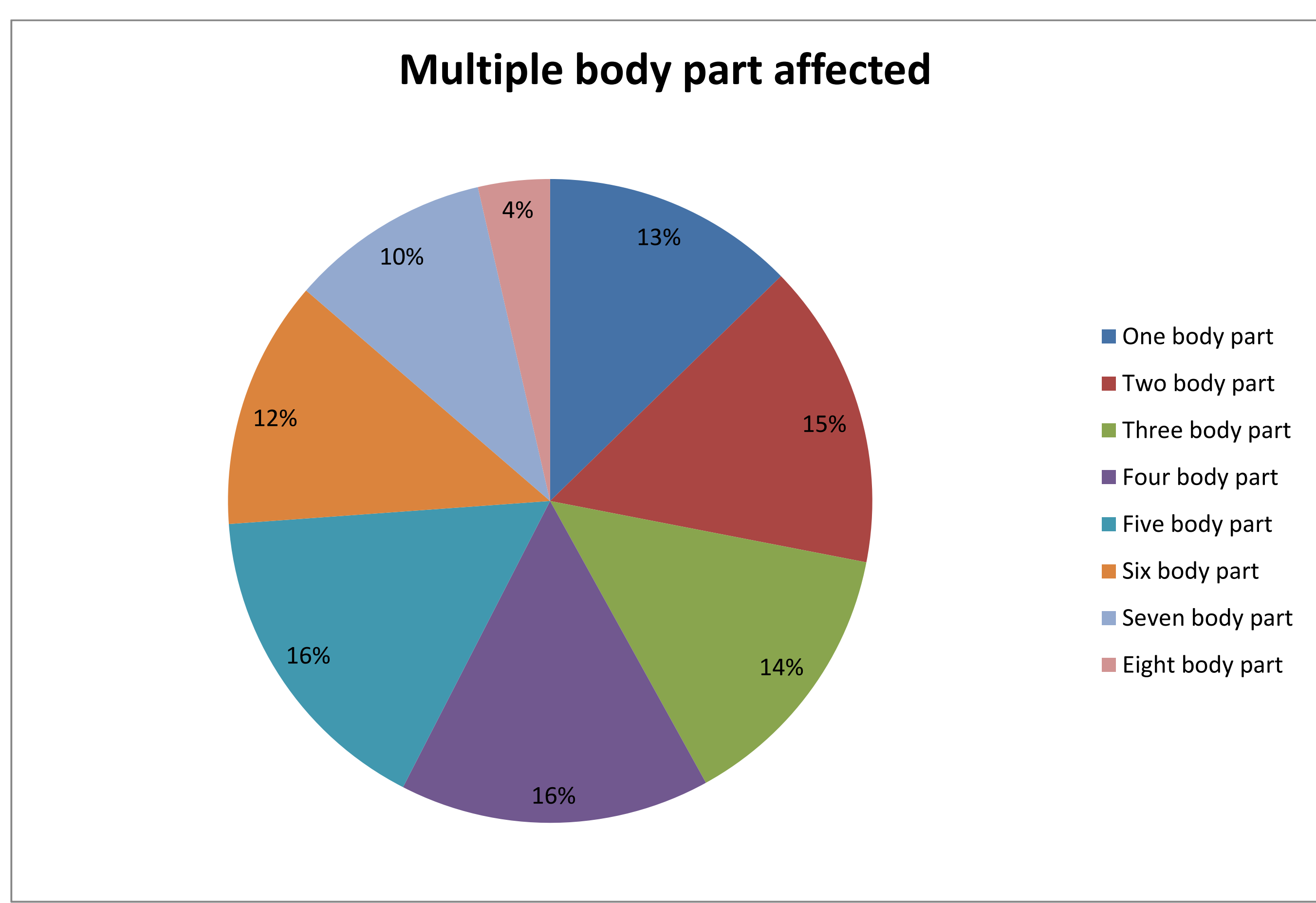


Figure 5: Number of body part affected of WRMSD among cobble stone workers in Addis Ababa Ethiopia, 2017(n=417)

5.7. Ergonomic hazard exposure assessment

A total of 56 chiseling workers were assessed for their exposure of WRMSD by using QEC. The exposure level was assessed for both standing and sitting working position of the chiseling activity. Back exposure level of subjects assessed for exposure of WRMSD is found to be in very high exposure level. From total of 56 subjects assessed 42(75%) had complained for back pain.

The exposure level for shoulder fall in high and very high exposure level area with majority (75%) falls in very high exposure level. From those assessed 71.5% complained for shoulder pain. Similarly wrist/ hand action area is also falls in high and very high exposure level with significant number of subjects (61%) complained for wrist pain. The exposure level for neck is moderate with lower proportion of subjects 15(26.7%) complained for neck pain.(Table 6)

Table 6: Ergonomic exposure level determined by using quick exposure cheek (QEC) of chiseling activity of cobblestone workers in Addis Ababa, Ethiopia(n=56)

QEC Parameters	Action area	Percent (%)	WMSD			
			Yes		**No**	
			Number	**Percent (%)**	**Number**	**Percent (%)**
Back	Very high	100	42	75	14	25
Shoulder	High	25	10	71.5	4	28.5
	Very high	75	31	73.8	11	26.2
Wrist/hand	High	50	16	57.1	12	42.9
	Very high	50	18	64.3	10	35.7
Neck	Moderate	100	15	26.7	41	73.3

Figure 5: photo of chiseling activity at cobblestone production site in Addis Ababa

Figure 6: photos of chiseling activity at cobblestone sites in Addis Ababa

5.8. Bivariate analysis

5.8.1. Sociodemographic factors

From sociodemographic variables sex of the respondents have statistically significant association with WRMSD at value <0.05 with 95% CI. The odds of males is 1.7 times higher when compared with the odds of female [COR: 1.7(1.01, 2.83)].(Table 7)

Table 7: Bivariate analysis of sociodemographic factors with WMSD among cobblestone workers in Addis Ababa Ethiopia

Variables	WMSD		COR (95% CI)	P value
	Yes	No		
Sex				
Male	346	69	1.69(1.01,2.83)	0.046
Female	76	26	1.00	
Age group(year)				
<20	23	81	1.00	
20-24	39	179	1.3(0.73,2.32)	0.64
25-29	25	128	1.4(0.77,2.73)	
≥ 30	8	29	1.02(0.41,2.55)	
Marital status				
Married	169	39	1.00	
Single	248	56	1.02(0.65,1.61)	0.92
Educational status				
No formal education	28	9	1.45(0.64,3.32)	0.75
Primary education	186	41	1.3(0.61,3.16)	
Secondary education	168	39	1.82(0.57,5.73)	
Higher education	34	6	1.00	
Monthly income				
500-1000 ETB	142	37	1.675(0.699,4.017)	
1001-1500 ETB	136	33	1.56(1.645,3.770)	0.6
1501-2000 ETB	92	18	1.258(0.490,3.230)	
>2001 ETB	45	7	1.00	
Working experience				
≤ 2 year	331	82	1.00	
>2 year	86	13	1.639(0.872,3.081)	0.12

5.8.2. Psychosocial and individual factors

From psychosocial factors relationship with colleagues, job stress and job satisfaction showed a statistically significant association. Respondents who lack good relationships with colleagues have 2 times higher odds with 95% CI [2.01(1.03, 4.06)].Subjects with job stress reveals 3 times

higher odds that of subjects without stress, [2.97(1.89, 4.72)].similarly respondents who lack job satisfaction showed 2.5 times higher odds of WMSD than respondents with job satisfaction at 95% CI[2.49(1.58,3.94)].(Table 8)

Table 8: Bivariate analysis of psychosocial and individual factors with WRMSD among cobblestone workers in Addis Ababa Ethiopia

Variable	WMSD		COR (95% CI)	P value
	Yes	**No**		
Cigarette smoking				
Yes	10	3	1.33(0.36,4.98)	
No	407	92	1.00	0.67
Drinking alcohol				
Yes	85	19	1.02(0.59,1.79)	0.93
No	332	76	1.00	
Physical exercise				
Yes	72	18	1.00	
No	345	77	1.12(0.63,1.99)	0.67
BMI				
Normal (18.50-24.99)	368	81	1.00	
Underweight (<18.50)	45	11	1.49(0.39,5.64)	0.8
Over weight(25.00-30.00)	9	3	1.36(0.32,5.89)	
Chronic illness				
Yes	60	9	1.61(0.77,3.36)	0.21
No	357	86	1.00	
Relation with colleague				
Good	85	337	1.00	
Fair	10	80	2.01(1.03,4.06)	**0.045**
Relation with boss				
Good	321	79	1.00	
Fair	78	14	1.37(0.75,2.54)	0.31
Job stress				
Yes	304	45	2.97(1.89,4.72)	**0.001**
No	113	50	1.00	

5.8.3. Occupational and ergonomic factors

From occupational and ergonomic factors work load in terms of working day, break between works ,working in twisting and bending position, repetitive work ,static position and ergonomic related training shows significant association with WMSD.

Working for more than five days a week has 3.8 times higher odds of than those working less than five days a week with 95 % CI[3.81(1.9,736)].respondents who lack break between works have 2 times higher odds for WMSD with COR[2.07(1.186,3.613)].

Working in twisting/bending position and repitive work have 6 times higher odds for WRMSD at 95% CI [6.2(3.47,11.76)] and [6.5(2.68,16.1)] respectively. Similarly, attaining static position have 3 times higher odds, [3.8(1.5, 9.6)]. The other factor lack of ergonomic training have three times higher odds for WMSD than those have ergonomic training with 95% CI[3.7(2.16,6.4)].(Table 9)

Table 9: Bivariate association of occupational and ergonomic factors with WMSD among cobblestone workers in Addis Ababa Ethiopia

Variable	WMSD		COR(95% CI)	P value
	Yes	No		
Working hour				
<8	122	26	1.00	
8-10	149	27	1.176(0.65,2.12)	0.24
>10	146	42	0.74(0.43,1.278)	
Working day				
≤5 days	21	16	1.00	
>5 days	396	79	3.81(1.9,736)	**0.001**
Breaks between works				
Yes	53	22	1.00	
No	364	73	2.07(1.186,3.613)	**0.01**
Duration of break				
≤20 minutes	19	6	1.5(0.5,4.4)	0.47
>20 minutes	34	16	1.00	
Working standing				
Yes	343	75	1.23(0.711,2.15)	0.45
No	74	20	1.00	
Duration of standing				
<2 hour	154	41	1.00	
2-5 hour	138	27	1.36(0.76,2.32)	0.26
>5 hour	49	7	1.8(0.78,4.42)	
Awkward position				
Yes	391	67	6.2(3.47,11.76)	
No	26	28	1.00	**0.0001**
Repetitive work				
Yes	408	83	6.5(2.68,16.1)	**0.0001**
No	9	12	1.00	
Static position				
Yes	11	9	3.8(1.5,9.6)	**0.004**
No	406	86	1.00	
Comfortable seat				
Yes				
No	407	91	1.00	
	10	4	1.78(0.54,5.83)	0.33
Ergonomics training				
Yes	42	28	1.00	
No	375	67	3.7(2.16,6.4)	**0.001**

5.9. Multivariable analysis

Variables with p value less than 0.2 was added to multivariate model hierarchically to avoid excees number variables in a model.From sociodemographic variables sex was significantly associated in the first model but not in the second and final model with [AOR: 1.65 and CI (1.01, 2.77)].From the psychosocial variables job stress and job satisfaction were significantly associate with WMSD in the second model with [AOR: 2.3(1.41, 3.78) and 1.74(1.06, 2.87)] respectively.

In the final model the variables job stress, working day, working in Awkward position, break between work and ergonomic training were significantly associate and found to be factors for WMSD.

Workers with Job stress are 1.7 times more likely to develop WMSD than that of participants without job stress with [AOR: 1.82 and CI (1.05,3.14)].Working for more than five days a week has approximately four times higher odds than working for less or five days a week with [AOR: 3.0 and CI (1.29,6.9)].Lack of break between works has two times higher odds of WMSD with [AOR:2.22 and CI (1.19, 4.17)].Similarly workers working in twisting/ bending(awkward) position are three times more likely to develop WMSD with [AOR: 2.93(1.26,6.9)].Workers who never take ergonomic training are three times more likely to develop WMSD than those who ever take ergonomic training.(Table 10)

Table 10: Multivariate logistic regression of factors associated with WRMSD among cobble stone workers in Addis Ababa Ethiopia,2017

Variable	Adjusted OR with (95% CI)		
	Model 1	Model 2	Model 3/final model
Mode l: Sociodemographic variables			
Sex			
Male	**1.65(1.01,2.77)***	1.68(0.98,2.86)	
Female	1.00	1.00	
Working experience			
<2 years	1.00		
>2 years	1.59(0.84,2.9)		
Model 2: Sociodemographic+ Psychosocial variables			
Chronic illness			
Yes		1.39(0.64,2.95)	
No		1.00	
Relation with colleagues			
Good		1.00	
Fair		1.60(0.77,3.30)	
Job stress			
Yes		**2.3(1.41,3.78)****	
No		1.00	
Model 3: Sociodemographic + psychosocial+ occupational and ergonomic			
Job stress			
Yes			**1.82(1.05,3.14)***
No			1.00
Working days			
5 days			1.00
>5 days			**3.0(1.29,6.9)****
Break between works			
Yes			1.00
No			**2.2(1.18,4.11)***
Awkward position			
Yes			**2.93(1.26,6.9)**
No			1.00
Repetitive work <30 sec			
Yes			2.7(0.83,8.7)
No			1.00
Static position			
Yes			1.24(0.39,3.82)
No			1.00
Ergonomic training			
Yes			1.00
No			**2.98(1.6,5.6)****

*significant at p value <0.05 ** <0.01 *** <0.001

Chapter six

6. Discussions

The 12 months prevalence of WMSD found in this study is significantly high from the nine anatomical body regions. The factors identified for WMSD in this study are job stress, working days, working in twisting bending position, breaks between works and ergonomic training. Exposure levels for WMSD is found to be high and very high for back, shoulder and wrist but moderate for neck which is consistent with the self reported musculoskeletal pain response found by Nordic for the different body parts.

The overall 12 month self reported prevalence of WMSD found in this study is 81.4% which is fairly comparable with other studies done among similar working sector in Nigeria quarry workers and USA mason workers which is 83.3% and 82% respectively(10, 12). Prevalence of WMSD from other sectors is less than prevalence in this study,77% among Indian construction workers, 66.7% among Malaysian construction workers, and 65.5% among Ethiopian construction workers, much less prevalence from Nigerian construction workers 39.7% (19, 28, 29). The significantly high prevalence of WMSD in this study could be explained by the extensive work load, highly stressful and repetitive nature of cobblestone work that imposes higher exposure for WMSD than other construction works.

The most commonly affected body part from this study is lower back followed by upper back, wrist and shoulder while the least commonly affected body part is neck. This result is consistent with other studies for lower and upper back being the highest but not for wrist and shoulder (12, 19, 29, 32). This discrepancy is due to the difference in the working condition between the different working activities. In these study workers attaining forceful exertion of hands using heavy hand tools with awkward position of wrist and hand could explain the higher prevalence of WMSD at shoulder and wrist. The result obtained from the ergonomic hazard exposure assessment using QEC is also consistent with the prevalence of self reported WMSD, the higher the exposure levels the higher the prevalence. The exposure level for back is very high while the exposure level for shoulder and wrist is either high or very high.

From the study results relatively lower prevalence is observed for neck, Knee and ankle/feet (24.2%, 33.8% and 34%) respectively. The low prevalence for ankle/feet is comparable with other study which are 33% among US mason tenders(12).The lower prevalence of knee and ankle/feet is due to the workers attain seated position for most of their activities that tend to lower the exposure for lower extremities. The prevalence for neck region is consistent from study of Nigerian construction workers which is 25%, but lower when compared to moderate exposure level obtained from QEC, these discrepancies could be the lack of clear anatomical demarcation between shoulder areas and neck that results in mixing up of shoulder pain with neck by the respondents.

Many factors likesociodemographic and individual factors, psychosocial and occupational factors from different literatures are mentioned with WMSDs. Previous literatures suggest for increasing age increasing pattern of WMSD(38, 39), but in this study age is not significantly associates when adjusting for other variables. This is due to majority of respondents in this study lies on the age group of 20-29 whichis very energetic age group to cope with the high physically demanding nature of cobblestone work. This in turn did not allow appreciating association for different age groups.

In this study job stress have significant association.Result from Nigerian construction workers reported 2 times higher odds for psychosocial stressors(32).which is similar with the finding of this study OR=1.75(1.004,3.03).Similarly cross-sectional study from Taiwan construction workers reported 2 times higher odds for subjects with job stress(5).The high odds of WMSD for job stress may be the physiological and psychological response of human body. One of the psychological responses could be workers tend work faster to cope with the work that leads to over using of muscle and increase risk of WMSD. In addition to psychosocial factors individual factors have also been reported from previous similar studies in Nigeria and Saudi Arabia for cigarette smoking and alcohol drinking but significant association were not found in this study due torespondentes may not feel conformable to tell their individual behavior of cigarette smoking and alcohol consumption.

The other factors that mostly associate with WMSD are occupational and ergonomic factors. Working in twisting/bending position have resulted 3 times higher odds of WMSD in this study. Other studies from Sweden construction workers and Indian stone cutters reported similar

association (15, 46).This associations could be explained as awkward position including excessive flexion and rotation of the trunk increases muscle tension and resulted in spasm and musculoskeletal smptoms(56).The pathophysiology of abnormal body posture is explained as abnormal postures and positions can increase tension or compression on nerves, or result in increased or decreased muscle lengths. With prolonged tension or compression on the nerve, chronic nerve compression can result. Alterations in muscle length can cause muscle weakness, requiring overuse of other muscles to compensate for the decrease in muscle force(60, 61).

Significant association also found for working days, working five or more days has two times higher odds than of working less. Indian brick manufactures shows association for working duration, working days and missing breaks. Consistent result found in this study for working days and missing breaks but not for working hour this may be different categories working hour due to difference in settings. Lack of break and more working days restricts the ability of muscles and bones to regenerate and heel itself (61), this may in turn contribute for the development of WMSD.

It is revealed that lack of ergonomic training poses three times higher odds for WMSD. This association is may be those workers with ergonomic training may have good posture awareness and good arrangement of work and break time that could lower their risk.Occupational therapists also recommend educating workers and addressing ergonomic training to reduce the morbidity related with WMSD(61).

6.1. Strengths and limitation

The use of mixed tool both the QEC exposure measurement for the ergonomic risks and the Nordic musculoskeletal disorder questioner could be mentioned as strength of this study.The exclusion of workers at the field during data collection period may miss severly ill workers which could underestimate the result.lack of measurement for height and weight of responedents is also another limitation identified.

7. Conclusions and recommendations

7.1. Conclusion

WRMSDs among cobblestone workers in Addis Ababa are characterized with very high prevalence. The erogonmic hazard exposure level for back and shoulder is very high while for neck is moderate. Job stress, Workload, twisting bending position, lack of adequate break and lack of ergonomic training are factors for WRMSDs.

7.2. Recommendation

- To Addis Ababa cobblestone production office it will be helpful to train new workers on manual handling to improve working posture and reduce the risk of WRMSDs.
- The working condition of cobble stone workers should be improved and BOLSA and better to recommend the implementation of decent work principles.
- Further study should be conducted on working posture analysis of the different activities of cobblestone production by mixing ergonomic hazard exposure measurement tools to recommend a comprehensive ergonomic intervention.

8. Reference

1. Occupational health and safety Answers Fact Sheets [database on the Internet]. Canadian Centre for Occupational Health & Safety. 2014 [cited aug 2016]. Available from: http:/www.cchos.ca/oshanswersl.
2. Punnett L, Ustun AP, Nelson DI, A M, Fingerhut, Leigh J, et al. Estimating the global burden of low back pain attributable to combined occupational exposures. American Journal of Industrial Medicine. 2005.
3. united states bureau of labor statistics:national occupational and illness requeering days away from work. In: labor Usdo, editor. 2014.
4. Holmstrom EB. Musculoskeletal disorders in construction workers related to physical, psychosocial, and individual factors. Acta Orthopaedica Scandinavica. 2009;63:55-.
5. lee HY, Yeh WY, Chen CW, Wand JD. Prevalence and psychosocial risk factors of upper extrimity musculoskeltal pain indusries of taiwan a nation wide study. Journal of occupational health. 2005;47:311-8.
6. Neeraja T, Lal B, Swarochish C. The factors associated with MSDs among construction workers. 2014;43:1-8. Epub janurary 2014.
7. David G, Robens. Ergonomic methods for assessing exposure to risk factors for work-related musculoskeletal disorders. Occupational Medicine. 2005;55:190-9.
8. David G, Robens. The development of the Quick Exposure Check (QEC) for assessing exposure to risk factors for work-related musculoskeletal disorders. applied ergonomics. 2008;39(1): 57–69.
9. Guangyan, Buckle P. A Practical Method for the Assessment of Work-Related Musculoskeletal Risks - Quick Exposure Check (QEC) Robens Centre for Health Ergonomics. 1998;42(19):1351-5.
10. Egwuonwu VA, Abidemi TB, Aiyejunsunle CB, Ezeukwu OA, Auwal A, E C, et al. A Cross-Sectional Survey Of Work Related Musculoskeletal Disorders Prevalence And Associated Risk Factors Among Quarry Workers In A South Eastern Nigerian Community. The Internet Journal of Epidemiology. 2013;11(2).
11. Reid A, Pinder A, Monnington S. Musculoskeletal problems in bricklayers,carpenters and plasterers: Literature review and results of site visits. Health and safety laboratory. 2001.
12. Goldsheyder, M N, SS W, R H. Musculoskeletal symptom survey among mason tenders. Am J Ind Med. 2002;42(5):384-96.
13. Donagi p. Stone cutter,International Hazard Datasheets on Occupation. [electronic]: Institute for Occupational Safety and Hygiene; 2009 [updated 20.04.2009.august 2016].
14. Singh J, Kocher G, Lal h. Musculoskeletal disorder among workers in small scale forging industry. International Journal of Applied Research in Mechanical Engineering (IJARME). 2012;2(2):2231 –5950.
15. Gangopadhyay S, Das B, Das T, Ghoshal G, Ghosh T. An Ergonomics Study on Posture-Related Discomfort and Occupational-Related Disorders Among Stonecutters of West Bengal, India. International Journal of Occupational Safety and Ergonomics (JOSE). 2010;16(1):69-79.
16. Putz-Anderson V, Bernard BP, Burt SE, Cole LL, Fairfield-Estill C, Fine LJ, et al. Musculoskeletal Disorders and Workplace Factors. US: National Institute for Occupational Safety and Health, 1997 Contract No.: 97B141.
17. devi K, Kiran UV. Work related musculoskletal disorder among unorganized sector. International Journal of Technical Research and Applications. 2015;3(3):225-9. Epub May-June 2015.
18. Arndt V, Rothenbacher D, Daniel U, Zschenderlein B, Schuberth S, Brenne H. Construction work and risk of occupational disability: a ten year follow up of 14 474 male

workers. Occup Environ Med. 2005;62:559–56.

19. Sharma HR, Appadurai S, Wubshet M, Tadesse T. Occupational exposures and related health effect among construction workers. Ethiop J Health Biomed Sci. 2008;1(1).
20. Tafese A, Nega A, Kifle M, Kebede W. Predictors of occupational exposure to neck and shoulder musculoskeletal disorders among sewing machine operators of garment industries in Ethiopia. Science Journal of Public Health. 2014;2(6):577-83. Epub November 20, 2014.
21. Yitayeh A, Mekonnen S, Fasika S, Gizachew M. Annual Prevalence of Self-Reported Work Related Musculoskeletal Disorders and Associated Factors among Nurses Working at Gondar Town Governmental Health Institutions, Northwest Ethiopia. Emergency Medicine. 2015;5(1). Epub November 21, 2014.
22. Molen HFvd, Veenstra SJ, Sluiter JK, Dresen MHWF. World at work: Bricklayers and bricklayers' assistants. Occup Environ Med. 2004; 61:89-93.
23. Musculoskeletal hazards and controls in masorny [database on the Internet]. Masonry Labour-Management Health and Safety Committee in partnership with the Infrastructure Health & Safety Association. 2012 [cited august 2016]. Available from: www.ihsa.ca.
24. Moges G. Under nutrition and its determinants among cobble stone project,yeka subcity,addis ababa,ethiopia: addis ababa university 2015.
25. Mamo H. Cardio-respiratory Function among Cobble Stone Workers in

Addis Ababa, Ethiopia: ADDIS ABABA UNIVERSITY; 2013.
26. Louw QA, Morris LD, Grimmer-Somers K. The Prevalence of low back pain in Africa: a systematic review. BMC Musculoskeletal Disorders 2007;8.
27. Work related musculoskelal disorder statistic,Great Britain. executive Has; 2015.
28. Jaiswal N, Veerkumar V. Work related Musculoskeletal Disorders among Construction Workers of India. Research Journal of Family, Community and Consumer Sciences. 2015;4(2):1-5. Epub feburary 2016.
29. Deros BM, Daruis DDI, Khamis NK, Mohamad D, Daud SFM, Amdan SM, et al. Prevalence of Work Related Musculoskeletal Disorders Symptoms among Construction Workers: a Case Study in Malaysia. Iranian J Publ Health,. 2014;43(sep 2014):53-7.
30. Boschman JS, Molen HFvd, Sluiter JK, Dresen MHF. Musculoskeletal disorders among construction workers: a one-year follow-up study. biomedcentral. 2012;13(2012):1471-2474.
31. Das B. Assessment of occupational health problems and physiological stress among brick field workers of west bengal,india. International Journal of Occupational Medicine and Environmental Health. 2014;27(3):413 – 25.
32. Ekpenyong CE. Associations Between Worker Characteristics, Workplace Factors,and Work-Related Musculoskeletal Disorders:A Cross-Sectional Study of Male Construction Workers in Nigeria. International Journal of Occupational Safety and Ergonomics (JOSE). 2014;20(3):447–62.
33. Sealetsa OJ, Moalosi R. A Survey of Musculoskeletal Disorder Prevalence in the Kiln Brick Moulding Industry in Botswana. J Ergonomics 2014;4(10):S4-010.
34. Thiede M, Liebers F, Seidler A, Gravemeyer S, Latza U. Gender Specific Analysis of Occupational Diseases of the Low Back Caused by Carrying, Lifting or Extreme Trunk Flexion—Use of a Prevention Index to Identify Occupations With High Prevention Needs. American journal of industrial medicine 2014;57:233-44.
35. Erick P, Smith D. Musculoskeletal disorder risk factors in the teaching profession: a critical review OA Musculoskeletal Medicine. 2013;1(3):29.
36. Leclerc A, Chastang J-F, Niedhammer I, Landre M-F, Roquelaure Y. Incidence of shoulder pain in repetitive work. Occup Environ Med 2004;61:39–44.

37. Hooftman WE, Beek AJvd, Bongers PM, Mechelen Wv. Is there a gender difference in the effect of work-related physical and psychosocial risk factors on musculoskeletal symptoms and related sickness absence? Scand J Work Environ Health. 2009;35(2):85-95.
38. Ilmarinen J. The ageing workforce – Challenges for occupational health

Occupational Medicine. 2006;56(6): 362-4.
39. Okunribido O, Wynn T. Ageing and work-related musculoskeletal disorders:A review of the recent literature. Executive HaSLftHaS; 2010.
40. Meo S, Alsaaran Z, Alshehri M, Khashougji M, Almeterk A, Almutairi S. Work-Related musculoskeletal symptoms among building construction workers in Riyadh, Saudi Arabia. Pak J Med Sci. 2013;29(6):1394-9.
41. ElWafa HSA, ElBestar SF, ElGilany A-H, Awad EE. Musculoskeletal disorders among municipal solid waste collectors in Mansoura, Egypt: a cross-sectional study. BMJ Open. 2012.
42. Inbaraj LR, Haebar OJ, Saj F, Dawson S, Paul P, Kundavaram A, et al. Prevalence of musculoskeletal disorders among brick kiln workers in rural Southern India. Indian J Occup Environ Med. 2013;17(2):71–5.
43. Lemasters GK, Atterbury MR, Booth-Jones AD, Bhattacharya A, Ollila-Glenn N, Forrester C, et al. Prevalence of work related musculoskeletal disorders in active union carpenters. Occup Environ Med 1998;55:421–7.
44. Heuer H, Klimmer F, Kylian H, Seeber A, Schmidt KH, Hoffmann G, et al. Musculoskeletal problems in bricklayers as a function of length of employment: The role of secondary selection by low-back pain. work & stress journal. 2007;10(4):322-35.
45. Sethi J, Sandhu JS, Imbanathan V. Effect of Body Mass Index on work related musculoskeletal discomfort and occupational stress of computer workers in a developed ergonomic setup. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology. 2011;3(22).
46. Engholm G, Holmström E. Dose–response associations between musculoskeletal disorders and physical and psychosocial factors among construction workers. Scand J Work Environ Health. 2005;31(2):57-67.
47. Das B. An evaluation of low back pain among female brick field workers of West Bengal, India. Environ Health Prev Med. 2015;20:360–8.
48. Passier L, McPhail S. Work related musculoskeletal disorders amongst therapists in physically demanding roles:qualitative analysis of risk factors and strategies for prevention. BMC Musculoskeletal Disorders 2011;12(24).
49. Yasobant S, Rajkumar P. Work-related musculoskeletal disorders among health care professionals: A cross sectional assessment of risk factors in a tertiary hospital, India. Indian J Occup Environ Med. 2014;18 (2):75–81.
50. Plouvier S, Leclerc A, Chastang J, Bonenfant S, Goldberg M. Socioeconomic position and low-back pain – the role of biomechanical strains and psychosocial work factors in the GAZEL cohort. Scand J Work Environ Health 2009;35(6):429-36.
51. Cook T, Rosecrance J, Zimmermann C. Work-related musculoskeletal disorders in bricklaying a symptom and job factors survey and guidelines for improvements. Appl Occup Environ Hyg 1996;11(11):1335-9.
52. Trevelyan FC, Haslam RA. Musculoskeletal disorders in a handmade brick manufacturing plant. International Journal of Industrial Ergonomics 2001;27 43-55.
53. Kunda R, Frantz J, Karachi F. Prevalence and Ergonomic Risk Factors of Work-related Musculoskeletal Injuries amongst Underground Mine Workers in Zambia. Journal of Occupaational Health 2013;55 211–7.

54. Bidiawati JRA, Suryani E. Improving The Work Position of Worker's Based on Quick Exposure Check Method to

Reduce the Risk of Work Related Musculoskeletal Disorders. Industrial Engineering and Service Science 2015 4 496 – 503.

55. Choobineh A, Tabatabaei SH, Mokhtarzadeh A, Salehi M. musculoskeltal problems among workers of iranian rubber factory. Journal of occupational health. 2007;49:418-23.

56. Hoogendoorn WE, Bongers PM, Vet HCWd, Ariëns GAM, Mechelen Wv, Bouter LM. High physical work load and low job satisfaction increase the risk of sickness absence due to low back pain: results of a prospective cohort study. Occup Environ Med. 2002;59:323–8.

57. Crawford JO. The Nordic Musculoskeletal Questionnaire. Occupational Medicine. 2007;57:300–1.

58. Kuorinka, Jonsson Bt, Kilbom A, Vinterberg Ht, Biering-Srensen F, Andersson G, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Applied Ergonomics 1987;18(3):233-7.

59. Attitudes in the American Workplace VII The American Institute of Stress; 2011.

60. Novak CB. Upper Extremity Work-Related Musculoskeletal Disorders: A Treatment Perspective. Journal of Orthopaedic & Sports Physical Therapy. 2004;34 (10).

61. Nainzadeh N, Malanticlin A, alvarez M, loeser AC. Repetitive Strain Injury and Cumulative Trauma Disorder Causes and Treatment. Mount sinai journal of medicine 1999;66 (3).

Annex 1

Information Sheet and consent form of study participants

Addis Ababa University College of Health Science, School of public health, environmental and occupational health specialty track

Questioner to assess the prevalence and associated factors among cobblestone workers in Addis Ababa, Ethiopia

Hello, my name is…………………. I am here in the behalf of Samerawit Teklu, a post graduate student from Addis Ababa University. Am here to collect information requiring you to interview on sociodemographic, individual and work related environment questions. Prior to this I will be explaining information about the study and requesting you to participate in the study.

Title of the study- Assessment of prevalence and associated factors of musculoskeletal disorder among coble stone workers in Addis Ababa, Ethiopia.

Back ground - Cobblestone production is highly labor intensive and demanding work that exposes workers for musculoskeletal disorders. Evidences on measuring exposure level are limited in the area. As a result studying magnitude and factors incorporating exposure level measurement will be crucial.

Objective – The objective of the study is to assess the prevalence and associated factors of musculoskeletal disorder among cobble stone workers in Addis Ababa, Ethiopia.

Benefit of the study – The study only has benefit in the long run after dissemination the result for responsible bodies to provide policy directives that improve work place conditions. The study will not have immediate financial, health care or job improvement.

Risk – The study do not pose any risk to the participants.

Confidentiality and right of the participants –The participation in this study is voluntary. You are not forced to answer or participate in study and you can discontinue at any time during the interview.

To ensure the confidentiality of any information you provide, your name will be replaced by code and the information you provide will kept confidential.

Duration of the interview – This interview will take approximately 15 – 20 minutes.

Permission- Could I get your permission to continue the interview?

If yes, continue the interview, if no skip to the next participant mentioning the reason.

Informed consent

I have read this form or it has been read to me in the language I understand all conditionsstated above .Therefore

1. I agree to participate 2. I refuse to participate

Name of investigator: Samerawit Teklu

Address: Mob +251913465829

E-mail: alukonjo@gmail.com

Supervisor address Tel …………………………….

Questiniere ID number………………………………

Date of interview ………………………………….

Time started ……………………………………….

Time completed …………………………………….

Result of interview

1. Completed
2. Respondent not available
3. Refused
4. Partially completed

Checked by

Supervisor name …………………………signature …………………..date……………

If no, skip to the next participant by writing reasons refusal below.

…………………………………………………………………………………………

Annex 2

Questionnaire for assessment of magnitude and associated factors of musculoskeletal disorder among cobble stone workers

Part one: Socio demographic characteristics

Code	Question	Possible response	Skip
001	Sex	1. Male 2. Female	
002	Age in years	………………	
003	Religion	1. Orthodox 2. Protestant 3. Muslim 4. Other specify	
004	Marital status	1. Single 2. Married 3. Widowed 4. Divorced	
005	Educational status	1. Illiterate 2 .Read and write 1. Primary education 2. Secondary education 3. TVET 4. Diploma and above	
006	Average monthly income in ETH-birr	…………………..	
007	Work experience	……………………	

Part two: Individual factors associated with work-related musculoskeletal disorders

101	Do you smoke cigarette?	1. Yes 2. No →	103
102	If your answer for Qn No 101 is yes 1. How often you smoke 2. How much stick per day	1.-------day/wk 2.-------/day	
103	Do you drink alcohol?	1. Yes 2. No →	105
104	If your answer for Qn No 103 is yes How often you drink?	________________ ----------------day/wk	
105	Do you have habit of exercise?	1. Yes 2. No →	107
106	How often you exercise at least for 30 minute?	----------------days/wk	
107	Body heiht	--------------------meter	
108	Body weight	--------------------kg	
109	BMI	1.Underweight <18.50 2.Normal=18.50-24.99 3.Overweight=25.00-29.99 4. Obese 30.00	
111	Do youhave chronic illness diagnosed by physician?	1. Yes 2. No	

Part three - Ergonomics factor associated with work-related musculoskeletal disorders

201	How many days did you work per week?	-----------------dayslwk	
202	How many cobble stones you produce per day?	---------------stone/day	
203	Does you work require frequent and continuous bending/ twisting?	1. Yes 2. No	
204	Does your work require continious repetitive movement less than 30 second?	1. Yes 2. No	
205	Do you work require standing for two hours per day?	1. Yes 2. No	
206	Does your work require manual material handling?	1. Yes 2. No	
207	Do you take breaks between works?	1. Yes 2. No →	Next section
208	If your answer is yes 1. How many days a week 2. How many hours a day	1.-----------day/wk 2.-----------hr/day	
209	Have you ever take training related to ergonomics safety at work?	1. Yes 2. No	

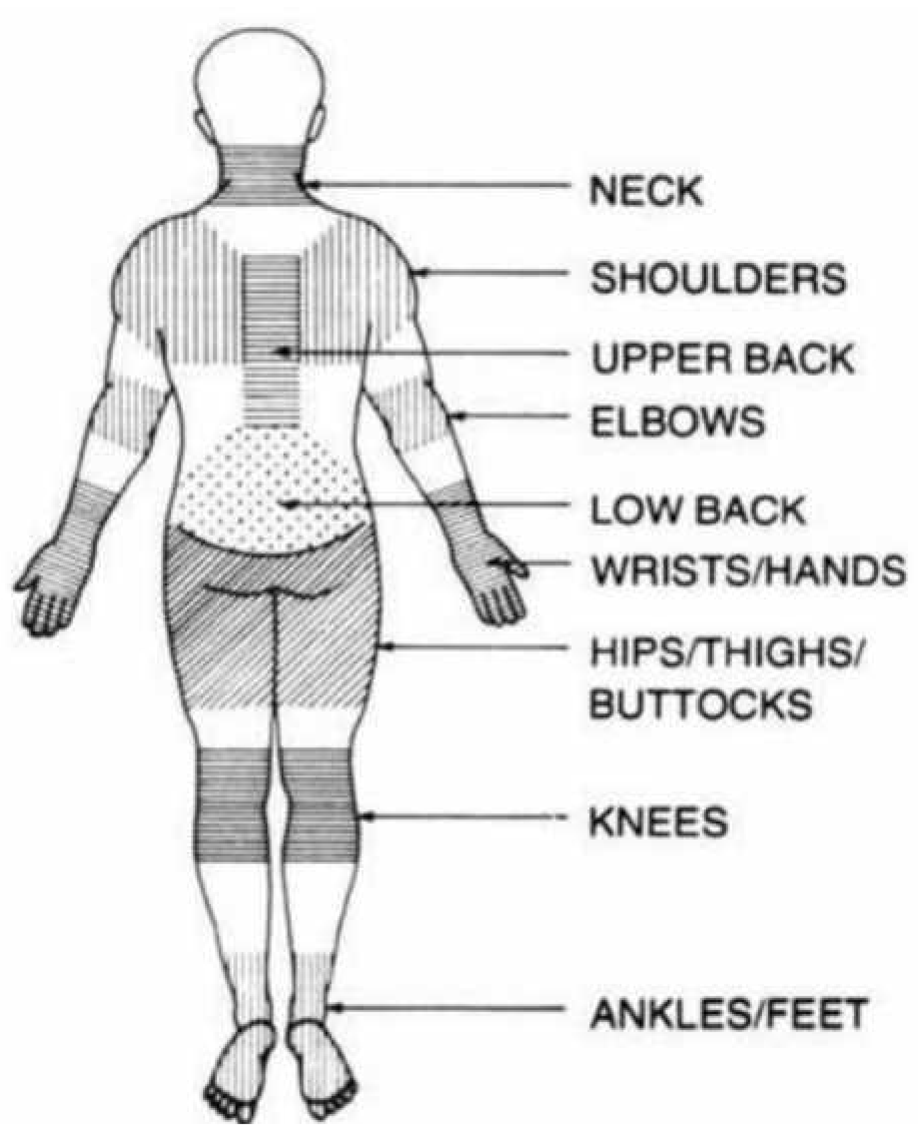
Part four –Psychosocial factor and working environmental associated with WRMSDs

301	Do you have comfortable sitting apparatus?	1. Yes 2. No	
302	Did you attend training of cobble stone production?	1. Yes 2. No	
303	How do you explain your relationship with other colloquies?	1. Good 2. Fair 3. Poor	
304	Do you have supervisor/boss?	1. Yes 2. No	
305	If your answer is yes how do you explain your relationship?	1. Good 2. Fair 3. Poor	
Thermal comfort assessment(make a thick)		Yes	No
306	Does the air feel warm or hot?		
307	Does the temperature in the workplace fluctuate during a normal working day?		
308	Is the workplace affected by external weather conditions?		
309	Is cold or warm air blowing directly into the workspace?		
310	Is work rate moderate to Intensive in warm or hot Conditions?		
311	Does workingenvironment have comfortable temperature?		

Job stress score

No	Questions	job stress score				
		Never	Rarely	Sometimes	Often	Very often
401	Conditions at work are unpleasant or sometimes even unsafe.	1	2	3	4	5
402	I feel that my job is negatively affecting my physical or emotional wellbeing	1	2	3	4	5
403	I have too much work to do and/or too many unreasonable deadlines.	1	2	3	4	5
404	I find it difficult to express my opinion or feelings about my job conditions to my superiors.	1	2	3	4	5
405	I feel that job pressures interfere with my family or personal life.	1	2	3	4	5
406	I have adequate control or input over my work duties.	1	2	3	4	5
407	I receive appropriate recognition or rewards for good performance.	1	2	3	4	5
408	I am able to utilize my skills and talents to the fullest extent at work	1	2	3	4	5
409	Final score					

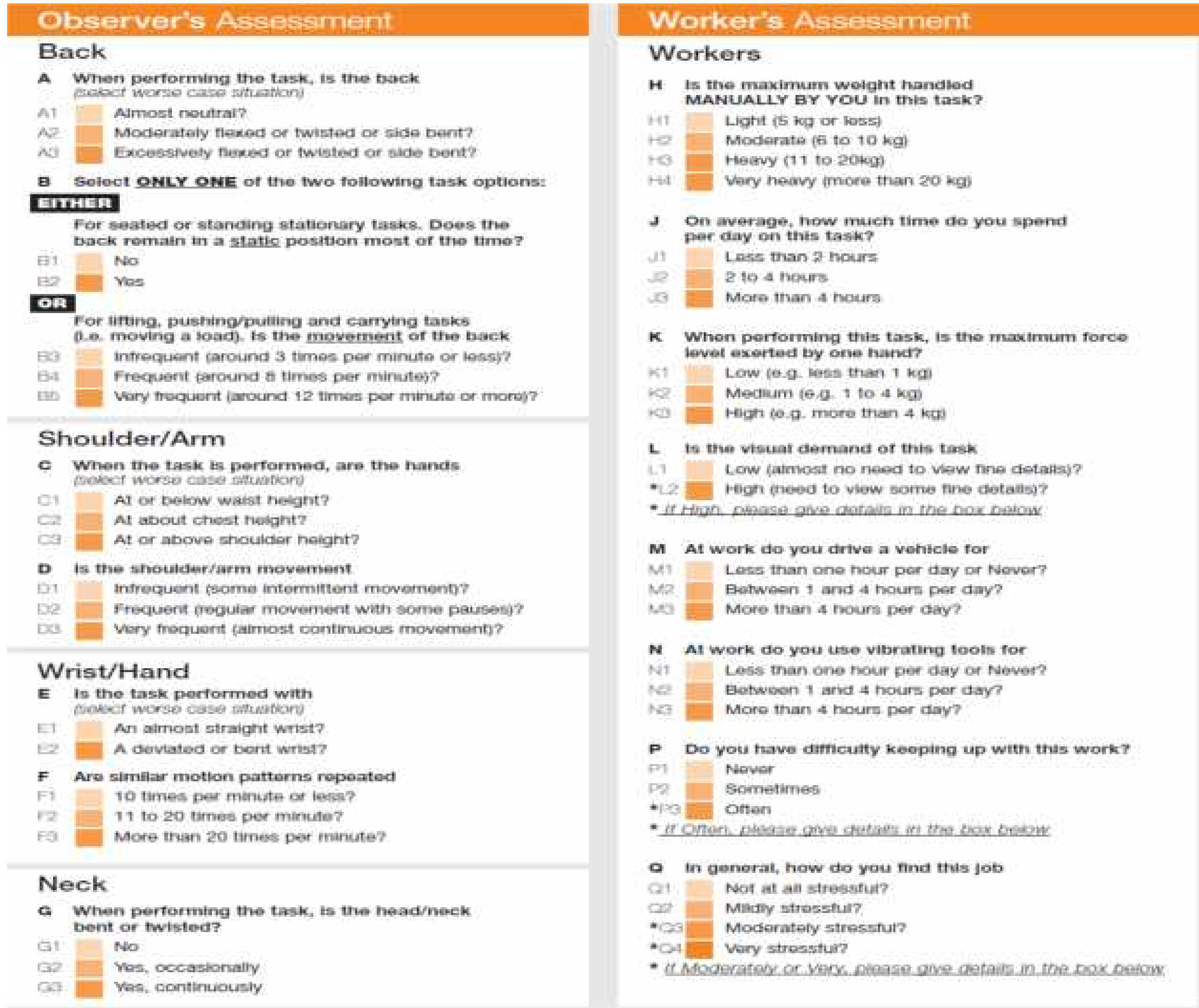
Part five: Questioners to asses WMSD in neck, shoulder, upper back, lower back, hip /thigh,Knee/leg, ankle/foot and wrist /hand. The diagram below shows the approximate position ofthe body parts referred to in the questionnaire.



	Have you at any time in the last 12 months had trouble (ache, discomfort and pain)in: (If no, go on to the next body region if yes, please continue)		During the last seven days have you had trouble
601	Neck	1. Yes 2. No	1. Yes 2. No
602	Upper shoulder	1. Yes 2. No	1. Yes 2. No
603	Lower shoulder	1. Yes 2. No	1. Yes 2. No
604	Upper back	1. Yes 2. No	1. Yes 2. No
605	Lower back	1. Yes 2. No	1. Yes 2. No
606	Right elbow	1. Yes 2. No	1. Yes 2. No
607	Left elbow	1. Yes 2. No	1. Yes 2. No
608	Right Wrists/hands	1. Yes 2. No	1. Yes 2. No
610	Left Wrists/hands	1. Yes 2. No	1. Yes 2. No
611	Right Hips/thighs	1. Yes 2. No	1. Yes 2. No
612	Left Hips/thighs	1. Yes 2. No	1. Yes 2. No
613	Right knee	1. Yes 2. No	1. Yes 2. No
614	Left knee	1. Yes 2. No	1. Yes 2. No
615	Right Ankles/feet	1. Yes 2. No	1. Yes 2. No
616	Left Ankles/feet	1. Yes 2. No	1. Yes 2. No

Annex 3

Quick exposure cheek method and score table for assessment of prevalence and associated factors musculoskeletal disorder among cobble stone workers



Observer's Assessment

Back

A When performing the task, is the back
(select worse case situation)
A1 Almost neutral?
A2 Moderately flexed or twisted or side bent?
A3 Excessively flexed or twisted or side bent?

B Select ONLY ONE of the two following task options:

EITHER
For seated or standing stationary tasks. Does the back remain in a static position most of the time?
B1 No
B2 Yes

OR
For lifting, pushing/pulling and carrying tasks (i.e. moving a load). Is the movement of the back
B3 Infrequent (around 3 times per minute or less)?
B4 Frequent (around 8 times per minute)?
B5 Very frequent (around 12 times per minute or more)?

Shoulder/Arm

C When the task is performed, are the hands
(select worse case situation)
C1 At or below waist height?
C2 At about chest height?
C3 At or above shoulder height?

D Is the shoulder/arm movement
D1 Infrequent (some intermittent movement)?
D2 Frequent (regular movement with some pauses)?
D3 Very frequent (almost continuous movement)?

Wrist/Hand

E Is the task performed with
(select worse case situation)
E1 An almost straight wrist?
E2 A deviated or bent wrist?

F Are similar motion patterns repeated
F1 10 times per minute or less?
F2 11 to 20 times per minute?
F3 More than 20 times per minute?

Neck

G When performing the task, is the head/neck bent or twisted?
G1 No
G2 Yes, occasionally
G3 Yes, continuously

Worker's Assessment

Workers

H Is the maximum weight handled MANUALLY BY YOU in this task?
H1 Light (5 kg or less)
H2 Moderate (6 to 10 kg)
H3 Heavy (11 to 20kg)
H4 Very heavy (more than 20 kg)

J On average, how much time do you spend per day on this task?
J1 Less than 2 hours
J2 2 to 4 hours
J3 More than 4 hours

K When performing this task, is the maximum force level exerted by one hand?
K1 Low (e.g. less than 1 kg)
K2 Medium (e.g. 1 to 4 kg)
K3 High (e.g. more than 4 kg)

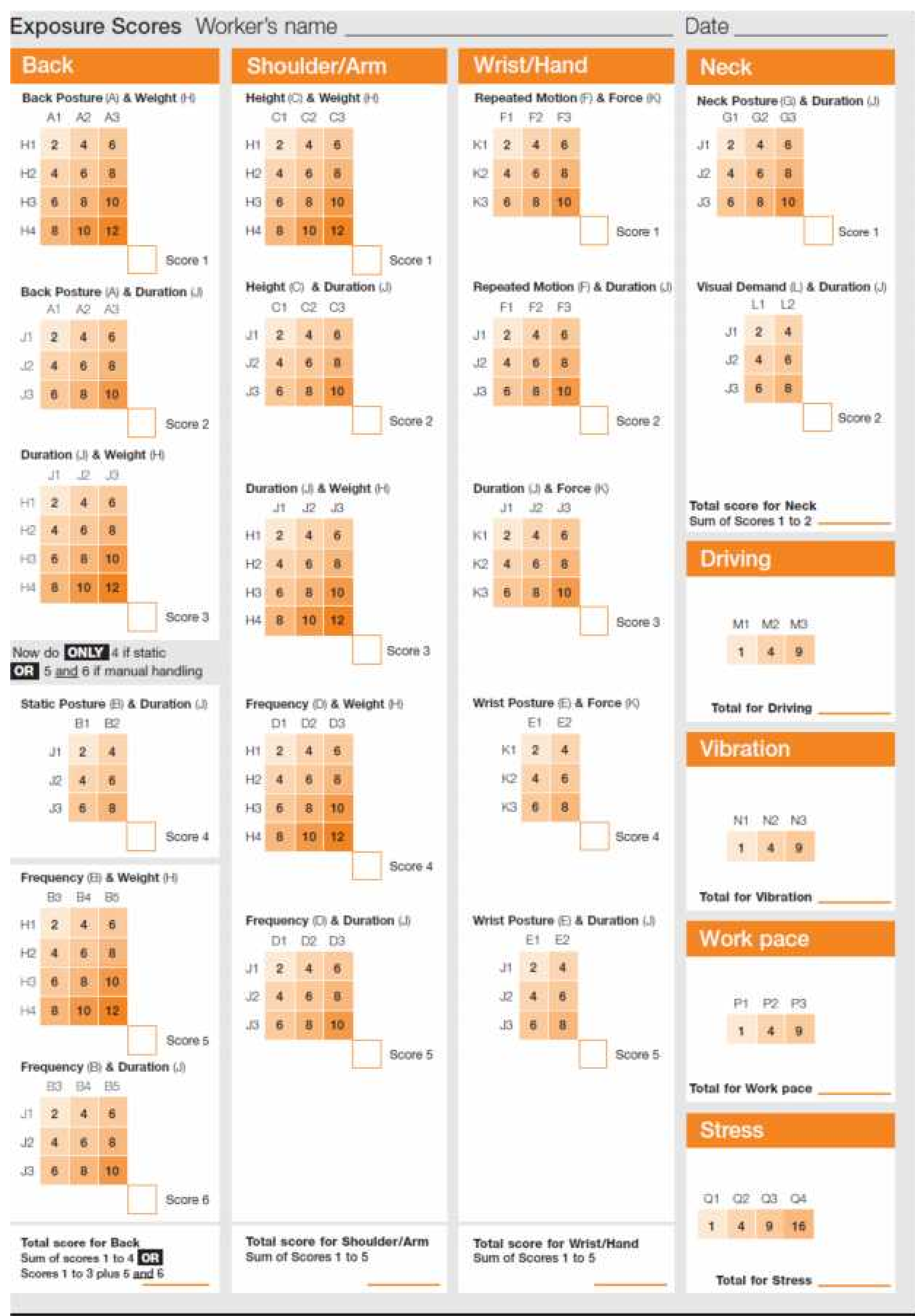
L Is the visual demand of this task
L1 Low (almost no need to view fine details)?
*L2 High (need to view some fine details)?
* *If High, please give details in the box below*

M At work do you drive a vehicle for
M1 Less than one hour per day or Never?
M2 Between 1 and 4 hours per day?
M3 More than 4 hours per day?

N At work do you use vibrating tools for
N1 Less than one hour per day or Never?
N2 Between 1 and 4 hours per day?
N3 More than 4 hours per day?

P Do you have difficulty keeping up with this work?
P1 Never
P2 Sometimes
*P3 Often
* *If Often, please give details in the box below*

Q In general, how do you find this job
Q1 Not at all stressful?
Q2 Mildly stressful?
*Q3 Moderately stressful?
*Q4 Very stressful?
* *If Moderately or Very, please give details in the box below*



Exposure Scores

Worker's name ______________________ Date __________

Back

Back Posture (A) **& Weight** (H)

	A1	A2	A3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 1

Back Posture (A) **& Duration** (J)

	A1	A2	A3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) **& Weight** (H)

	J1	J2	J3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 3

Now do **ONLY** 4 if static **OR** 5 and 6 if manual handling

Static Posture (B) **& Duration** (J)

	B1	B2
J1	2	4
J2	4	6
J3	6	8

Score 4

Frequency (B) **& Weight** (H)

	B3	B4	B5
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 5

Frequency (B) **& Duration** (J)

	B3	B4	B5
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 6

Total score for Back
Sum of scores 1 to 4 **OR**
Scores 1 to 3 plus 5 and 6 ______

Shoulder/Arm

Height (C) **& Weight** (H)

	C1	C2	C3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 1

Height (C) **& Duration** (J)

	C1	C2	C3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) **& Weight** (H)

	J1	J2	J3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 3

Frequency (D) **& Weight** (H)

	D1	D2	D3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 4

Frequency (D) **& Duration** (J)

	D1	D2	D3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 5

Total score for Shoulder/Arm
Sum of Scores 1 to 5 ______

Wrist/Hand

Repeated Motion (F) **& Force** (K)

	F1	F2	F3
K1	2	4	6
K2	4	6	8
K3	6	8	10

Score 1

Repeated Motion (F) **& Duration** (J)

	F1	F2	F3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) **& Force** (K)

	J1	J2	J3
K1	2	4	6
K2	4	6	8
K3	6	8	10

Score 3

Wrist Posture (E) **& Force** (K)

	E1	E2
K1	2	4
K2	4	6
K3	6	8

Score 4

Wrist Posture (E) **& Duration** (J)

	E1	E2
J1	2	4
J2	4	6
J3	6	8

Score 5

Total score for Wrist/Hand
Sum of Scores 1 to 5 ______

Neck

Neck Posture (G) **& Duration** (J)

	G1	G2	G3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 1

Visual Demand (L) **& Duration** (J)

	L1	L2
J1	2	4
J2	4	6
J3	6	8

Score 2

Total score for Neck
Sum of Scores 1 to 2 ______

Driving

M1	M2	M3
1	4	9

Total for Driving ______

Vibration

N1	N2	N3
1	4	9

Total for Vibration ______

Work pace

P1	P2	P3
1	4	9

Total for Work pace ______

Stress

Q1	Q2	Q3	Q4
1	4	9	16

Total for Stress ______

Annex IV Amharic version of information sheet and consent form

በአዲስ አበባ ዩኒቨርስቲ ጤና ሳይንስ ኮላጅ የህብረተሰብ ጤና ትምህርት ቤት

የጥናቱ መግለጫና የፍቃደኝነት መስጫ የአማርኛ ቅፅ

መግቢያ፡- ጤና ይስጥልኝ እንደምን አሉ? እኔ………… እባላለሁ። እዚህ የመጣሁት ይህንን ጥናት የምታካሂደዉን የአዲስ አበባ ዩኒቨርሲቲ የጤና ሳይንስ ኮሌጅ የሕብረተሰብ ጤና ትምህርት ክፍል የድህረ ምረቃ ተማሪ የሆነችውን ሳምራዊት ተክሉን ወክዬ ነው ። በአዲስ አበባ ከተማ በሚገኙ የኮብልሰቶን ሠራተኞች በስራ ምክንያት የሚከሰቱ የጡንቻና የመገጣጠሚያ አካላት ህመም መጠንና ተያያዥ መንስኤዎች ለማጥናት ነው። ስለዚህ በጥናቱ ላይ ተሳትፎ ለማድረግ ወይም ላለማድረግ እንዲወስኑ በቅድሚያ የተወሰነ መረጃ እንሰጥዎታለን ።

የጥናቱ ርዕስ፡ በአዲስ አበባ ከተማ በሚገኙ የኮብልሰቶን ሠራተኞች በስራ ምክንያትየሚከሰቱ የጡንቻና የመገጣጠሚያ አካላት ህመም መጠንና ተያያዥ መንስኤዎች ለማጥናት ነው።

የጥናቱ ጥቅም: ይህ ጥናት ለተሳታፉው ተሳታፉ በመሆናቸው በቀጥታ የሚያገኙት የገንዘብ፣የጤና እንክብካቤም ሆነ ሌሎች ጥቅሞች የሉትም። ነገር ግን በሂደት የጥናቱ ውጤት ለሚመለከተውአካልና እንደ ግብዓትነት ያገለግላል። በተጨማሪም በመስኩ እንደ መነሻ መረጃ ሆኖ ያገለግላል።

የጥናቱ ጉዳት፡ የቃለ መጠይቁ ተሳታፉ በጥናቱ የሚደርስባቸው ምንም ዓይነት ጉዳት አይደርስባቸውም።

ሚስጥራዊነት ፡ተሳታፉዎች ስማቸውን እንዲጠቅሱ አይጠበቅም ።ማንኛውንም ተሳታፉዎች የሚሰጡትን መረጃ በሙለ ሚስጥራዊነቱ እንዲጠበቅ የጥናቱ ስነ-ምግባር ያስገድዳል በመሆኑም ተሳታፉው የሚሰጠው መረጃ ሚስጥራዊነት ስለሚኖረው ተሳታፉው ከአስተዳደራዊ ጫና ነፃ ነው።

የተሳታፉዎች መብት፡- ተሳታፉው በዚህ ጥናት ሊይ የመሳተፍ ወይም ያለመሳተፍ መብቱ የተጠበቀ ነው። በመሳተፍ ላይ እያለ ቃለመጠይቁ በማንኛውም ሰዓት ማቋረጥ ወይም ከጥያቄዎቹ ውስጥ ለመመስ የማይፈልጉትን ጥያቄ አለመመለስ ይቻላሉ። ቃለ-መጠይቁ በአማካይ 10-15 ደቂቃ ይወስዳል ። በቃለ መጠይቁ ወቅት ግልጽ ያሌሆነን ነገር መጠየቅ ይቻላል።

መገናኘት የሚፈልጉ ከሆነ፡- የጥናቱ ተሳታፉ ስለጥናቱ ሁኔታ እና ይዘት ግሌፅ ካሌሆነሎት በማንኛውም ሰዓት መረጃ የመጠየቅ መብት አልዎት። በዚህ ሰዓት ስለትቃለ መጠይቁን ዓላማ ወይም ይዘት የሚጠይቁኝ ነገር አለዎት ? በጥናቱ ለመሳተፍ ፍቃደኛ ነዎት?

የፍቃደኝነት መግለጫ ቅፅ

ከዚህ በሊይ ስለጥናቱ የተጻፈውን መግለጫ በሚገባኝ ቋንቋ አንብቤ ወይም ተነቦልኝ ተረድቻለሁ። በማንኛውም ሰዓት ከጥናቱ ያለምንም ቅጣት ማቋረጥ እንደምችል ተረድቻለው። በመሆኑም በዚህ

1. እስማማለሁ 2. አልስማማም (መልሱ እስማማለሁ ከሆነ ወደሚቀጥለው ገፅ ይሻገሩ። መልሱ አልስማማም ከሆነ አመስግነው ወደሚቀጥሀው ሠራተኛ ይሂዱ። ለጥናቱ ፍቃደኛ

ያልሆኑበትን ምክንያት በመጠየቅና በማስታወሻ ላይ በመያዝ ለጥናቱ ተቆጣጣሪ ሪፖርት ያድርጉ፡፡

ጥናቱን የሚያካሂደዉ ስም፡ ሳምራዊት ተክሉ

ስልክ ቁጥር፡0913465829

ኢሜል፡alukonjo@gmail.com

የተቆጣጣሪዉ ስም-----------------------------ስልክ-------------------------

መለያ ኮድ ቁጥር -----------------------

የተጀመረበት ሰዓት------------------------

ያለቀበት ሰዓት----------------------------

የቃለ መጠይቁ ዉጤት

1 ሙሉ በሙሉ ተጠናቋል
2 ተጠያቂዉ አልተገኘም
3 ተጠያቂዉ ለመሳተፍ ፍቃደኛ አልሆነም
4 በከፊል ተጠናቋል

የቃለ መጠይቅ አድራጊዉ፡-ስም ------------------------------- ፉርማ------------------------ቀን-----------

ቃለ መጠይቁን ያረጋገጠዉ ሱፐርቫይዘር ስም______________ ፉርማ_________________ቀን--------------

Annex V Amharic version of questionnaire

ተ.ቁ	ጥያቄዎች	መልሶች	ይሻገሩ

001	ጾታ	1. ወንድ 2. ሴት	
002	እድሜ በአመት	--------------	
003	የጋብቻ ሁኔታ	1. ያገባ/ች 2. ያላገባ/ች 3. የፈታ/ች 4. የሞተበት/ች 5. ሌላ ካለ ይገለጽ	
004	ሀይማኖት	1. ኦርቶዶስ 2. ሙስሊም 3. ትሮቴስታነት 4. ካቶሊክ 5. ሌላ ካለ ይገለጽ	
005	የትምህርት ደረጃ	1. ምንም ያልተማረ 2. ማንበብና መጻፍ 3. አንደኛ ደረጃ(1-8) 4. ሁለተኛ ደረጃ (9-12) 5. የቴክንክና ሙያ ሰርተፊኬት 6. ድግሪ	
006	ወርሀዊ ገቢ	-------------	
007	የስራ ልምድ	--------------	

ክፍል ሁለት፡የግለሰብ ሁኔታን የተመለከቱ ጥያቄወች

ተ.ቁ	ጥያቄዎች	መልሶች	ተሻገር
101	ትምባሆ /ሲጃራ ያጨሳሉ ?	1. አዎ 2. አላጨስም ⟶	103
102	ለተራቁጥር 101 መልሰዎ አዎ ከሆነ በሳምንቱ ለምንያህልቀን ና ምን ያህል ሺጃራ (በባኮ ወይምበነጠላ)ያጨሳሉ ?	1. --------ቀን/ በሳምንት 2. --------ሲጃራ	
103	አልኮል ይጠጣሉ ?	1. አዎ 2. አልጠጣም ⟶	105
104	ለተራቁጥር 103 መልሰዎ አዎ ከሆነ ምንያህል ቀን በሳምንትና በወር ይጠጣሉ ?	1. _____ቀን በሳምነት 2. ___ቀን በወር 3. ሌላ ካለ ይገለጽ ___________	
105	የአካል ብቃት እንቅስቃሴ ያደርጋሉ?	1. አዎ 2. አላደርግም ⟶	107
106	ለተራቁጥር 105 መልሰዎ አዎ ከሆነበየሳምንቱ ለምንያህልቀናት ቢያንስ ለ30 ደቂቃ ስፖርት ይሰራሉ?	-------------ቀናት	
107	የሰውነትክብደት በ ኪሎግራም	------------- ኪ.ግ	
108	ቁመት በሴንትሜትር	--------------ሴ.ሜ	
109	BMI (ክብደት/ቁመት 2)	1. ከክብደት በታች (<18.50) 2. ተመጣጣኝ (18.50-24.99) 3. ከክብደት በላይ (25.00-29.9) 4. የተጋነና ክብደት (30.00)	

ክፍል ሶስት፡ ከስራ ቦታው ና ከስራው አሰራር ሁኔታ ጋር ተያይዞ ያሉ መንስኤዎች

ተ.ቁ	ጥያቄዎች	መልስ	ተሻገር
201	ምን ያህል ሰአት በስራ ላይ ቆመው ያሳልፋሉ?	---------ሰዐት/በቀን	
202	ስራዎ ምቹ ባለሆነ ሁኔታ ለተከታታይ ሰዐታት ታጥፈው ወይም ተጠማዘው እንድሰሩአድረጎዎታል?	1. አዎ 2. አላረገኝም	
203	በተመሳሳይ ሁኔታ ለ2 ሰአታት ቆመው ወይ ቁጭ ብለው ይሰራሉ?	1. አዎ 2. አልሰራም	
204	ከ30 ሰከንድ ባነሰ ግዜ ውስጥ ድግግሞሽያለው ስራ ለተከታታይ ሰዐታተ ይሰራሉ?	1. አዎ 2. አልሰራም	
205	በዚህ ስራ በቀን ውስጥ ምንያህል ግዜ ያሳልፋሉ?	----------ሰአት	
206	በሳምንት ውስጥምንያህል ቀን ይሰራሉ?	-----------ቀን	
207	በቀን ውስጥ በአማካይ በቁጥር ምንያህል ኮብል ስቶን ይጠርባሉ ?	-----------ኮብል/በቀን	
208	በስራ ሰአት በቀን ውስጥ ከምሳ ሰአት ውጭእረፍት አለዎት?	1. አዎ 2. የለኝም →	211
209	ለተራቁጥር 208 መልሰዎ አዎ ከሆነ ስንት ግዜ፣ለምን ያህል ደቂቃ	-------ግዜ -----ደቂቃ	
210	በስራ ቦታዎ ላይ የስራ ደህንነት ስልጠናወይም ከጤና ጋር በጠያያዘ ሰልጥነው ያውቃሉ?	1. አዎ 2. አይ	

ክፍል 4፡ከስራ አካባቢና ከስነልቦና ጋር ተያያዥነት ያላቸው ጥያቄዎች

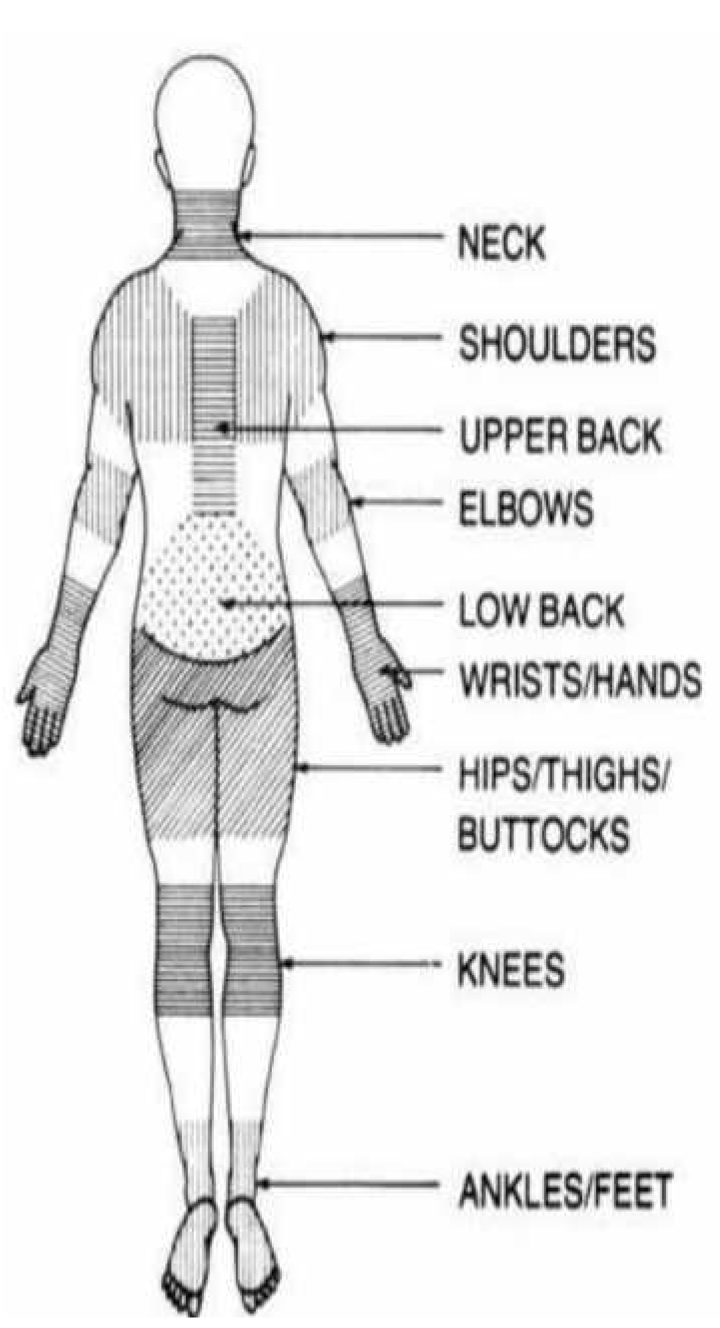
ተ.ቁ	ጥያቄዎች	መልስ	ይሻገሩ
301	የስራ ቦታዎ ምቹ የሆነ መቀመጫ አለው?	1. አዎ 2. አይ	
302	ከስራ ጓደኛዎ ጋር ያለውን ግንኙነት እንዴት ይገልጹታል ?	1. ጥሩ 2. መጠነኛ 3. ጥሩ ያልሆነ	
303	በስራዎ አለቃ አለዎት ?	1. አዎ 2. አይ →	የሚቀጥለዉ ክፍል
304	ከስራ አለቃዎ ጋር ያለውን ግንኙነት እንዴት ይገልጹታል ?	1. ጥሩ 2. መጠነኛ 3. ጥሩ ያልሆነ	
የስራ ቦታ የሙቀት ሁኔታ መገምገሚያ ጥያቄዎ (በመልሱ ላይ ምልክት ያድርጉ)		**አዎ**	**አይ**
305	ቀዝቃዛ ወይም ሙቀት ያለው የአየር ንብረት በስራ ቦታዎ ላይ ይሰማወታል ?		
306	በስራ ሰአት የአየር ሙቀት በስራ አካባቢ ይለዋወጣል ?		
307	ቀዝቃዛ ወይም ሞቃት አየር በስራ ቦታ ላይ ይነፍሳል?		
308	የስራ ክብደት ሙቅ በሆነ አየር ይጨምራል ?		
309	የስራ ቦታዎ የአየር ሁኔታ በእርሶ አይታ	1. ምቹ ነዉ 2. ምቹ አይደለም	

የስራ ድብርት መለኪያ

ተ.ቁ	ጥያቄዎች	የስራድብርት መለኪያዎች				
		በፍፁም	አልፎአልፎ	አንዳንዴ	ብዙጊዜ	ሁልጊዜ
401	የስራ ቦታ ሁኔታዎች ደስ የማይሉና አንዳንዴ ደህንነቱ ያልተጠበቀ ሆኖ ያውቃል?	1	2	3	4	5
402	ስራዬ አካላዊ ና ስነ-ልቦናዊ ጉዳትያደርስበዎታል?	1	2	3	4	5
403	ብዙ የስራ ጫና አለበዎት ?	1	2	3	4	5
404	ስለ ስራ ሁኔታዎ ለአለቃዎት መናገርይከብደዎታል?	1	2	3	4	5
405	የስራጫናው ከግልና ከቤተሰብ ህይወቴአጋጭቶዎታል?	1	2	3	4	5
406	የስራ ድርሻዎትን በአግባቡ ማከናወንናመቆጣጠር ይችልሉን?	1	2	3	4	5
407	በጥሩ ሁኔታ ለሰሩት ስራ እውቅና/ ሽልማትተሰጥቶዎታል?	1	2	3	4	5
408	ችሎታዎትን ና ክህሎትዎን በስራዎ በደንብይጠቀማሉ?	1	2	3	4	5
409	አጠቃላይ ውጤት					

aክፍል5፡ባለፉት 12 ወራት ውስጥ በስራ ምክንያት የሚመጣ የጡንቻ እና አጥንት ህመም መጠንን ለማወቅ የተዘጋጀ(ከኖርዲክ ስታንዳርድ መጠይቅ የተወሰደ)

ተ.ቁ	ባለፈው 12 ወራት ውስጥ በጡንቻ ና በአጥንት ላይ አስቸጋሪ የሆነ ህመም(መቆርጠም፣መደንዘዝ) ስሜት አጋጥሞት ያውቃሉ?መልሰዎ የለም ከሆነ ወደቀጣይ የሠውነት ክፍል ይሻገሩ ፣አዎ ከሆነ ጥያቄዉንይቀጥሉ		ባለፈው 7 ቀናት ውስአስቸጋሪየሆነህመም(ስሜት አጋጥሞት ያውቃል?
501	አንገት	1. አዎ 2. የለም	1 አዎ 2 የለም
502	ቀኝ ትከሻ	1. አዎ 2. የለም	1 አዎ 2 የለም
503	ግራ ትከሻ	1. አዎ 2. የለም	1 አዎ 2 የለም
504	የላይኛዉ ወገብ	1. አዎ 2. የለም	1 አዎ 2 የለም
505	የታችኛዉ ወገብ	1. አዎ 2. የለም	1 አዎ 2 የለም
506	ክርን(በግራ)	1. አዎ 2. የለም	1 አዎ 2 የለም
507	ክርን(በቀኝ)	1. አዎ 2. የለም	1 አዎ 2 የለም
508	የእጅ አንጓ(በግራ)	1. አዎ 2. የለም	1 አዎ 2 የለም
509	የእጅ አንጓ(በቀኝ)	1. አዎ 2. የለም	1 አዎ 2 የለም
510	ዳሌ ና መቀመጫ(በግራ)	1. አዎ 2. የለም	1 አዎ 2 የለም
511	ዳሌ ና መቀመጫ(በቀኝ)	1. አዎ 2. የለም	1 አዎ 2 የለም
512	ጉለበት(በግራ)	1. አዎ 2. የለም	1 አዎ 2 የለም
513	ጉለበት(በቀኝ)	1. አዎ 2. የለም	1 አዎ 2 የለም
514	እግር/አልቦ(በግራ)	1. አዎ 2. የለም	1 አዎ 2 የለም
	እግር/አልቦ(በቀኝ)	1. አዎ 2. የለም	1 አዎ 2 የለም


NECK
SHOULDERS
UPPER BACK
ELBOWS
LOW BACK
WRISTS/HANDS
HIPS/THIGHS/
BUTTOCKS
KNEES
ANKLES/FEET

ክፍል 6፡ የአጥንትና የጡንቻ ህመም የስራ ቦታ ተጋላጭነት መለኪያ

የሰራተኛዉ ምዘና

H በስራ ላይ በእጅዎ የሚያንቀሳቅሱት ከፍተኛ ክብደት መጠን

- [ ] H1 ቀላል(5 ኪ.ግ በታች)
- [ ] H2 መካከለኛ(6-10 ኪ.ግ)
- [ ] H3 ከባድ(11-20 ኪ.ግ)
- [ ] H4 በጣም ከባድ(ከ 20 ኪ.ግ በላይ)

J በአማካይ በዚህ ስራ ላይ በቀን ለምን ያህል ሰዐት ይቆያሉ

- [ ] J1 ከ 2 ሰዐት ያነሰ
- [ ] J2 2-4 ሰዐት
- [ ] J3 ከ 4 ሰዐት በላይ

K በአንድ እጅዎ ሊያሳርፉት የሚችሉት ከፍተኛ የጉልበት መጠን

- [ ] K1 ቀላል(ከ 1 ኪ.ግ ያነሰ)
- [ ] K2 መካከለኛ(1-4 ኪ.ግ)
- [ ] K3 ከባድ(ከ 4 ኪ.ግ በላይ)

L ስራዎ የሚጠይቀዉ የአይታ ትኩረት መጠን

- [ ] L1 ዝቅተኛ(ጥቃቅን ነገሮችን ማየት የማይጠይቅ)
- [ ] L2 ከፍተኛ(ጥቃቅን ነገሮችን ማየት የሚጠይቅ)

M በስራ ላይ ተሽከርካሪ ይጠቀማሉ

- [ ] M1 ከ1 ሰዐት ያነሰ/ በጭራሽ
- [ ] M2 1-4 ሰዐት
- [ ] M3 ከ 4 ሰዐት በላይ

N በስራ ላይ የሚርገበገብ መሳሪያ ይጠቀማሉ

- [ ] N1 ከ1 ሰዐት ያነሰ/ በጭራሽ
- [ ] N2 1-4 ሰዐት
- [ ] ከ 4 ሰዐት በላይ

P በዚህ ስራ ላይ ለመቀጠል አስቸጋሪ ሆኖቦት ያዉቃል

- [ ] P1 በፍጹም
- [ ] P2 አንዳንዴ
- [ ] P3 ብዙ ጊዜ

Q በአጠቃላይ ይህን ስራ እንዴት አገኙት

- [ ] Q1ቀላል ስራ
- [ ] Q2 በመጠኑ የሚያስቸግር
- [ ] Q3 መካከለኛ የሚያስቸግር
- [ ] Q4 በጣም አስቸጋሪ

Curriculum vitae

1. **Personal information**

Name	Samerawit Teklu
Sex	Female
Date of birth	1984 E.C
Marital status	Single
Nationality	Ethiopian
Address	Addis Ababa
Mobile	0913465829/0911623866

2. **Educational background**

- Elementary School — Biherawi elementary school
- Secondary School — Magic carpet
- Higher Education — Debre Berehan university
  BSC in public health officer

3. **Language**

	Speaking	Listening	Writing	Reading
Amharic	Excellent	Excellent	Excellent	Excellent
English	Excellent	Excellent	Excellent	Excellent

4. **Hobbies**

- ❖ Reading different book, listening music

ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ethical and technical Conduct of the research project and for provision of required progress reports as Per terms and conditions of the Research Publications Office in effect at the time of Grant is forwarded as the result of this application.

Name of the student: ____

Date.____________________ Signature _________________

Approval of the primary Advisor

Name of the primary advisor:_________________________________

Date.____________________ Signature _________________