

ASSESSMENT OF THE STATUS OF OCCUPATIONAL SAFETY AND HEALTH OF SOAPSTONE MINE WORKERS IN TABAKA KISII COUNTY, KENYA

¹MEDRINE JELIMO YATOR, ²DR. CHARLES MBURU,
³DR. BENSON KARANJA

^{1,2,3}JKUAT, Kenya

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Abstract: Mining is an industry that significantly contributes to the improvement of economic growth and development in many countries. Despite the enactment of legal and institutional frameworks many mine workers in quarries work in the presence of occupational hazards which lead to huge burden of accidents, and occupational injuries. This study assessed the status of occupational safety and health of soapstone mine workers in Tabaka, Kisii County, Kenya. Descriptive cross-sectional study was used where stratified random sampling and simple random sampling were used to draw a sample of 174 respondents. A structured, self-administered questionnaire was used to collect data on nature and frequencies of injuries, observational checklist used record how soapstone mining activities were performed by workers, while interview was conducted with quarry managers and institutions involved in occupational health and safety. Data was subjected to statistical analysis using SPSS version 21.0. Chi-square test of association was used to test hypothesis with $p < 0.05$ considered statistically significant. The socio-demographic analysis showed 129 (74.1%) respondents were male with 114(65.5%) being the age-group of 36-50. 103(59.2%) had primary education. The type of injury experienced were cuts at 90(51.7%), fractures 44(25.3%), bruises 28 (16.1%), and back/chest injuries at 12 (6.9%). Injuries were caused by being struck/hit by rock 45(25.9%), sharp rock edges 43(24.7%), falls 18(10.3%), working tools/machinery 47(27%), lifting heavy load 10(2.9%) and cutting of rocks 11(6.3%). The injuries affected hand at 71(40.8%), head 57(32.8%), back/chest 21(12.1%), legs/knee/feet 14(8%) and arm 11(6.3%). The study concludes that there are occupational health and safety hazards associated with soapstone quarry activities in Tabaka, Kisii. It was recommended that enforcing bodies should develop and implement framework for sensitization and enforcing of compliance of OSH regulations on small scale mining operations to reduce nature and frequencies of occupation hazards.

Keywords: Mining, Mine worker, Soapstone, Occupational Injuries, Prevention, Awareness.

1. INTRODUCTION

Globally, mining industry plays an important role in the improvement of countries economic growth and development (Shen *et al.*, 2015). It is estimated that approximately 13 million people participate in small scale mining activities influencing livelihood of 80-100 million people in developing world (Hilson & Maconachie, 2017). Occupational Health and Safety encompasses all aspects of health and safety concerns in a workplace with emphasis towards primary prevention of hazards. According to Kumar, Verma and Neetika (2016), 75% of the global labour force lives in developing countries but approximately 5-10% have accessibility to occupational health and safety services. According to International Labour Organization (ILO) and World Health Organization (WHO), occupational safety and health is a fundamental right of workers all over the world. Occupational Health and Safety aims to protect the health, safety, and welfare of workers in order to promote a safe working environment. Kenya has achieved significant progress in occupational safety and health

through the promulgation of the new Constitution of Kenya and the enactment of the Occupational Health and Safety Act No 15 of 2008 (Mitullah & Wachira, 2011). Even though Environmental Impact Assessments (EIAs) are conducted before the beginning of quarrying, mitigation and actual process of mining is not followed (Eshiwani, 2014). The basic knowledge of safety requirements and the importance of using Personal Protective Equipment (PPE) is poorly comprehended in small scale mining (Hilson et al. 2017). Awolusi & Marks (2015), claims that the reduction of risks, the improvement of safety, and the prevention of accidents needs to be key and should receive attention from the employers, employees and the relevant authorities. Tabaka soapstone miners and handicrafts are known all over the world for artistic prowess over the years. However, the individuals who participate in the various mining processes often lack the training, skills, and knowledge needed to practice safely (Hilson, 2012). The great demand for soapstone products both locally and internationally coupled with low-income levels, increasing unemployment rate, and poverty makes small-scale soapstone mining an attractive venture for many to engage in. The small-scale mining sector provides employment for a large proportion of unemployed individuals in Tabaka, Kisii County. The exploitation of the soapstone deposits in Kenya, is characterized by the usage of relatively simple tools (Hilson, 2012).

2. NATURE OF OCCUPATIONAL SAFETY AND HEALTH HAZARDS

Small-scale miners use crude techniques and work under disorganized, labour-intensive, dangerous, and unlawful conditions which contribute to accidents and injuries such as fractures, burns (contusions), back/chest injuries, cuts (lacerations), and neck injuries (Perfect, 2017). In Philippines, up to 35% of quarry workers are injured at work due to prolonged digging, sitting in awkward positions, bending, and carrying heavy loads resulting in excruciating and persistent injuries that cause back pain (Leung & Lu, 2016). Developing countries experience occupational accidents and injuries caused by organic and mineral dusts, toxic metals, solvents, chemicals, physical factors like noise and vibration and biological hazards such as viruses and bacterial infections. Ergonomic challenges such as poor mining methods cause injuries, accidents, and musculoskeletal disorders (Sikpa, 2011). Miners face a plethora of dangers characterized by falling rocks, roof collapse, fires, explosions, entrapment, mobile equipment accidents, noise, dusts, vibrations with commonly reported injuries among the miners are fractures, neck injuries, and back injuries with upper limbs being injured most in the body parts (Wanjiku, 2015). The hazards encountered at quarries include physical hazards such as extreme temperature, vibration, falls, trips and ergonomic hazards such as manual handling, poorly designed tools, and repetitive work (GoK, 2007c). Manual handling of rocks is common in quarries causing the most common injuries at the workplace. Mechanization and automation is fundamental in reducing traditional hazards involved in manual handling since back injuries continue to affect many workers at the workplace. Effective training on proper handling methods and the use of mechanical devices will significantly decrease the number and severity of injuries and other ergonomic issues. Elimination of hazards can be reduced through organizational measures, engineering controls, use of barriers to isolate hazardous substances, and administrative controls to minimize hazards through redesigning of safe work systems (GoK, 2007c).

3. MATERIALS AND METHODS

3.1 Study Design

A descriptive cross-sectional study was employed for the study. Stratified random sampling and simple random sampling were used to draw a sample of 174 respondents from organized self-help groups are involved directly in soapstone activities such as mining, carving, finishing, and marketing from quarry sites in Tabaka. A structured, self-administered questionnaire, observational checklist, and interviews were used as research tools.

The sample size was calculated using *Slovin* formula

$$n = \frac{N}{1 + N(e)^2}$$

Where

n- desired sample Size

N-Population size

e-Degree of accuracy/confidence interval (margin of error), expressed as 5% (0.05)

$$n = \frac{222}{1 + 222(0.05)^2} = 174$$

Proportionate stratified random sampling was used to assign samples to the five self-help groups involved in mining activities as follows: The population of the soapstone quarry workers was obtained from the records of the quarry's managers. Coded numbers were used in place of soapstone miners. A list of random numbers was generated using Microsoft Excel true number generator before selecting the required sample in each stratum.

Size of strata X Required sample size

Total population

Table 1. Proportionate allocation of sample size

Group Name	Total population	Required Sample
Smolart Self Help Group	55	43
Top Designers Self Help Group	43	34
ISA Self Help group	40	31
Tabaka Chigware Youth Group	43	34
Terazzo Africa Self Help Group	41	32
TOTAL	222	174

The chairpersons of the groups were purposively sampled as key informants for oral interviews. This ensured high objectivity in sample selection was achieved by giving each item in the target population an equal chance of being selected and included in the final sample drawn.

3.2 Data processing and analysis

Data were collected, screened, sorted, and thereafter analyzed using Statistical Package for Social Services version 22. The coded data was analyzed both quantitatively and qualitatively. The results are presented in terms of tables and figures. Bivariate analysis of variables using Chi-square test of association used for testing statistical significance. A p value less than 0.05 was considered statistically significant.

4. RESULTS

4.1 Socio-demographic Characteristics of the Respondents

The socio-demographic analysis shows that majority of the respondents were male 129 (74.1%) and female were 45(25.9%) with 114(65.5%) being the age-group of 36-50. Majority respondents were aged from 36-50. 3(1.7%) of the miners had no formal education, 103(59.2%) had primary education, 40(20.1%) had secondary education and 28(16.1%) had tertiary education as the highest level of education 6(3.4%) were single, 153(87.9%) were married, 14(8%) had separated and 1(0.6%) were widowed. it was observed that soapstone quarrying activities did not require advanced skills since most of the work was informal. This implied that majority of the respondents were family individuals with responsibilities of dependents which could be the major reason for their engagement in soapstone activities. The results concur with Ayoo (2018) research findings of majority of (60.1%) of the artisan gold mining being married

Table 2: Socio-demographic Characteristics of the Respondents

Variable	Category	Frequency	Percent %
Gender	Male	29	74.1
	Female	45	25.9
Age	18-35	52	29.9
	36-50	114	65.5
	>50	8	4.6
Education	No formal education	3	1.5
	Primary	103	59.2
	Secondary	40	23
	Tertiary	28	16.1
Marital status	Single	6	51.7
	Married	153	76.9
	Separated	14	8
	Widowed	1	0.6

4.2 Nature and Frequency of Accidents and Injuries

The type of injury experienced most was cuts at 90(51.7%), fractures 44(25.3%), bruises 28 (16.1%), and back/chest injuries at 12 (6.9%). Majority of the of the respondents identified injuries as caused by being struck/hit by rock 45(25.9%), sharp rock edges 43(24.7%), falls at 18(10.3%), working tools/machinery at 47(27%), lifting heavy load at 10(2.9%) and cutting of rocks 11(6.3%). The injuries that soapstone miners encountered affected hand at 71(40.8%), head 57(32.8%), back/chest 21(12.1%), legs/knee/feet 14(8%) and at arm 11(6.3%). The injuries on the body parts could be attributed to ergonomic hazards and manual works in quarries that involves lifting heavy rocks, cutting of rocks, bending and use of hand tools. This concurs with results of Absar (2017) that mining sector workers experience back problems, neck, arm and hand problems and Ayoo (2018) that safety threats among miners were working tools (20%), falling/sliding (14.7%), falling rocks (26.3%).

Table 3. Nature and frequency of Accidents and Injuries

Variable	Category	Frequency	Percent %
Type of injury	Cuts	90	51.7
	Fractures	44	25.3
	Bruises	28	16.1
	Back/chest injuries	12	6.9
Cause of injury	Struck/hit by rock	45	25.9
	Sharp rock edges	43	24.7
	Fall	18	10.3
	Working tools/Machinery	47	27
	Lifting heavy load	10	5.7
	Cutting of rocks	11	6.3
Part of body injured	Head	57	32.8
	Hand	71	40.8
	Arm	11	5.5
	Back/chest	21	10.6
	Legs/knee/feet	14	7.0

4.3 Severity and Frequency of Injuries

The nature of injuries most respondents experienced were minor at 89(51.1%), major at 43(24.8%) and severe at 42(24.1%). 40.3% of the respondents were injured more than 10 times in the past 12 months with 58(33.3%) been injured 1-5 times. Majority of the respondents at 93(53.4%) did not report accidents/incidents while 81(46.6%) did. Despite the high potential effects and magnitude of the injuries, most mine workers did not report which could be attribute to fear associated with noncompliance to OSH regulations, sanctions and possible closure of the mine sites.

Table 4. Severity and frequency of injuries

Variable	Category	Frequency	Percent %
Severity of injury	Minor	89	51.1
	Major	43	24.8
	Severe	42	24.1
Frequency accidents and injuries in 12 months	1-5 times	58	33.3
	6-10 times	46	26.4
	More than 10 times	70	40.2
Report accidents/injuries	Yes	81	44.6
	No	93	53.4

4.4 Association of Nature of Injuries with Type of Injuries

Table 5. Association of Nature of Injuries with Type of Injuries

Variable	Nature of Injuries			Chi Square, p	
	Category	Major	Minor		Severe
Type of injury	Cuts	32(74.4%)	44(49.4%)	14(33.3%)	$\chi^2=25.950$ p=0.000, df=6
	Fractures	8(18.6%)	24(27%)	12(28.6%)	
	Bruises	0(0%)	19(21.3%)	9(21.4%)	
Cause of injury	Back/chest injuries	3(7%)	2(2.2%)	7(16.7%)	$\chi^2=33.613$ p=0.000, df=10
	Struck by rock	18(41.9%)	26(29.2%)	7(16.7%)	
	Sharp rock edges	4(9.3%)	35(39.3%)	12(28.6%)	
	Fall	6(14%)	6(6.7%)	6(14.3%)	
	Working tools/machinery	11(25.6%)	18(20.2%)	16(38.1%)	
Part of body injured	Lifting of heavy load	0(0%)	4(4.5%)	1(2.4%)	$\chi^2=13.941$ p=0.083, df=8
	Cutting of rocks	4(9.3%)	0(0%)	0(0%)	
	Head	6(14%)	38(42.7%)	13(31%)	
	Hand	23(53.5%)	28(31.5%)	20(47.6%)	
	Arm	4(9.3%)	5(5.6%)	2(4.8%)	
Report accidents/incidents	Back/chest	7(16.3%)	11(12.4%)	3(7.1%)	$\chi^2=3.620$ p=0.164, df=2
	Legs/Knee/feet	3(7%)	7(7.9%)	4(9.5%)	
	No	18(41.9%)	49(55.1%)	26(61.9%)	
Yes	82(58.1%)	51(44.9%)	74(38.1%)		

A bivariate analysis using chi square test of association indicated that cause of injury ($\chi^2=33.613$, p=0.000, df=10) and type of injury ($\chi^2=25.950$, p=0.000, df=6) were statistically significance to the nature of injuries at the mines because p<0.05. To ensure that mining operation are performed in a safe environment, it is important to implement the necessary laid down measures of occupation safety and health of occupational hazards to reduce injuries at the workplace

5. CONCLUSION AND RECOMMENDATION

The study concluded that there are occupational health and safety hazards associated with soapstone quarry activities in Tabaka, Kisii. High proportion of the soapstone mine workers were injured at work (97.1%) with nature of injuries being cuts, fractures, bruises, and back/chest injuries caused by working tools/machinery, lifting heavy load and cutting of rocks. The injuries affected hand and head and majority (93%) of the accidents were not reported.

The study recommended that NEMA, County Government, DOSH officials with other stakeholders should develop and implement framework for sensitization and enforcing of compliance of OSH regulations on small scale mining operations to reduce nature and frequencies of occupation hazards and use multi-disciplinary approach such as administrative control measures, education, periodic training, and supervision of technical guidelines to prevent and control occupational health related problems in the quarries

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