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Knowledge of Occupational Hazards and Use of Protective Equipment among Petrol Service Station Workers in Nakuru, Kenya

Joshua Kyalo Mutungi*, Wilkister Moturi**, Stanley Makindi***
**Department of Environmental Science, Egerton University, Kenya.
Email: mutungijoshua@gmail.com, wnyaora@egerton.ac.ke
*** Department of Environmental Sciences, MachakosUniversity, Kenya.
Email: smakindi@mksu.ac.ke

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Abstract

Employers are responsible for the safety, health and welfare of all persons working in their workplaces. Where the occupational hazard cannot be eliminated, the employer is required to inform all workers of any health risks and imminent danger present at the workplace, safety procedures in place, and protective measures available. Workers with a better understanding of relevant occupational hazards present in their workplace tend to implement relevant safety procedures, resulting to a healthy worker and a safe work environment. On the contrary, lack of knowledge and poor attitude towards safety procedures result in improper occupational health and safety practices thus putting the lives of fellow workers and customers at risk. However, there is limited documented data focusing on the knowledge of occupational hazards and the use of Personal Protective Equipments (PPEs) among petrol service station workers in Kenya. A cross-sectional survey of 192 workers picked randomly from 32 petrol stations within Nakuruwas employedin this study. Data was collected through questionnaires, an interview guide and an observation checklist, and analysed using the Statistical Package for the Social Sciences (SPSS Version 20). From the findings, all respondents (100%) had good knowledge of occupational hazards and about 92.2% of the respondents knew of one or more potential health effects associated with Premium Motor Spirit(PMS) exposure. The level of knowledge was significantly affected by the level of education. Regarding the use of PPEs, the study revealed that 60% of the respondents had been provided with PPEs. However, from observations, only 12, (6.7%) of the respondents used PPEs at the time of the study,particularly,Aprons/Overalls (99.1%). The low usage was attributed to the fact that the availability of PPEs was only "on need basis" and thus mostly worn during offloading which was considered to be hazardous. The findings of this study have drawn attention to the need for employers to provide workers who are occupationally exposed with requisite PPEs. Moreover, there is also a need for a lifelong education programme for the workers about occupational hazards and health risks, a PPE training programme and an arrangement for safety communication in the local language to change the perception and unsafe behaviours among petrol station workers.

Key words: *Knowledge, PMS exposure, Occupational Hazards, Petrol Service Station, PPEs*

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I. INTRODUCTION

In Kenya, petrol service stations have been rising tremendously over the last decade. The rapid growth of petrol stations is due to ever increasing use of automobiles. The industry is rapidly emerging as a major source of employment especially in urban and peri-urban areas where it has attracted large workforce. Apart from refuelling services, these facilities also sell Liquidified Pressurized Gas(LPG) cylinders and provide a 24-hour vehicle services like car wash, oil change and mechanical repairs to automobiles, food outlets and large parking areas to its customers; attracting massive employment of staff into petroleum industry. However, workers in this industry are exposed to several safety and health challenges such as chemical, biological, mechanical, physical, biological, physiological and psychosocial hazards [1]. According to the International Labour Organization (ILO), each year, about 2.3 million workers die becauseof occupational accidents and diseases, whereas 337 million suffer from it. Whereas in Sub-Saharan African countries about 54 000 fatal occupational accidents happen annually and approximately, 42 million work-related accidents that took place resulted to at least three (3) days absence from work [2].Moreover, the fatality rate as a result of work related incidences in Sub-Saharan African countries is 21/100000 workers and the accident rate per 100000 workers is 16000 [3]. However, there is little or no documentation on the occupational illness, injuries and fatalities in Kenya meaning that there is likelihood that such cases go unreported or overlooked.

Petrol service stations are considered hazardous places because they generate and release toxic fumes known as Volatile Organic Compounds (VOCs) which consist of a mixture of benzene, toluene, ethylbenzene and xylenes (BTEX), cadmium, lead and arsenic [4, 5, 6]. These chemical hazards are released during loading, storage, supply and refuelling of automobiles, oil spillage and exhaust fumes released from customers' automobiles and finds its way into the work environment constituting a high potential health risk to the petrol station workers [7]. Adverse health outcomes associated with these VOC include respiratory disorders, neurogenic [8,9] allergic skin reactions, infertility[10], carcinogenic [11, 12] and mutagenic potential [13]. However, the health effects of VOCs will depend on the nature of the VOC, the level of exposure and the length of exposure [14].

In order to minimize the exposure to occupational hazards, employers are required to provide occupational safety and health orientation to their new, young and inexperienced workers upon their hire or transfer regardless of the jurisdiction in which they operate [15]. The safety information should include but not limited to the specific hazards, conditions, equipment, procedures, policies, practices, rules and regulations where the work occurs and company responsibility. Workers are supposed to wear Personal Protective Equipments (PPEs) like gloves, overalls and practice high personal hygiene at all time at work place [16]. Further, the inhalation of petrol vapour can be minimized when a workplace is provided with adequate ventilation, workers work in shifts and rotation of task. All containers used to store and transport petrol must be suitable, leak-proof, made of metal or other material of adequate strength and construction to prevent evaporation [17]. Furthermore, petrol stations are required to install Vapour Control System (VCS) and activated at the time of discharge of petroleum products from petrol tankers to the Underground Storage Tanks (UST). Moreover, installation of Vapour Recovery Units (VRU) in the petrol bulk storages ensure that all petroleum vapours released from the USTs are recovered [18]. The Government of Kenya (GoK) through an Act of Parliament published the Occupational Safety and Health Act (OSHA) in 2007 to replace Factories and Other Places of Work Act in order to safeguard the safety, health and welfare of persons at work, whether temporary or

permanently and all persons lawfully present at workplaces. Where the hazard cannot be eliminated for instance in petrol stations where toxic fumes are generated and released during operations, the employer is required to provide information to the workers on the type of hazards in place and health and safety procedures available at the workplace including the persons or personnel to whom the worker may make an inquiry or launch a complain about their safety and health [19]. However, compliance to the provisions of OSHA 2007 among petrol stations in Kenya is relatively low. Besides, employees working in petrol stations lack requisite knowledge and skills due to shortage of training and awareness on the occupational hazards and potential health risks associated with the volatile organic fumes present. The Directorate of Occupational Safety and Health Services (DOSHS) is tasked with enforcement of safety and health of workplace ensuring that all comply to set safety regulations and those contravene to face the law.

The employee has a right to refuse or even complain to the relevant authorities should he/she find that the task compromises his health status. However, due to high job insecurity, low educational standards and poverty, petrol station staff are exposed to exploitation by employers and high levels of occupational hazards [20]. Apart from uniforms, the use of and access to appropriate personal protective gears in these sector is often limited. Workers who are new to the work may know the hazards present but may not understand the risks or have different perception about how exposure affects their health. Workers may not report some illnesses or even seek medical attention but continue going to the workplace as if everything is normal. Some assumptions and misconception are that risks are part of work and that short time exposure may not be a problem, thus it is only the older people who have experienced long exposures to hazards should be worried [21].

Health and safety related studies on Kenyan petrol station shows that petrol stations have done well in installation of firefighting equipment and warning signs thus taking fire risks very seriously by ensuring they comply to the legal framework [22,23]. However, there is littleresearch and minimal information on the knowledge of work-related hazards and use of PPEs. It remains to be seen whether employees and management provide information to the workers on the type of hazards in place, health and safety procedures, and if workers are trained on the importance of PPEs and how to use them. Therefore, this study assessed the level of occupational hazard awareness, availability and types of PPEs commonly used by petrol station workers.

II. METHODOLOGY

A. Study area

This study was carried out among petrol service station workers in Nakuru County, Kenya. Nakuru County lies within the Great Rift Valley and is located between Longitude 35º 28` and 35º 36` East and Latitude 0º 13 and 1º 10` South, 160km North west of Nairobi covering an area of 2,325.8km².

B. Research Design

Cross-sectional and descriptive study designs were used in this study. Data from each selected petrol station was collected at a time and examined. The researcher used both qualitative and quantitative approaches in data collection.

C. Sample size and sampling procedure

Purposive sampling was used to 32 petrol stations within three (3) sub-counties namely,Njoro, Molo and Nakuru Municipality due to their proximity to the Nairobi-Western highway. The study focused on petrol stations which had dispenser pumps for diesel, petrol and kerosene, car servicing bay and Front Office section. The petrol stations which met the above criteria were Four (4) in Njoro and Five (5) in Molo, while systematic random sampling was used to select 23 petrol

stations in Nakuru municipality where the study concentrated on petrol stations along Nairobi-Eldoret highway. Stratified and simple random techniques were used to obtain samples from selected petrol stations. A number of respondents were picked randomly and proportionately drawn from each section in all petrol stations involved in the study to give a desired sample size of 192. A proportionate ratio was used to select respondents from dispenser pump section, car servicing section and front office section. The respondents within selected sections from all petrol station were then sampled through simple random sampling and the samples used for data collection.

The sample size was determined using the formula $n = (Z^2pq)/e^2$ for an infinite population [24]. The sample $n = (1.96^2x0.5x0.5)/ 0.05^2 = 384$. Since the target sample was petrol station staff who were few under normal circumstances (less than 10000) and if 384 is the estimated total number of staff in selected stations, then sample size was calculated using formula nf=(nxN)/(n+(N-1). Where, nf = desired sample size when target population is less than 10,000. n = desired sample size when population is greater than 10,000. N = the estimate of the population size [25]. The desired sample size nf=(384x384)/(384+(384-1) = 192.

D. Data Collection and analysis

Data was collected through questionnaires, interview guide and observation checklist. Both open and closed-ended questionnaires were used to collect data from the respondents on the social economic details, occupational hazards and safety awareness, availability and types of PPEs workers use on regular basis. Secondary data was obtained from Energy and Petroleum Regulation authority (EPRA) website, policy research working papers, published books and relevant journals. The data collected from the field was coded, organized and analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0. The analysis of the data used descriptive statistics and qualitative statistics for non-numerical data and quantitative statistics for numerical values. Pearson Chi-square test analysis was also used to show the association between different variables to achieve the objectives. The research findings were then presented using charts and tables that helped in understanding and interpretation of the information.

III. RESULTS

A total of one hundred and eighty (180) petrol service station workers were interviewed with a response rate of 93.8%. The obtained response rate is high and acceptable in social research [26]. Twelve (12) of the respondents not included in the study after their stations declined to participate in the survey. The findings are presented qualitatively and quantitatively. Pearson Correlation coefficient was used at P = 0.05 to correlate the variables.

The respondents were drawn from pump attendant section (50%), car servicing (33.3%) and front office section (16.7%).

Table 1: Designation of the Respondents

Designation	Frequency (n=180)	Percent (%)
Pump attendant	**90**	**50.0**
Car servicing	**60**	**33.3**
Front office: Supervisor / manager	**30**	**16.7**

E. Social economic characteristics of the respondents

The studyhad more male respondents (76.1%) than female(23.9%) while the majority of the respondentswere from the age bracket of 18-25 years(43.3%).Majority (86.7%) worked 8-10hrs a day,84.4% had worked 5 years and below while over90% of the respondent had received post primaryeducation as illustrated in table 2 below.

Table 2: Social economic characteristics of the respondents

Variable	Frequency (n=180)	Percent (%)
Sex		
Male	**137**	**76.1**
Female	**43**	**23.9**
Age(years)		
18-25 years	**78**	**43.3**
26-35years	**69**	**38.3**
36-45years	**33**	**18.3**
Education		
Primary	**16**	**8.9**
Secondary	**84**	**46.7**
Tertiary	**74**	**41.1**
University	**6**	**3.3**
Hours worked per day		
Below 8hours	**10**	**5.6**
8-10 hours	**156**	**86.7**
11-12hours	**10**	**5.6**
Over 12 hours	**4**	**2.2**
Work experience		
Below 1 year	**76**	**42.2**
1-5 years	**76**	**42.2**
6-10 years	**28**	**15.6**

F. Level of knowledge on occupational hazards and health risk.

The findings indicate that all the respondents 180 (100%) were aware of occupational hazards present at their workplace where respondents could mention more than one risk. When asked to outline them, all respondents (100%) could easily identify fire as an occupational hazard. Other hazards mentioned were oil spill (83.9%), Inhalation of Premium Motor Spirit (PMS) (85.6%), explosives (63.3%), noise (35%), fuel contact with body (93.9%), cold weather (26.1%) and risk of being run over by customer vehicles (65%).

The study noted that the knowledge level of the respondents on health effects associated with PMS vapours varied. Of the respondents, 166 (92.2%) of the respondents showed that they had good level of knowledge(knowledgeable), whereas 14 (7.8%) had no knowledge on potential health effects associated with PMS as illustrated in the table 3 below.

Table 3: Level of knowledge on occupational hazards and health risk

variable	Frequency (n=180)	Percent (%)
***Types of Hazard/risks present**		
Fire	**180**	**100**
Fuel contact with body	**170**	**93.9**
Inhalation of PMS	**154**	**85.6**
Oil spill	**149**	**82.8**
Run over by vehicles	**117**	**65.0**
Explosions	**113**	**63.0**
Cold	**47**	**26.1**
Level of Knowledge on potential health effects		
No Knowledge on health effects	**54**	**30**
Low knowledge on health effects	**46**	**25.6**
Moderate knowledge on health effects	**66**	**36.6**
Advance knowledge on health effects	**14**	**7.8**
***Multiple responses**		

G. Availability and use of personal protective equipment

In regard to the self-reported use of PPE and uniforms, about 86.1% of the respondents reported that uniforms are available for use and were required to put on while on duty while 13.9% reported that they wore their own cloth while at work as illustrated in plate 3and 4.Majority of the respondents 108 (60%) stated that employer provided PPE, out of which the most commonbeing Aprons/overall (99.1%) while the least being face mask(16.7%).However, the findings of the study from the observations showed that only 12 (6.7%) of the respondents used PPE at the time of the study as illustrated in the table 4 below.

Table 4: Provision, Usage and Non-Usage of PPE while at Work

Provision of PPE	Frequency n=180	Percentage (%)
Yes	108	60
No	72	40
***Type of PPE provided**	**n=108**	
Aprons /overall	107	99.1
Reflector jacket	40	37
Gloves	39	36.1
Safety boots	22	22.1
Face mask	18	16.7
Use of PPE	**n=180**	
Yes	12	6.7
No	168	93.3
***Type of PPE used while at work**	**n=12**	
Aprons/overall	10	83.3
Reflector jacket	5	41.6
gloves	1	8.3
Safety boots	7	58.3
Face mask	1	8.3
Reasons for non-use of PPE	**n=180**	
Not available	**95**	**52.8**
Not necessary in my section	**36**	**20.0**
Not directly involved in loading and offloading	**40**	**22.2**
Uncomfortable	**9**	**5**

***: Multiple responses** **PPE: Personal protective equipment**

H. Association between socio-economic factors and use of PPEs

The analysis in table 5 below shows the calculated Chi-square value and the associated p-values between socio-economic factors and PPEs.

Table 5:Chi-Square Tests for Socio-Economic Factors and Use of PPEs

Variable	Chi-Square Value	Df (degree of freedom)	Asymp. Sig. (P-value)
Designation	6.071	2	0.048
Age	1.453	2	0.484
Level of formal education	38.584	3	.000
Work experience	1.677	2	0.432

The results showed that at 5% level of significance (p=0.05), there was no association found between age and use of PPE and there was no association between work experience and use of PPE. However, the analysis above showed that at 5% level of significance, there was a significant association between designation of the worker and use of PPE. Further, there was a significant association between level of formal education and use of PPE.

IV. DISCUSSION

The respondents were drawn proportionately from the pump attendant section, car servicing, and front office section. About 76.1% of respondents were men; this was not surprising considering that petrol stations are predominantly a male-dominated occupation in Kenya which is similar to findings in Nigeria where 72% of respondents were also men [27]. Possible reasons for young males dominating the workforce could be because pump operations and car servicing were considered to be strenuous and risky tasks since petrol stations operate till late at night. The results suggest that more than half of the participants (81.6%) were youth. The results show that the majority of the respondents were from the age bracket of 18-25 years (43.3%) and 26-35(38.3%). This generally implies that more than half of the workforce in petrol stations is composed of young staff less than 35 years and thus youth are more likely to be exposed to occupational hazards than workers who are above 35 years in petrol stations workplaces. The results of the study are consistent with similar studies done in Nigeria [27] and Brazil [28] who noted that most of the workers were young adults.

The study shows that over 90% of the respondents had received post-primary education and were thus knowledgeable to answer on the issues under study. Petrol service station workers who have had a higher level of education were more likely to obtain updates that increase their awareness of hazards and PPE and were more likely to make use of available PPEs [29]. About 86.7% of the respondents worked 8-10hours a day. The findings are consistent with similar studies donein

Nigeria who observed that most respondents (51.4%) work for more than 8 hours daily [30]. This implies that most staff worked 8 to 10 hours a day without a work break in between the shift. Though there are no safe levels of exposure, long working hours show that the staff is constantly exposed to PMS throughout the workday. Fewer working hours and break in between shifts for workers in high-risk areas are necessary to minimize exposure to occupational hazards [31]. Regarding working experience for the respondents in the current station, it was worth noting that about 84.4% of the respondents had worked 5 years and below. The finding concurs with a previous study among petroleum and allied industry workers. This could be because the workforce was majorly young adults who may have just started working after completing post-primary education. Another possible reason could be the fact that petrol station workers don't stay on the job for long and that there is high turnover in this sector. This should have an implication for training since the employers may not invest much in training if employees don't stay on for long.

It is interesting to know that all respondents (100%) were aware of the occupational hazards associated with their job where more than one hazard/risk was mentioned. The risk of fire was easily mentioned by all respondents [32]. This is because most of the stations had fire extinguishers and warning signs reading "No smoking" displayed at the forecourt and offloading area. This finding was supported by a study conducted in Nigeria where the most frequent hazard reported in the study was a fire hazard [33]. Regarding knowledge levels on health effects, about 70% of the respondents knew one or more health hazards of PMS exposure. This concurs with similar studies in Thailand [34] and in Nigeria [35] who observed that the knowledge levels of the respondents on health and safety at work were 50% and 55.2%, respectively. Further, the results suggest that the level of knowledge of workers on occupational hazards was significantly influenced by the level of education and periodic in-service training. The possible explanation could be that education could improve the understanding of workers and boosts a means of communication for acquiring knowledge. Similarly, administrative controls such as in-service safety training and retraining, safety awareness campaigns, and communication can improve the awareness level of occupationally exposed workers [36].

Administrative strategy at the workplace should be complemented with the provision of adequate and suitable PPEs to reduce the intensity of exposure. Though a good proportion of respondents (60%) were aware of one or more types of PPE, only 6.7% of the used PPEs at the time of this study, use of apron/overall predominated while gloves and face mask were least used. This study concurs with a similar study done in Sudan in which only 5.0% of petrol pump attendants used any form of PPE at work [37]. The low usage was attributed to the fact that their availability was only "on need basis" thus mostly worn during offloading which was considered to be hazardous. The findings are supported by a study in Tanzania which reported that non-availability was the main reason for the non-usage of PPE in petrol stations [38].

The study also showed that the level of education, designation of workers, and in-service training influenced the use of PPE among petrol service station workers. This could be attributed to the fact that workers with higher education can read and obtain additional information from different information sources thus increasing their awareness of hazards and PPEs. This is in agreement with a previous study among petroleum and allied industry workers. Similarly, in-service safety training will improve the levels of awareness [39]. However, the results showed that there was no association found between age, work experience, and use of PPE. This implies workers' age and work experience may not necessarily result in the utilization of provided PPEs. Although work experience did not lead to better use of PPE among respondents, in-service training appeared to.

V. CONCLUSIONS

From the research findings, all respondents were aware of the occupational hazards associated with their profession and more than half of the respondents knew of one or more health effects associated with PMS exposure. However, the observed unsafe behaviours suggested that there was a gap between real health risk level and the risk perceived by workers. The findings also suggested that the level of knowledge of workers on occupational hazards was significantly influenced by the level of education and periodic in-service training. Subsequently, the study showed that the level of education and in-service training influenced the use of PPE among petrol service station workers.

Though adverse health outcomes associated with PMS exposure are well documented in most studies, there are no established safe limit exposures. The inhalation of petrol vapourscan be minimized when a workplace is provided with adequate ventilation, workers work in shifts and rotational tasks. The study revealed that PPEs usage among petrol station workers was low. The low usage was attributed to the fact management in most petrol stations limits the use of requisite PPE at work. The availability of PPEs was only "on need basis" thus mostly worn during offloading which was considered to be hazardous. There remains a gap between workers' knowledge of occupational hazards and the implementation of safe work procedures as a mitigation measure. This shows that the level of knowledge was good but too narrow. Therefore, there is a need to conduct safety training and retraining of all staff on safety measures at the workplace.

From the study,it is evident that administrative controls such as periodic in-service safety training, safety awareness campaigns and communication can improve the awareness level of occupationally exposed workers and help to reduce the risks of occupational diseases and illness associated with exposure to volatile organic compounds present at petrol stations. Further, these administrative strategies should be complemented with the provision of adequate and suitable PPEs to reduce the intensity of exposure. Employers have both legal and moral responsibility to safeguard the safety and health of all workers at the workplace by providing safety facilities and ensuring systems and procedures of work are safe and without health risks. Employers and management should inform all workers of health hazards present at the workplace, hazard control and mitigation measures in place in a local language and provide, enforce and monitor the use of requisite PPEs for all workers who are occupationally exposed. Workers are responsible for appropriately using at all times the provided personal protective equipment and observing the laid down safety and health procedures, requirements and instructions present at the workplace as stipulated in the OSH Act of 2007.

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