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Evaluation of the Construction Workers on the Utilization on the Right Personal Protective Equipment in Mombasa County, Kenya

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ABSTRACT

Purpose*:* The purpose of this study was to evaluate the extent to which the right personal protective equipments were used in Mombasa County, Kenya. About one hundred and four (104) respondents on the construction sites were interviewed and evaluated on the utilization on the right personal protective equipment in Mombasa County, Kenya. Methods: This study was cross sectional design whereby 13 sites were purposively and randomly selected within Mombasa County. The target population was construction workers where 104 respondents were interviewed. Questionnaires, Observation checklist and schedules were used to collect the participant's views. Data was analyzed with SPSS version 20.and Chi square was used to establish statistical significance between variables. Results: Majority of the respondents were male 89 (85.6%) while female were very few at 15(14.4%. Two(11.7%) respondents were aged between 18-20 years, 18(17.5%) were between 21-25 years, 20(19.4%) were aged between 26-30 years, 19(18.4%) were aged between 31-35 years, 22(21.4%) were aged between 36-40 years, 11(10.7%) were aged between 41-45 years and 1(1%) was over 46 years the respondents were aged between 18-46 years. Most of the employees (50.5%) were in the age group 31-45 years old and are considered to be middle age, age group 18-30 are considered to be young generation while 46 years and above are considered to be old age since working in construction site require a lot of energy according to (ILO, 2007). On levels of education about 45 (43.3%) had secondary education which is regarded as literacy levels in Kenya. Conclusion and recommendation: This study therefore found that (57)54.8% were not having and using the right personal protective equipment during working time which was statistically significant with construction work related injuries. Therefore, this study recommends constant and intensive awareness campaigns on the importance use of the right personal protective equipment in the construction sites and fully implementation of OSHA ACT 2007.

INTRODUCTION

The construction work is an ongoing activity in both developed and developing countries in the world and Kenya not an exception. It has been presumed with major risks among the workers from less developed countries where embracing health and safety precautions has not been sufficiently adhered to. In studies done by (Kirega 2004) also found that workers experience some risks and hazards resulting from the processes of the construction activities due to lack an elaborative training curriculum by site contractors.

Therefore, construction engineering and hygiene plays a great role as far as personal protective equipment is concerned in ensuring safety in the construction works is maintained to reduce the risks involved and improve work environment among the construction workers worldwide. In Kenya a lone, according to OSHA 2007 indicated that over 90% of the construction accidents occurred between the year 2008 and 2009 respectively due to poverty and unemployment as attributing factors in the construction works (Muui, 2018).

On evaluating the utilization of the right personal protective equipment among the construction workers in Mombasa Country Kenya, it was revealed that this industry was a major employer of the stakeholders as well as with the highest causalities due to lack of proper use of personal protective equipment. This also concurred with a study by (Swuste, 2008) who found that predisposing factors exposes workers to construction hazards and risks which sometimes are not well reported and documented in risk registers (Directorate of Occupational Safety And Health Services-DOSHS, 2009) in Kenya.

MATERIALS AND METHODS

This was cross-sectional study design was to establish the thirteen registered location of the construction sites in Mombasa County Kenya.

The study was conducted in **Mombasa County** located in the coastal region of Kenya. The county lies between latitudes 3°56’ and 4°10’ south of the equator and longitudes 39°34’ and 39°46’ east. With population of 939,370 (Census 2009). Administratively, the County is segregated into seven divisions, eighteen locations and thirty sub-location and hosts six constituencies namely Mvita, Changamwe, Jomvu, Likoni, Kisauni and Nyali.

The choice of the site was based on the many unplanned buildings in the county and inadequate use of PPE among the workers in the construction sector in the County. Some of the registerd construction companies operating in Mombasa includes; ANR Constructions, ANK Renovators Ltd, Ariay Builders, Betogo Contractors, Bhudia Construction Co.Ltd, Bilkon Builders, Capital Construction Co. Ltd, Cirago Builders, Coast Builders, Continental Flooring Works , Dadars & Heavens Ltd and Daje Enterprises Among Others (Ministry of Labour records, 2013). However, many others exist which do not adhere to the NCA (2011) and OSHA (2007) and were not considered on this study.

The study involved only the sites that were registered by Directorate of Occupational Safety And Health Services (DOSHS) as per the time of the study (2013) with a target population of 800 workers as per the record. This target groups were employees working on permanent, temporary and casual basis.

The considered workers who were 18 years and above and excluded minors who were 18 years and below and those unwilling to participate.

Sampling frame consisted of all construction workers aged above 18 years. Minimum sample size was calculated using the method of sample size determination derived by Bartlett *et al.*, (2001). To select the participants in this study, construction workers were recruited randomly during lunch break. The total numbers of construction workers were 800 so the sample size was 104 considering data was continuous and at 95% confidence interval.

There were 26 construction sites in the study area during the study period, only 13 sites (50%) were selected for study according to Mugenda and Mugenda (1999) 50% is adequate for analysis and reporting. Purposive method was ideal because the study sampled the sites that had been authorised by the National Construction Authority (NCA). The selected sites had uniform PPE requirements because they were above two storeys. The 13 sites had been registered by the Mombasa County and certified by National Construction Authority and were two storeys and above. In each site, 8 participants were randomly selected to participate in the study because the number of construction workers in all the sites was almost the same.

The validity of the instrument was tested using a pilot study where variance and acceptability was tested.

The reliability of the research tools was tested by subjecting the research instruments to various sites and obtained data analyzed within 95% Confidence Intervals (CIs).

The data was coded and double entered into a relational database on Microsoft Access. The data was analyzed using the Statistical Package for Social Scientist (SPSS) version 20. The factors that influence Occupational health and safety, research variables under investigation and data from different construction sites were compared using Chi Square Test. The results are presented in form of frequency tables, pie charts, photographs and bar graphs.

The permission to conduct this survey was obtained from Jomo Kenyatta University of Agriculture and Technology ethical review committee and NACOSTI (National Commission For Science, Technology & Innovation) before the commencement of this study. Confidentiality was maintained throughout the study.

STUDY RESULTS

CHARACTERISTICS OF RESPONDENTS

Majority of the respondents were male 89 (85.6%) while female were a few 15(14.4%) in this study. Most often than not, work in construction sites, require strength and masculinity that's why it attracts more males than females as seen in this study. Hard work with high occupational risk is always done by men.

According to this study, 2(11.7%) respondents were aged between 18-20 years, 18(17.5%) were between 21-25 years, 20(19.4%) were aged between 26-30 years, 19(18.4%) were aged between 31-35 years, 22(21.4%) were aged between 36-40 years, 11(10.7%) were aged between 41-45 years and 1(1%) was over 46 years. Only one participant did not know his/ her age or was not sure since it was not indicated in the questionnaire (Figure 1) as can be seen below.

Most of the employees (50.5%) were in the age group 31-45 years old and are considered to be middle age, age group 18-30 are considered to be young generation while 46 years and above are considered to be old age since working in construction site require a lot of energy according to

(ILO, 2007). In this study construction work attracted middle age people because of the need to feed their families.

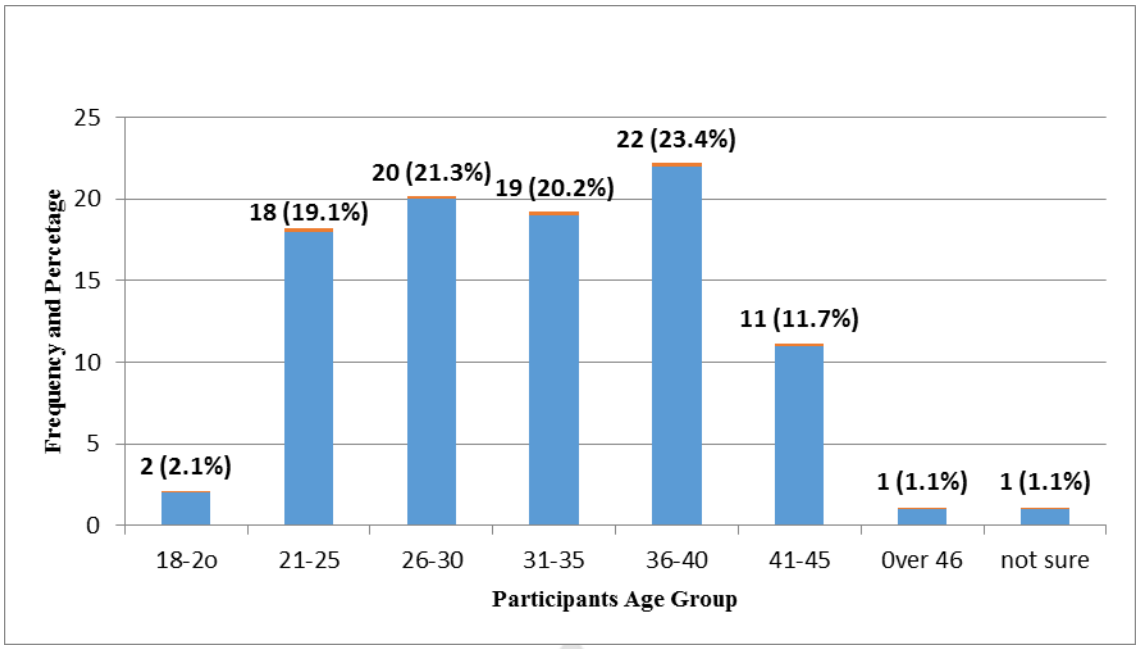

Figure 1: Age groups of the participants

Univariate analysis showed that the average age of participants was 31 years. The median age was 33 years during the study. Majority of the workers were 38 years old. The youngest person at the time of the study was 19 years old while the eldest workers was 48 years old. Young workers tend to feel immune to hazards and do not take PPEs usage seriously while older workers feel they are used to certain types of equipments and that they have experience to work safely despite the hazard invoved (Figure 1).

The study showed that, 56(54.4%) participants were married, 12(11.7%) were divorced, 3(2.9%) were widowed while the remaining 32(31.1%) were single (Figure 2). Only one person did not respond to this question. Among the participants, very few (31.1%) were single while majorities (69.0%) were either married or divorced. It is evident that all people, despite of their marital status are able to work in the construction industry.

Due to consideration, majority of the respondents were married (54.4%) worked in construction industry despite the work considered risky as a result of high incidences and accidents.

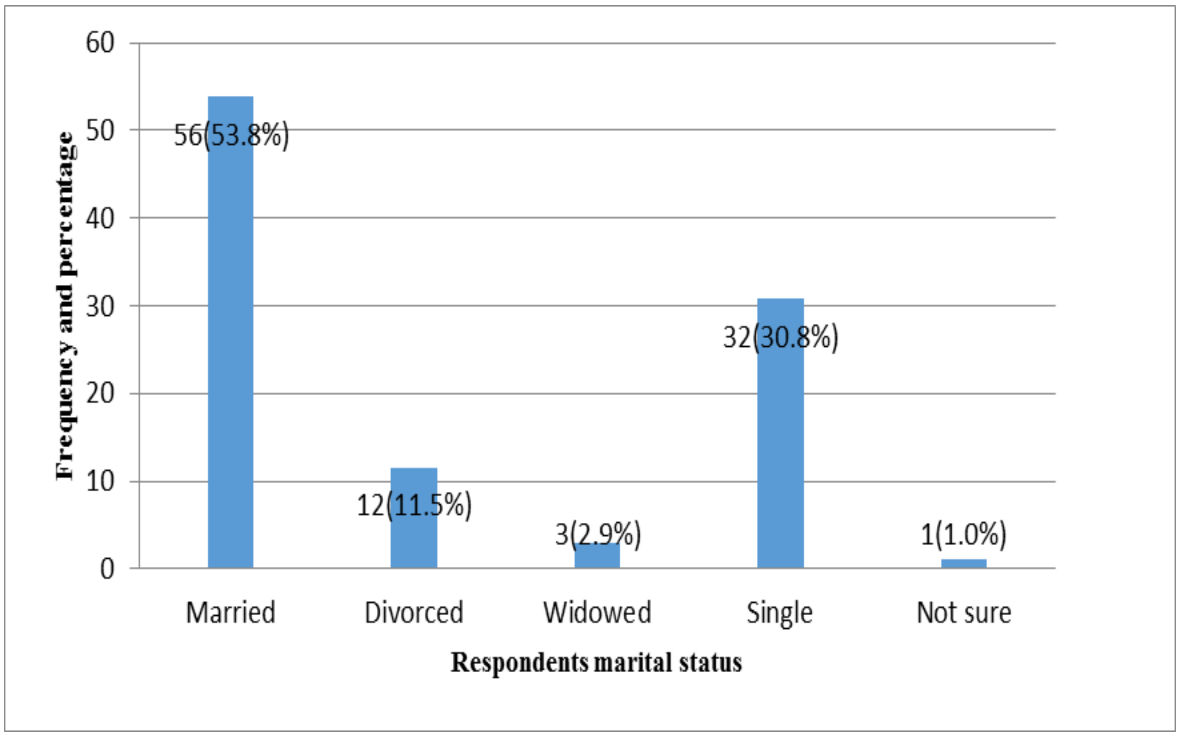

Figure 2: Respondents marital status

The finding of this study showed that, 3(2.9%) participants had no knowledge of any personal protective equipment in use in their respective construction sites compared to 101 (97.1%) who were aware of the existence of these equipment in their respective construction sites (Figure 2). There was significant association (χ^2=13.9, df=12, p=0.00) between awareness of the existence of PPE's by the construction workers and the construction sites in this study (Table 1).

Only 3(37.5%) participants in construction site 009 were not aware of any PPE's in use in their construction site as can be seen in Table 1 below.

Table 1: Knowledge of existence of PPE's among the participants

Sites	Knowledge of Personal Protective Equipment			χ^2	df	p-value
	No (n) (%)	Yes (n) (%)	Total (n) (%)			
001	0 (0.0)	8 (100.0)	8 (100.0)	13.9	12	0.00
002	0 (0.0)	8 (100.0)	8 (100.0)			
003	0 (0.0)	8 (100.0)	8 (100.0)			
004	0 (0.0)	8 (100.0)	8 (100.0)			
005	0 (0.0)	8 (100.0)	8 (100.0)			
006	0 (0.0)	8 (100.0)	8 (100.0)			
007	0 (0.0)	8 (100.0)	8 (100.0)			
008	0 (0.0)	8 (100.0)	8 (100.0)			
009	3 (37.5)	5 (62.5)	8 (100.0)			
010	0 (0.0)	8 (100.0)	8 (100.0)			
011	0 (0.0)	8 (100.0)	8 (100.0)			
012	0 (0.0)	8 (100.0)	8 (100.0)			
013	0 (0.0)	8 (100.0)	8 (100.0)			
Total	3 (2.9)	101 (97.1)	103 (100.0)			

Key: n - Frequency, (%) – percentages

Majority had knowledge of the existence of PPE yet they were using the wrong PPE. Instead of helmets they were using improvised helmets made from locally available materials There was a significant association (χ^2=34.5, df=12, p=0.00) between the existence of injuries and ailments associated with working in the construction sites and PPE utilization among the construction workers.

From the study findings, there was no significant association (χ^2=20.5, df=12, p=0.37) between not having fume hazard and any particular construction site except site 001. Again there was no significant association between (χ^2=20.5, df=12, p=0.37) not experiencing vibration hazards and any particular construction site except construction site.

The Pearson's chi square test showed that there was no significant association (χ^2=3.66, df=6, p=0.30) between any particular age group of the workers and PPE use in this study (Table 2).

Table 2: Analysis of social demographic characteristics and PPE utilization

Workers characteristics and PPE Utilization	χ^2	df	p-value
Age group of participants vs. PPE utilization	3.6	6	0.30
Highest education attained vs. PPE utilization	2.37	4	0.50
Workers years' experience vs. PPE utilization	2.37	6	0.25
Terms of employment vs. PPE utilization	16.0	12	0.90
Marital status vs PPE utilization	1.17	12	0.07

The results showed that, 49(49%) participants affirmed availability of the following PPE; safety boots, helmet, overall, heavy duty gloves, 2(2%) dust masks, 5(5%) ear masks, 10(10%) helmet, 7(7%) overalls, 3(3%) goggles, 2(2%) heavy duty gloves, 1(1%) safety harness/belts and other equipment respectively while the remaining [20(20%)] affirmed the availability of all the above equipment.

The checklist revealed that, 13(100.0%) construction sites had PPE in place in this study. Similarly, 7(53.8%) construction sites had helmet in their respective sites while 6(46.2%) did not have helmets. The construction sites which did not have helmets were 001, 004, 007, 008,012 and 013, respectively. There was no significant association (χ^2=20.5, df=12, p=0.30) between helmet presence and any particular construction site (p>0.05) in this study (Table 2).

On the issue of face/eye protection, 5(38.5%) construction sites had face/ eye protection while 8(61.5%) did not have this kinds of PPE's. Those construction sites with face/eye protection were 002, 003, 006 009 and 010, respectively. A total of 8 (61.5%) construction sites had gloves while 5(38.5%) sites did not have gloves as one of their PPE's. The sites without gloves were 001, 004, 007, 011 and 013, respectively. Only 4(30.8%) construction sites had nose masks/respiratory protection materials while 9(69.2%) had none of these PPE's. The sites with nose masks/respiratory protection were 002, 003, 006 and 010, respectively.

Regarding ear plugs/ muffs, only 4(30.8%) construction sites had ear plugs/ muffs while 9(69.2%) did not have. The sites with ear plugs/ muffs were 002, 006, 009 and 010, respectively. Majority [11 (84.6%)] of the construction sites did not have safety belts/ harness while only 2(15.4%) construction sites had safety belts/ harness. The sites which had the safety belts/ harness were 002 and 010.

A total of 6(46.2%) construction sites had PPE that match the purpose in their respective sites while 7(53.8%) had PPE that did not match the hazards. The sites with PPE that match the hazards were 002, 003, 005, 006, 009 and 010, respectively. There was no significant association (χ^2=20.5, df=12, p=0.30) between having PPE's that match the hazards and any particular construction site in this study.

In this study the sites which used PPE's were 7(53.8%) while 6(46.2%) were not using PPE's despite having them. The construction sites that were not using PPE's were 001, 004, 007, 008, 011 and 013, respectively. There was no significant association (χ^2=20.5, df=12, p=0.37) between not using PPE's and any particular construction site in this study (Table 3).

Table 3: Analysis of the checklist and PPE use/maintenance in the construction sites

Variables analyzed with Pearson chi square test	χ^2	Df	p-value
Not using PPE vs. Construction site	20.5	12	0.37
PPE matching the hazards vs. Construction sites	5.5	12	0.30
PPE maintenance vs. Construction sites	5.5	12	0.30

.**Provision of PPE by the construction companies**

The study showed that, 57(54.8%) participants did not have any PPE's while 47(45.2%) confirmed to be in possession of these equipment in their respective sites for use during work (Table 4). This explains the illness/injuries reported earlier which could be prevented by the use of PPE's. There was no significant association (χ^2=1.0, df=12, p=0.21) between any particular construction site and the use of PPE's by the construction workers (Table 4). There was also no significant association (χ^2=12.0, df=12, p=0.82) between PPE use and the prevalence of accidents/injuries among the constructions workers in this study.

Table 4: Participants who had personal protective equipments

Sites	Having and not having PPEs			χ^2	df	p-value
	No (n) (%)	Yes (n) (%)	Total (n) (%)			
001	2 (25.0)	6 (75.0)	8 (100.0)	1.0	12	0.21
002	5 (62.5)	3 (37.5)	8 (100.0)			
003	3 (37.5)	5 (62.5)	8 (100.0)			
004	5 (62.5)	3 (37.5)	8 (100.0)			
005	5 (62.5)	3 (37.5)	8 (100.0)			
006	5 (62.5)	3 (37.5)	8 (100.0)			
007	5 (62.5)	3 (37.5)	8 (100.0)			
008	3 (37.5)	5 (62.5)	8 (100.0)			
009	6 (75.0)	2 (25.0)	8 (100.0)			
010	2 (25.0)	6 (75.0)	8 (100.0)			
011	3 (37.5)	5 (62.5)	8 (100.0)			
012	6 (75.0)	2 (25.0)	8 (100.0)			
013	7 (87.5)	1 (12.5)	8 (100.0)			
Total	57 (54.8)	47 (45.2)	104 (100.0)			

Key: n - Frequency, (%) – percentage, x2 - Pearson chi square test, df – degree of freedom

PPE acquisition by construction workers

In this study 16(34%) participants who confirmed to have PPE's had safety boots, 3(6.4%) had dust masks, 2(4.3%) had ear masks, 9(19.1%) had helmets, 10(21.3%) had overalls, 5(10.6%) had goggles, 1(2.1%) had heavy duty gloves while the remaining 1(2.1%) had no response to this question. On acquisition of PPE's 11(23.4%) had obtained them by borrowing, 7(14.9%) were provided by their respective employers while the remaining 29(61.7%) bought the equipment by themselves (Table 5).

Table 5: PPE's acquisition by the construction workers

Sites	Means of acquiring PPEs				χ^2,df,p
	Borrowed (n) (%)	Provided by employer (n) (%)	Bought myself (n) (%)	Total (n) (%)	p-value
001	0 (0.0)	1 (16.7)	5 (83.3)	6 (100.0)	
002	1 (33.3)	1 (33.3)	1 (33.3)	3 (100.0)	
003	0 (0.0)	1 (20.0)	4 (80.0)	5 (100.0)	
004	1 (33.3)	0 (0.0)	2 (66.7)	3 (100.0)	
005	1 (33.3)	0 (0.0)	2 (66.7)	3 (100.0)	
006	0 (0.0)	1 (33.3)	2 (66.7)	3 (100.0)	
007	1 (33.3)	0 (0.0)	2 (66.7)	3 (100.0)	
008	1 (20.0)	1 (20.0)	3 (60.0)	5 (100.0)	1.1, 12, 0.92
009	1 (50.0)	1 (50.0)	0 (0.0)	2 (100.0)	
010	2 (33.3)	0 (0.0)	4 (66.7)	6 (100.0)	
011	2 (40.0)	1 (20.0)	2 (40.0)	5 (100.0)	
012	1 (50.0)	0 (0.0)	1 (50.0)	2 (100.0)	
013	0 (0.0)	0 (0.0)	1 (100.0)	1 (100.0)	
Total	11 (23.4)	7 (14.9)	29 (61.7)	47 (100.0)	

Key: n - Frequency, (%) – percentage, χ^2 - Pearson chi square test, df – degree of freedom

Reasons for not utilizing PPE by the workers

The respondents gave varied reasons why they did not use the available PPE's in their work place. This study showed that some participants did not have them because they did not see any importance of them; others did not have them because they were feeling uncomfortable to use them. Others also did not have the equipment because they were expensive to buy/afford.

Data analysis revealed that there was no significant association (χ^2 =11.5, df=12, p=0.40) between any response and the construction site as seen in (Table 6). Observation showed that some workers had PPE's but they were not using them.

Table 6: Reasons for not using PPE's by the participants

Sites	**Reasons for not using PPEs**				**χ^2 (df)**	**p-value**
	Not Important (n) (%)	Uncomfortable to use (n) (%)	Expensive (n) (%)	Total (n) (%)		
001	0 (0.0)	1 (50.0)	1 (50.0)	2 (100.0)	11.5(12)	0.40
002	0 (0.0)	2 (40.0)	3 (60.0)	5 (100.0)		
003	0 (0.0)	0 (0.0)	3 (100.0)	3 (100.0)		
004	0 (0.0)	0 (0.0)	5 (100.0)	5 (100.0)		
005	1 (20.0)	0 (0.0)	4 (80.0)	5 (100.0)		
006	0 (0.0)	1 (20.0)	4 (80.0)	5 (100.0)		
007	2 (40.0)	2 (40.0)	1 (20.0)	5 (100.0)		
008	0 (0.0)	0 (0.0)	3 (100.0)	3 (100.0)		
009	3 (50.0)	0 (0.0)	3 (50.0)	6 (100.0)		
010	0 (0.0)	0 (0.0)	2 (100.0)	2 (100.0)		
011	1 (33.3)	1 (33.3)	1 (33.3)	3 (100.0)		
012	1 (16.7)	1 (16.7)	4 (66.6)	6 (100.0)		
013	1 (14.3)	2 (28.6)	4 (57.1)	7 (100.0)		
Total	9 (15.8)	10 (17.5)	38 (66.7)	57 (100.0)		

Key: n - Frequency, (%) – percentage, χ^2 - Pearson chi square test, df – degree of freedom

DISCUSSIONS

The results on gender concur with a similar study by Acharya (2014) on Utilization Pattern of Personal Protective Equipment among Industrial Workers of Nepal, majority of the respondents were male (68.4%). Kimeto (2014) in his study on safety provision among tea factory workers

reported that male workers in the factories were high (75.0%) compared to their female counterparts (25.0%). Ogula (2005) also observed similar results.

On age of participants, this concurs with a similar study done by Khairuzzaman *et al.,* (2014) who found workers age ranging being between 25 and 60 years with a majority being in the age group of 30–40 years. In this study construction work attracted middle age people because of the need to feed their families. Acharya (2014) in a similar study in Nepal also found that majority of the construction workers were in age group 30-40 years and were more likely to use PPE compared to others. Guidotti, (2011), in a similar study had similar observation.

On the Knowledge of existence of PPE's among the participants, a similar study by Tylor, (2011) in UK showed that some construction workers continue to have a rather low utilization of protective clothing, despite the fact that they were very much aware of the association between PPE utilization and associated injuries/ailments.

The results of another study by Cong, (2008) which was carried out on knowledge attitude and practice on PPEs to rattan craftsmen in trade village in Vietnam showed that majority of the workers had low knowledge on PPEs and also the usage was low.

On social demographic characteristics and PPE utilization, a similar study by Guidotti (2011), it was found that young workers tend to feel immune to hazards and do not take PPE usage seriously while older workers feel that they are used to certain types of equipments and that they have experience to work safely despite the hazards involved hence there was no significant association between any age group and PPE utilization.

On the availability of PPE at construction sites as confirmed by the workers that, the PPE's was in line with the type of work and hazards one was exposed at any particular time. In this study construction workers reported to be using the following PPE's; safety boots, helmet, overall, heavy duty gloves, dust masks, ear masks, helmet, overalls, goggles, heavy duty gloves and safety harness/ belts. Each PPE's is used for a different work in the construction sites. Safety boots are used to protect foot from injuries. Goggles are used to protect eyes from strong light during welding and also protect from dust.

Overalls are used to protect one's clothing from getting dirty. Helmets are used against head injuries. Ear muffs are used to protect ears against excessive noise in the construction sites. Safety harness/belts are used to protect workers from falling from heights. The OSHA (2007) stipulate that it is the responsibility of the occupier to provide a safe working environment to the workers including the provision of proper and working PPE's. In this study different workers were using different PPE's for different jobs.

In this study workers who confirmed that they had PPE's were 47(45.2%). Some workers are provided with PPE and yet they were not using them especially goggles and face masks as observed in this study. These workers said that the PPE were not comfortable. Hence concur with the results of similar studies (Ziauddin, 2006; Yu *et al*., 2005; Paramasivam *et al.,* 2010; WHO, 2007). It was observed that some workers working in welding department were provided with goggles for eye protection but they were not using them properly.

On the PPE acquisition by construction workers, (Table 4.8) shows that majority of the workers from all the construction sites bought PPE's by them. This implies that the contractors have not taken into consideration in their budgets to ensure safety measures for the workers are in place. The workers were asked to name the reason for not having the PPE and most of them cited the cost of the PPE as a problem, although this should not be a real problem if the employers could adhere to the OSHA regulations or rather the employees should be educated on their rights or safety conditions as stipulated by the OSHA, 2007.

There was no significant association (χ^2=1.1, df=12, p=0.92) between acquisition of PPE's by the construction workers and any particular construction site one comes from as shown in (Table 4.8).

On the reasons for not utilizing PPE by the worker's observation showed that some workers had PPE's but they were not using them. In another similar study, more than two quarters did not feel uncomfortable using PPE, hence it influenced the increase in the use of PPE in workplace (Truong *et al.,* 2009). Study conducted in Saudi Arab showed that 12% of the participants used PPE all the time while, 60% did not use any type of PPE.

The main reasons given for not using PPE were non-availability of equipment and that the equipment was too heavy causing inconvenience. A variety of preventive measures and PPE were mentioned, their use however, was unsatisfactory (Taha, 2003). Elsewhere it has been recommended that the workers need to be trained on proper use of PPE to reduce the occupational health hazards (Parimalam *et al.,* 2007).

CONCLUSION AND RECOMMENDATIONS

All workers were aware of hazards, injuries and illness associated with construction work. However most (80%) workers had suffered illness or injuries in the course of their duties.

The prevalence of injuries remained high although there was no significant association (p=0.10) between the type of injuries/ailments and any particular construction sites under study.

Since, there was significant association of (p=0.00) between awareness and the existence of PPE's by the construction workers and the construction sites still the usage of the right PPEs was low.

Therefore, further research needs to be done to establish the perception on the right use of PPEs in the other construction sites in Kenya as a whole.

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