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FACTORS ASSOCIATED WITH WORKERS' EXPOSURE TO OCCUPATIONAL HAZARDS AT NORTH RIFT JUA KALI ENTERPRISES IN ELDORET TOWN, KENYA

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ABSTRACT

Background: The Jua kali industry relies on a steady stream of incoming scrap metal from industrial operations and individual scrap peddlers. Despite the progress made in the scrap metal industry, workers are still potentially exposed to hazards from ergonomic, noise, dusts, fumes, and powerful machinery especially those working in upcoming towns.

Objective: The main objective of the study was to assess factors associated with welders' exposure to occupational hazards during their duties.

Study Setting: The study was conducted at the North Rift Jua Kali Enterprises in Eldoret town.

Study Subjects: The study targeted 140 welders who were already working in the North Rift Jua Kali Enterprises in Eldoret town, key informants including, official from NRJKE, labour officer and public health officer in charge of occupational safety and health (OSH).

Methods: The study utilized a cross sectional study design. Simple random sampling technique was employed to recruit the workers based on their employment numbers or registration numbers. In addition, purposive sampling technique was employed to select key informants including, official from NRJKE, labour officer and public health officer in charge of occupational safety and health (OSH).

Results: Welding is predominantly a male dominated occupation 87(88.8%). Majority 36(36.7%) of the welders were aged 26-35 years. Most welders had at least some primary school education 43(43.9%). Majority of the welders 83(84.7%) were employed as casuals. Factors associated with occurrence of occupational health hazards among welders in Eldoret are; age ($X^2 = 6.788$; $p < 0.001$), education level ($X^2 = 2.048$; $p < 0.001$) and level of awareness on use of PPEs ($X^2 = 0.832$; $p < 0.001$). The key informants indicated the level of working experience and level of education.

Conclusions and recommendations: Welding of metals in Eldoret is mainly done by young males who are usually employed on casual basis. The main

factors associated with exposure to occupational hazards among the welders are age, level of education and level of awareness on use of PPEs. There is need to target the younger welders with health awareness messages on using personal protective equipment's in order to reduce exposure to occupational hazards.

INTRODUCTION

Occupational diseases and disorders are those associated with a particular occupation or industry, which occur as a result of physical, chemical, social, biological and psychological factors present at work as encountered in the course of employment (Asogwa, 1979). Further, occupational hazards and diseases can be ascribed to improper working conditions and their occurrence can be prevented. The control of occupational hazards decreases the incidence of accidents and work-related diseases and as well improving the health and general morale of the labour force (Asogwa, 1979). This in turn leads to increased workers efficiency and decreased absenteeism from work. In most cases the economic benefits far outweigh the costs of eliminating hazards (Sabitu *et al*, 1998). Alongside the advancement in technology, more risky and fatal workplace hazards have developed. Some of these hazards have been recognized while others remain unrecognized.

According to the US Occupational Safety and Health Administration (OSHA), the most common illnesses experienced in the industry includes poisoning by heavy metals including lead, cadmium, nickel. Disorders associated with repeated trauma include skin diseases, and respiratory conditions associated with contact and/or inhalation of toxic agents. The most common events leading to injuries from work involved contact with an object or piece of equipment; over extension which may cause sprains, strains, heat burns, cuts, lacerations, and punctures. Vibration hazards are closely

related or associated with noise hazards because tools that produce vibration typically also produce excessive levels of noise. Vibration related problems are not only serious, but they are also widespread (Waweru, 2012). Fatalities in this industry are common; for example, between 2007 and 2009 there were two fatal incidents at two scrap metal recycling facilities in the Seattle (Rolp & Pulkkinen, 2007).

In Kenya, the Occupational Safety and Health Act, 2007 was legislated to secure the safety, health and welfare of persons at work and protect persons against risks to safety and health arising out of, or in connection with, the activities of persons at work. However, there are still a large number of accidents at the workplace.

The scrap metal industry has become important industrial activity. The world-wide consumption of scrap metal is in the order of 500 million tons each year (Salem *et al*, 2013). The increased importance of scrap metal as a resource has been paralleled by an increase in the frequency that radioactively contaminated activated metal scrap and metal scrap with radioactive source(s) or substances contaminated within it are detected in metal scrap shipments. Some of these radioactive scrap metal has gone undetected and has been accidentally smelted down or processed and has thus entered the stream as consumer products on sale to the public.

The WHO has ranked accidental injury fifth globally among causes of death. Rukunga (2001). In US the scrap metal recycling industry in 2001 employed 16,000 workers and reported approximately 3,000 injuries and illnesses. The most common

cause of illnesses was poisoning from lead and cadmium, disorders associated with repeated trauma, skin disorders and respiratory conditions due to inhalation of or other contacts with toxic agents. The most common injuries were; sprain and strain, heat burns and cuts, lacerations and punctures. There is also risk of psychosocial hazards such as stress at work and exhaustion in addition to the ergonomic hazards that mainly involve musculoskeletal injuries as; muscle sprain, muscle pain, dislocation and fracture (Okuga *et al.*, 2012). Handling sharp or pointed pieces of scrap metal poses cut or abrasion hazards to hand or body. Thus, employees involved in activities of this type may be exposed to metal fumes, smoke, hot environments, and hot material when working near furnaces, and may come in contact with metals that present hazards through both skin contact and inhalation. Thermal gas torches expose employees to sprays of sparks and metal dust particles, high temperatures, bright light that could damage eyes (light both inside and outside of the visible spectrum), and various gases. Compressed gas cylinders can also present explosion hazards due to excessive heat or physical damage (Foulke, 2008). Welding is one of the occupations that contribute to work-related accidents and diseases in the context to developing countries (Bhumika *et al.*, 2014). The process remains the most common method of joining metals today and is a part of the art of metal fabrication that involves the building of metal structures by cutting, bending and joining. Polishing, painting or coating of the metal pieces also goes along with the other processes (Bhumika *et al.*, 2014).

The acute symptoms associated with welding may consist of metal fume fever (flu-like symptoms with alternating chills and high fever that last for a few days), irritation of the eyes, nose, chest and respiratory tract causing cough, wheezing,

breathlessness, bronchitis, pulmonary edema, pneumonitis and gastrointestinal effects, such as nausea, loss of appetite, vomiting, cramps and slow digestion (El-Zein, 2005). Scrap metal recycling industry is a large industry worldwide and has been in existence since eighteenth century. As a worker in this industry, one will be engaged in various types of activities that are important for production of goods and services. These activities will affect the physical and mental well-being of workers.

Occupational health broadly deals with the total health of the employed person to maintain and promote the well-being of workers. Occupational health and safety services need to be put in place to protect workers from occupational related diseases and accidents. International Labour Organization (ILO) estimates that 270 million occupational accidents and two million work related deaths occur each year (Waweru, 2012). Sub-Sahara Africa appear to have the greatest rate per worker of occupational injuries followed by Asia (excluding China and India) (Lund & Marriott, 2011). Kenya is among the developing countries undergoing significant industrialization and has scrap metal industry that employs quite many workers who contribute immensely to the construction industry.

Even though the informal sector economy contributes greatly to the economy of the country, its explosive growth has brought more hazards than before. These include; physical hazards (injuries), biological hazards (bacteria), mechanical (vibrations and noise), chemical (lead poisoning) and psycho-social hazards (stress, fatigue) (Karanja *et al.*, 2003). Hazardous working environments not only harm the informal sector workers, but also decrease the enterprise productivity which in turn decreases income because of poor health and inability to effectively Theuri, (2012).

According to records available there usually around 8 cases of various injuries on daily basis that are recorded among welders. Therefore, this study aimed at assessing determinants of exposure to occupational hazards to recommend exposure controls and risk management interventions to ultimately reduce occupational injuries, illnesses and fatalities in this industry and improve productivity of employees.

METHODS

Research Design: A cross sectional study design was used. Both quantitative and qualitative data was collected.

Study Site: The study was conducted at the North Rift Jua kali enterprises Eldoret town Uasin-Gishu County. Eldoret is the headquarters of Uasin-Gishu County and it is located approximately 300 km from Nairobi and approximately 308 km from Kampala Uganda. According to 2009 census, the population in Uasin-Gishu county where Eldoret is located is 497449. The town is a hub for several economic activities including; steel mills and cereal mills, industries, food factories, plastic manufacturing industries and textile. Other infrastructure includes; provision of medical facilities such Moi Teaching and Referral Hospital, private hospitals and county hospital. Eldoret International airport is also located within the town along Eldoret Kisumu road near Kapsaret.

Study Population: The quantitative study targeted all the welders working in North Rift Jua Kali Enterprises (NRJKE) in Eldoret town while the qualitative aspect of the study targeted the key informants an official from NRJKE, a labour officer and public health officer in charge of occupational safety and health (OSH). According to the Ministry of labour North Rift Chapter, there are 140 registered welders in the region which formed the Target Population.

Sample Size calculation: Sample size was determined by Yamene Taro formula (Israel, 2006) for finite population. The formula is given as

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

Where,

n = required sample size

N = population size (140)

e = standard error in this case 0.05.

Therefore, the minimum sample size is 104 welders and three key informants.

Sampling Procedures: Simple random sampling technique was employed to select the workers based on their employment numbers or registration numbers. Each number was recorded on a piece of paper, folded, put in a container, thoroughly mixed and picked randomly up to the required sample size. Purposive sampling method was employed in the selection of key informants from NRJE, public health and labour departments. They were believed to have the required information on the determinants of occupational health hazards and safety.

Inclusion and Exclusion Criteria: Adult metal welders at Eldoret Jua Kali who had worked for at least six months and were of sound mental status were included in the study.

Research instruments: This research study utilized questionnaires and an observation checklist as the main research instruments tools. Two kinds of semi-structured questionnaires were developed, one kind for welders and other for key informants. A pre-tested semi-structured questionnaire was used. According to Kombo *et al.*, (2009), the use of questionnaire as an instrument of research normally gives the respondents adequate time to provide well thought responses in the questionnaire items and enables large samples to be covered within a short time.

For the qualitative aspect of this study, the chairman of welders, representative of the ministry of labour and the public health

officer were interviewed. The three key informants were chosen because they were believed to have adequate information on determinants of occupational health hazards.

The researcher used the observation tool to observe if the workers/employees (welders) were using protective garments including overalls, overcoats, gloves, industrial boot and protective gears such as mouth mask, goggles, earmuffs. On working environment researcher checked on shelter, ventilation, waste disposal.

Validity and Reliability of the Instrument: To ensure validity of the research instruments, the questionnaire was reviewed by the experts (supervisors) in the field of study to evaluate it in relation to the research objectives. Their inputs were incorporated in the final copy of the questionnaire. Reliability is the extent to which research results are consistent and replicable. To ensure this, a pilot pre-test study was carried out at Turbo involving 14 scrap metal workers (10% of the sample size). Split half technique was used to determine the reliability of the questionnaire. This involved administering the questionnaire once and dividing the questionnaire items into two parts. The sum of the scores of the two sets of data was correlated using Pearson product moment correlation (PPMC). A correlation coefficient of ≥ 0.5 was considered reliable (Orodho, 2009). In this study, a reliability coefficient of 0.72 was obtained showing that the instruments were reliable and therefore adopted for this study.

Data Analysis: Completed questionnaires were coded and entered in a database

designed using the statistical package for social sciences (SPSS V.20). Data were analysed using both descriptive and inferential statistics. This involved frequencies, mean and standard deviation in summarizing the data. Data presentation was in the form of table, bar prose and pie-charts.

Ethical Considerations: The researcher sought approval to conduct the research from Institutional Research and Ethics Committee (IREC) Baraton University. A written informed consent was sought from the respective scrap metal worker after thorough explanation of the objectives and the procedures of the study. Moreover, the benefit of the study was explained to the study participants. Respondents' participation was voluntary. Confidentiality was ensured through anonymity of the research instruments. Hard copies were kept under key and lock while data entered in the computer were protected using security codes.

RESULTS

The study presented the results of demographic data collected from respondents which were; gender, age, and highest level of education.

Socio-demographic characteristics of the Respondents

Gender of the Respondents: Majority 87(88.8%) of the respondents in this study were males (see figure 1 below).

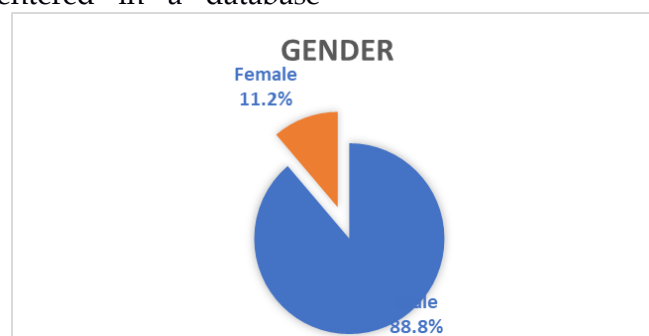


Figure 1: Gender of The Respondents

Age of the Respondents: Most of the respondents were between 26-35 years (figure 2 below).

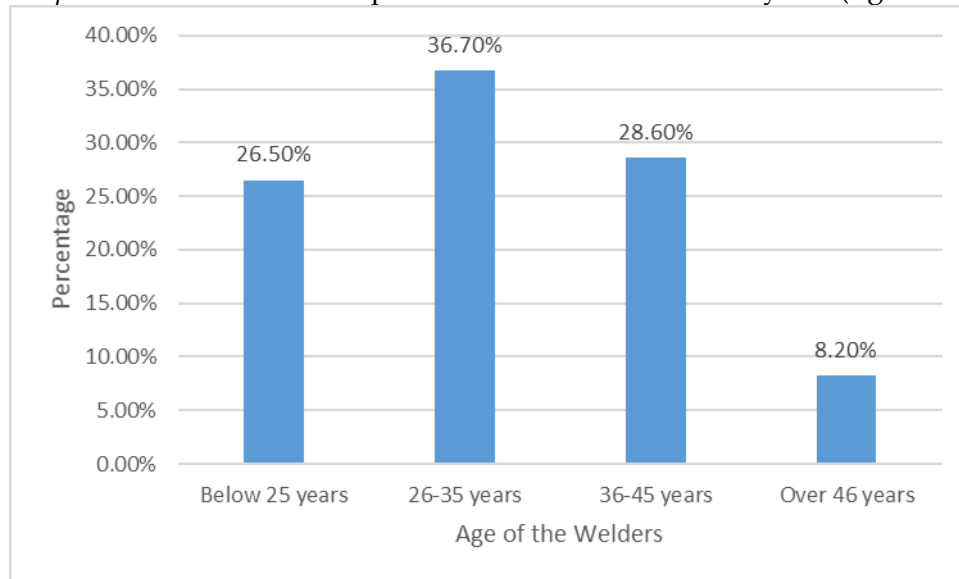


Figure 2: Age Distribution for the Respondents

Education Level of the Respondents: Majority of the respondents had primary school level of education, 43(43.9%) (Figure 3).

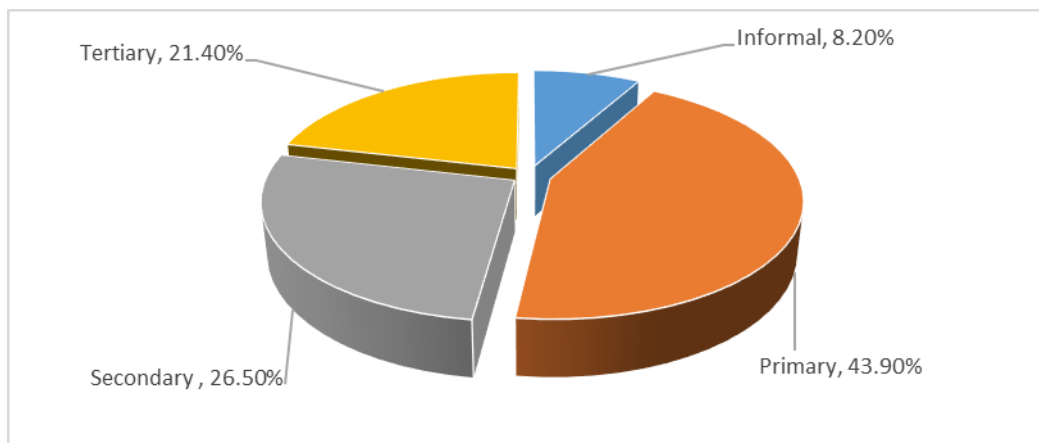


Figure 3: Education Level of the Respondents

Terms of Service: Most of the respondents indicated that they were mostly casual laborers employed by the owners of the scrap metal businesses (Figure 4).

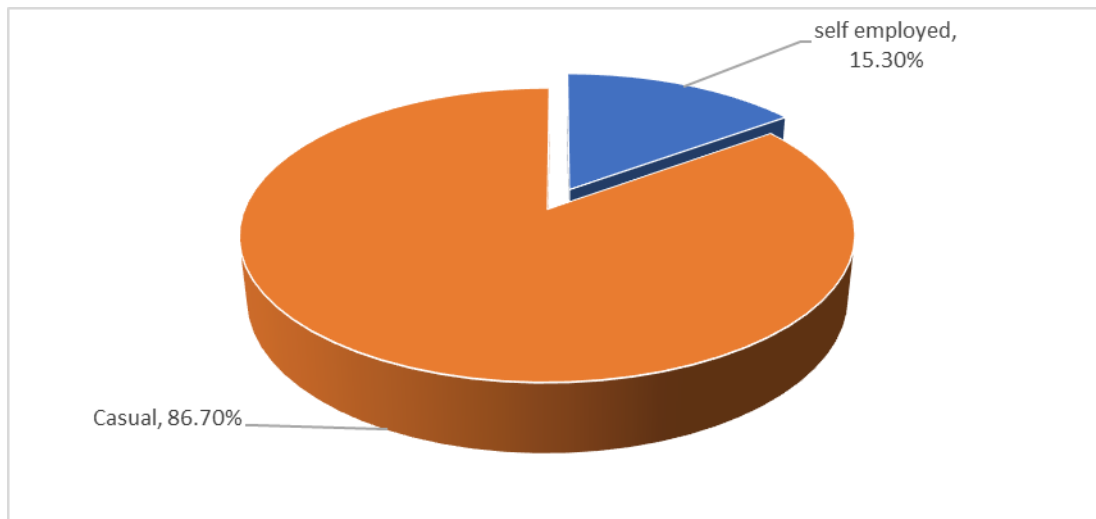


Figure 4: Terms of Service in Employment

Factors Associated with exposure to occupational Hazards: There was no significant association between gender and exposure to occupational health hazards among welders ($X^2 = 0.057$; $p = 0.643$). However, the study found a significant association between age and exposure to occupational health hazards ($X^2 = 6.788$; $p < 0.0001$). Similarly, education level of the respondents was associated with

occurrence of occupational health hazards ($X^2 = 2.048$; $p = .001$). There was no significant association between terms of service and exposure to occupational risks and hazards ($X^2 = 3.59$; $p = 0.261$). The study also recorded a significant association between the use of PPEs and exposure to health hazards ($X^2 = 16.832$; $p = 0.001$). The results are presented in table 1 below.

Table 1
Factors Associated with exposure to occupational Hazards

	Factors	Chi Square	P. Value
1	Gender	0.057	0.643
2	Age	6.788	0.001
3	Education level	2.048	0.001
4	Terms of service	3.59	0.261
4	Use of PPE	16.832	0.001

The qualitative aspect from the key informants indicated the level of experience working in the scrap metal industry as well as the level of education as the main factors associated with exposure to occupational hazards.

DISCUSSION

The aim of this study was to identify factors associated with worker’s exposure to occupational hazards among welders in Eldoret Town. Some of the demographic data collected from respondents included;

gender, age, and level of education, terms and the use PPEs.

Gender of the Respondents: This study has shown that nearly all the respondents were male therefore indicating that welding is a male dominated occupation. This shows that there is gender segregation of the workforce which strongly contributes to gender differences in working conditions, and hence gender differences in exposures to hazards and health outcomes as noted by European Agency for Safety and Health at Work (2003).

Age and exposure to industrial health hazards: The study has shown that there is an association between age and exposure to health hazards. A previous study observed that the age of a worker and the risk of an accident are inversely related, possibly because older workers are more experienced, have good work knowledge, and better skills compared to younger workers (Jackson, & Loomis, 2002). Further, Amabye (2017) in his study found out that there was a statistically significant difference in the level of exposure to occupational risks and hazards among workers of different age group with workers in the lower age group being more highly exposed to occupational risks and hazards in the work place.

Education Level of the Respondents: Workers' awareness of occupational hazards is dependent on their increased level of educational attainment. This agrees with a study conducted in Nigeria by Sabitu, Iliyasu and Dauda (2009) on awareness of occupational hazards and adherence to safety measures among welders in Kaduna metropolis in northern Nigeria. Their findings noted that the level of awareness of occupational hazards was high with sub optimal utilization of protective measures against the hazards. Therefore, need for health and safety education of these workers for health and increased productivity. This might be due to the fact that workers who attained a higher level of education could

have the tendency to apply the learned knowledge into health and safety practices.

Terms of Service: There were no employees who were employed on permanent basis. From the responses therefore, it can be shown that majority of the welders in Eldoret town were casuals. The findings of this study also showed no difference in exposure to occupational risks and hazards among the permanent and casual workers. This is inconsistent with a study that reported higher (54.5%) exposure among casual workers (Norkaew, 2009).

Use of PPEs: The study results noted that most common personal protective equipment's used by welders were welding glasses/shields and aprons. However, most of the personal protective equipment's were not used by the welders. This shows that majority of the welders were exposed to occupational health hazards associated with welding. The study findings concur with Foulke (2008) who noted that at welding sector, laborers are much of the time presented to more wellbeing risks which can be prevented by the utilization of the proper mix of Personal Protective Equipment (PPE) like gloves, hard caps, heavy industrial boots, thick dress, and respirators.

Level of experience: According to the key informants, the level of education and experience in the welding industry were the major socio-economic factors influencing the occurrence of occupational health hazards among welders. They reiterated that younger, uneducated welders were mostly affected by welding hazards. According to the key informants, most of the time, these welders complained of coughing, wheezing, irritation of the eyes. This is an indication that these workers were affected by welding.

CONCLUSION AND RECOMMENDATIONS

Welding in Eldoret town is a male dominated occupation with most welders

being generally young and aged between 26-35 years with at least some primary education. Main factors associated with exposure to occupational hazards include; age, level of education and the awareness on use of PPEs.

There is a need to train welders working in the Eldoret scrap metal industry on the importance of using personal protective equipment's (PPEs) so as to reduce exposure to occupational hazards that may inherently be part of their working environment.

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