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ASBESTOS SAFETY AND HEALTH RISK AWARENESS AMONG MAINTENANCE WORKERS IN KENYAN PUBLIC UNIVERSITIES

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ABSTRACT

This study evaluated asbestos safety and health risks awareness among maintenance workers in public universities in Kenya through four aspects of education, policy, perception and knowledge. The study anchored on positivism philosophy with a descriptive design approach achieved by survey of394 respondents using a semi-structured questionnaire. Both descriptive and inferential statistics were analysed. The regression coefficients model analysis showed that knowledge (beta = .242, p =.000) and perception (beta = .177, p=.002) statistically predicted university awareness for asbestos safety and health risks (p<.05). However, both education (beta = .018, p = .217) and policy (beta =.115, p = .380) had poor significance (p>.05) indicating that the two constructs failed to predict the awareness of asbestos safety and health risks. Overall, majority of the public universities had awareness levels of over 40 percent but all below 50 percent with an average of 44 percent. Having focused on the safety and health risks awareness aspect, the study recommends concerted efforts by public universities in raising awareness over the banned asbestos and asbestos containing materials at the work place. Additionally, public universities need to increase training funds allocation while aiming to improve on the implementation of the safety and health risks policy.

Keywords: Asbestos, Awareness, Health, Risks, Safety, Kenya.

1. INTRODUCTION

Asbestos, a common element in insulation and building materials prior to the 1970s, was considered an ideal material for use in the construction industry but is today considered toxic

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waste. The problem with asbestos arises when the fibres become airborne and are inhaled. Because of the size of the fibres, they cannot be expelled by the lungs [1]. They are also sharp and penetrate tissues. Asbestos fibres enter the body by inhalation of airborne particles or by ingestion and can become embedded in the tissues of the respiratory or digestive systems. Years of exposure to asbestos can cause numerous disabling or fatal diseases [2]. Among these diseases are asbestosis, an emphysema like condition; lung cancer; mesothelioma, a cancerous tumour that spreads rapidly in the cells of membranes covering the lungs and body organs; and gastrointestinal cancer [3]. It is a cancer of the mesothelial lining of the lungs and the chest cavity, the peritoneum or the pericardium. Unlike lung cancer, mesothelioma has no association with smoking [4] the only established causal factor is exposure to asbestos or similar fibres[5].

Globally, studies[6, 7, 8] have established that health factors caused by the natural occurring asbestos (NOA) in various industrial mining areas indeed were prevalent in the soils and hence forced the mining firms to make provisions on how to prevent the hazardous nature of the NOA materials. Additionally, socio political factors made it difficult to implement the total ban on asbestos since buildings are costly to replace in terms of new roofing. Again, with the fire resisting nature of asbestos materials, it has become a problem convincing people to totally move away from the use of asbestos even after the global ban. Years of exposure to asbestos can cause numerous disabling or fatal diseases [2]. Among these diseases are asbestosis, an emphysema like condition; lung cancer; mesothelioma, a cancerous tumour that spreads rapidly in the cells of membranes covering the lungs and body organs; and gastrointestinal cancer [4]. Furthermore, differences existed in the way various countries of for example, the Caribbean implemented their policies on the asbestos ban as compared to the Latin American neighbours to the south of the Caribbean including Brazil and Argentina.

Kenyan public institutions with buildings constructed in the last century still have asbestos roofing despite many legislations globally setting safety and health standards for the reduction in usage of asbestos materials as a health risk and danger [9, 10, 11]. The study was thus inspired by the global, regional and local findings that clearly indicated the gaping holes in the usage of asbestos in public buildings in the face of legislation that has sought to limit or totally illegalize the use of these hazardous materials both in present form and in disposal. Kenyan universities are established under the Universities Act 2012 and the Science, Technology and Innovation Act 2013. Through the established Acts, Kenya has got 35 public universities spread across the country although most of them have a campus in the capital city of Nairobi.

1.1 Problem Statement

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In spite of all the warnings from health facilities and environmental organizations both private and public about asbestos and ACMs, the same results seem to repeat over years with increasing cases of lung infections related to their usage or disposal with ILO [3] statistics showing that almost 100, 000 people die every year due to asbestos exposure yet the communities were not aware of the health and safety risks. There is a clear need to have the situation arrested through careful research to establish how the usage and disposal of asbestos and ACMs relate to the healthcare of maintenance workers at these public universities. The fact that these public universities still use many old buildings with asbestos and have high number of employees working under their maintenance departments where disposal of materials is done calls for the examination of the universities on remedial strategies. It is a challenge that could only be addressed through field study to establish the variables that come into play for the unquestionably unstable situation in the usage of asbestos and ACMs causing risky hazards in the healthcare of maintenance staff at public universities in Kenya.

1.2 Justification and Scope

The study thus sought to answer the key question, "What is the level of asbestos safety and health risks awareness among maintenance workers in public universities in Kenya?" This was localised to Kenyan public universities meeting the asbestos containing materials study criteria. From previous studies [4, 7], the key indicators of awareness in safety and health risks include education, policy, perception and knowledge. These indicators were thus used to measure awareness of asbestos safety and health risks at the public universities in Kenya.

2. MATERIALS AND METHODS

This study thus, adopted positivism philosophy[12, 13] because it depended on quantifiable observation that would facilitate statistical analysis. Testing of hypotheses was done through statistical analysis where null hypotheses was accepted or rejected. The study measured the data and made inferences on the real situations; a focus on the assessment of asbestos safety and health management among maintenance workers at public universities in Kenya.

2.1 Research Design

Additionally, Descriptive design was chosen since it adds high reaction quality and low refusal rates[14]. Descriptive design was additionally viewed as proper on the grounds that it gives a depth and comprehensive search complete needed to have a description of the subject under examination[15]; evaluation of asbestos safety and health management among maintenance workers in public universities in Kenya.

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2.2 Target Population

The target population for this study comprised all the 35 public universities as registered under the Universities Act 2012 and the Science, Technology and Innovation Act 2013. It involved all workers in the maintenance departments or sections of the universities. The rationale for their inclusion was that they the first in line of people handling or directly getting in contact with the asbestos and ACM.

2.3 Sample Selection

Sample size was calculated using the formula applied by among statistical scholars [16, 17] as follows:

$$n = \frac{Z^2 P (1-P)}{\delta^2}$$

Where;

n - Required sample size

Z-1.96 (confidence level at 95%)

P-Proportion of maintenance workers exposed to asbestos in public universities in Kenya (not known therefore 50% was used)

δ- Level of precision at 5% (standard value of 0.05)

$$n = \frac{(1.96)^2 (0.50) (1-0.50)}{0.05^2}$$

n = 384 to the nearest 100 which added up to 400 participants.

Participants were asked questions on the four aspects of awareness including:

i) Knowledge on asbestos/ACM within the institution

ii) Perception/behavior on asbestos/ACM

iii) Institutions Policy (measures in place) on Asbestos safety and health risks

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iv) Their Education/training on Asbestos safety and health risks

2.4 Subject selection criteria

Purposive sampling methods were used to select universities containing old buildings characterized with asbestos roofing. After selecting the institution, participants were selected from maintenance workers. Every worker had an equal chance of participating in the study. Out of the total 35 public universities a convenience sample was used at each of the targeted 15 public universities. The list of all males and females was put into consideration so as to ensure equality and to make the sample to be representative as much as possible.

2.4.1 Subject inclusion criteria

Public University that contain old buildings with asbestos roofing

Employees who have worked for one year and above in the maintenance department and willing to participate in the study

2.4.2. Subject exclusion criteria

1. Public Universities that does not have old buildings with asbestos roofing
2. Employees who have worked for less than one year in the maintenance department.
3. Those workers meeting inclusion criteria and were not willing to participate in the study

2.4.3. Subject exclusion criteria

Data was analysed through use of both descriptive and inferential statistics. The descriptive statistics involved frequencies, mean and percentages. Inferential statistics involved regression coefficients and significance levels derived from the study tool which had Likert-type scale where:

1 = Strongly Disagree

2 = Disagree

3 = Neutral (Did not Know)

4 = Agree

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5 = Strongly Agree

3. RESULTS

To establish the study results, both descriptive and inferential statistics were applied in analysing the field results.

3.1 Demographic Statistics of the study respondents

Table 1 presents the data on demographic characteristics of the participants. Male participants were 289(73%) while the females were 105(27%) hence were the minority. The study shows that most participants had college education [180 (46%)] during the study. Those with primary school education were 17(4%) while university graduates were 76(19%). The category referred to as others were those individuals who after completing primary school went to do artisan course, others were trained by professionals such as welders and mechanics, they were the least with 12 (3%) respondents. Employees in maintenance department were working as either general workers [243(62%)] or managers/supervisors [151(38%)]. The study participants had an average of 11.89 years of experience in their respective areas of work. The newest workers at below 5 years totaled 105 (26%) while the longest working category at over 16 years were 107 which is approximately 27%.

Table 1: Demographic Information of Respondents

Variables	Categories	Frequency (n)	Percentage (%)
Sex	Male	289	73
	Female	105	27
		394	**100**
Educational level	Primary School	17	4
	Secondary school	109	28
	College	180	46
	University	76	19
	Others	12	3
		394	**100**
Work position	General workers	243	62
	Managerial/supervisory	151	38
		394	**100**
Work experience	0 to 5 years	105	26
	6 to 10 years	110	28
	11 to 15 years	72	19

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16 + years	107	27
	394	**100**

3.2. Descriptive Results

Results presented in Table 2 for the overall comparison of awareness in the 15 sampled public universities show that various universities had differing levels of awareness with university coded 9 having 68 percent in knowledge compared to the lowest at 32 percent which is university coded 1. In terms of perception, public universities coded 6 and 8 scored highest with 70 percent as compared to the lowest score of public university coded 3 at 40 percent. For awareness through policy, public university coded 11 had the highest score at 50 percent with the lowest being public university coded 5 at 28 percent. Finally, the training component was led by public university coded 12 with a 45 percent training while the lowest was public university coded 15 at 25 percent training of staff.

The overall awareness level as per the public university was also captured on Table 2 with the leading pubic university coded 2 at 49 percent while the lowest awareness level was 39 percent at public universities coded 1 and 3. Otherwise, majority of the public universities had awareness levels of over 40 but all below 50 percent and averaging 44 percent.

Table 2: Individual Public University Awareness Levels

Awareness													
No.	**1. Knowledge %**			**2. Perception %**			**3. Policy %**			**4. Training %**			
	K	**DNK**	**UK**	**S**	**US**	**NS**	**S**	**FS**	**NS**	**T**	**NT**	**OT**	**Overall Awareness Level**
1.	32	34	34	55	34	11	34	57	9	34	50	16	**39**
2.	43	45	12	68	23	9	45	35	20	40	50	10	**49**
3.	52	37	16	40	37	23	30	52	18	32	47	21	**39**
4.	57	36	7	55	25	20	36	46	18	36	62	2	**46**
5.	56	35	9	58	20	22	28	45	27	35	55	10	**44**
6.	48	34	18	70	20	10	34	50	16	34	54	12	**47**
7.	51	34	15	47	40	13	34	48	18	34	34	32	**42**
8.	54	29	17	70	30	0	29	54	17	29	42	29	**46**
9.	68	30	2	40	35	25	25	60	15	40	40	20	**46**

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10.	43	38	19	45	45	10	38	46	16	38	48	14	**41**
11.	51	45	4	56	35	9	50	40	10	30	45	25	**47**
12.	37	45	18	51	40	9	45	47	8	45	45	10	**45**
13.	53	37	10	57	37	6	37	43	20	37	56	7	**46**
14.	38	32	30	65	26	9	32	58	10	32	58	10	**42**
15.	42	40	18	62	30	8	40	50	10	25	47	28	**42**
Average	**48**	**37**	**15**	**56**	**32**	**12**	**36**	**49**	**15**	**35**	**49**	**16**	**44**
K-know, DNK-Do not know, UK-Unknowledgeable, S-Safe, US- Unsafe, S- sure, FS- Fairly sure, NS- Not sure, T-Trained, NT-Not trained, OT- Other training													

Additionally, the study also provided a comparative safety and health risks awareness levels on a bar chart as demonstrated in Figure 1.

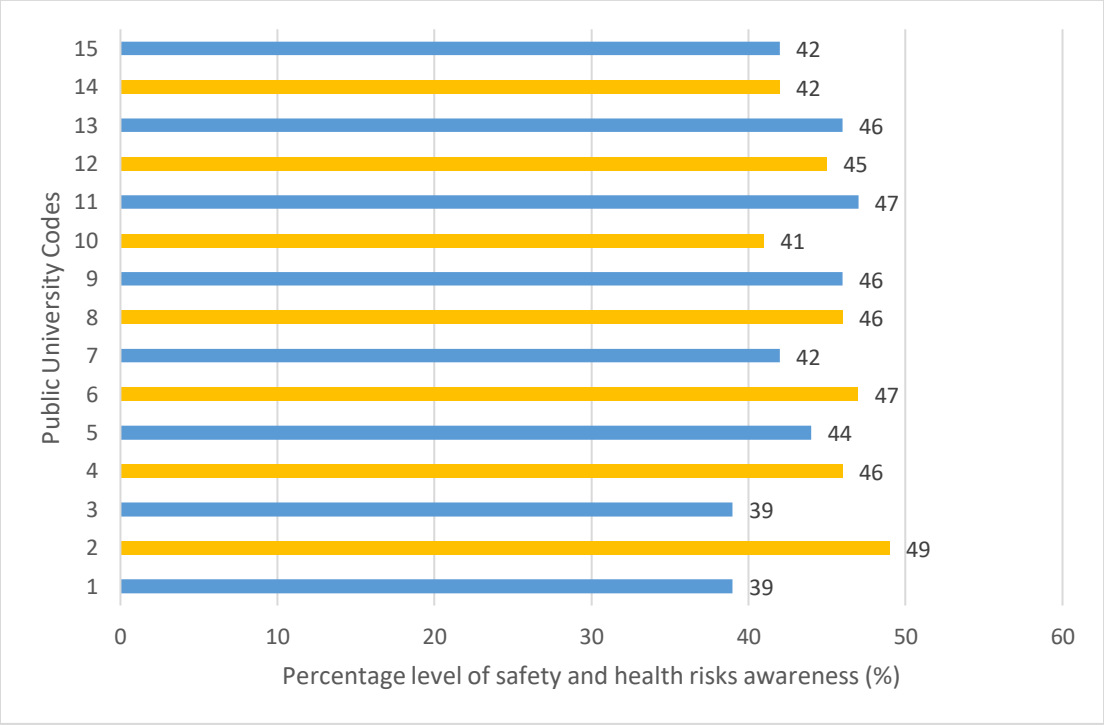

Figure 1: Overall Public University Comparison of Awareness Levels

3.3 Descriptive Results for Awareness Aspects

The study focused on 4 aspects of safety and health risks awareness including knowledge, perception, policy and education/training of respondents.

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3.3.1 Knowledge on Asbestos safety and health risks

On the question of knowledge on safety and health risks, results presented in Figure 2 show that, 190 (48%) of the respondents confirmed that they knew of the safety and health risks from asbestos dust/fibres while another 147(37%) affirmed that they did not know the safety and health risks from asbestos and ACM fibres/dust. Additionally, there was 15% who did not have any knowledge about asbestos and ACMs at the public universities.

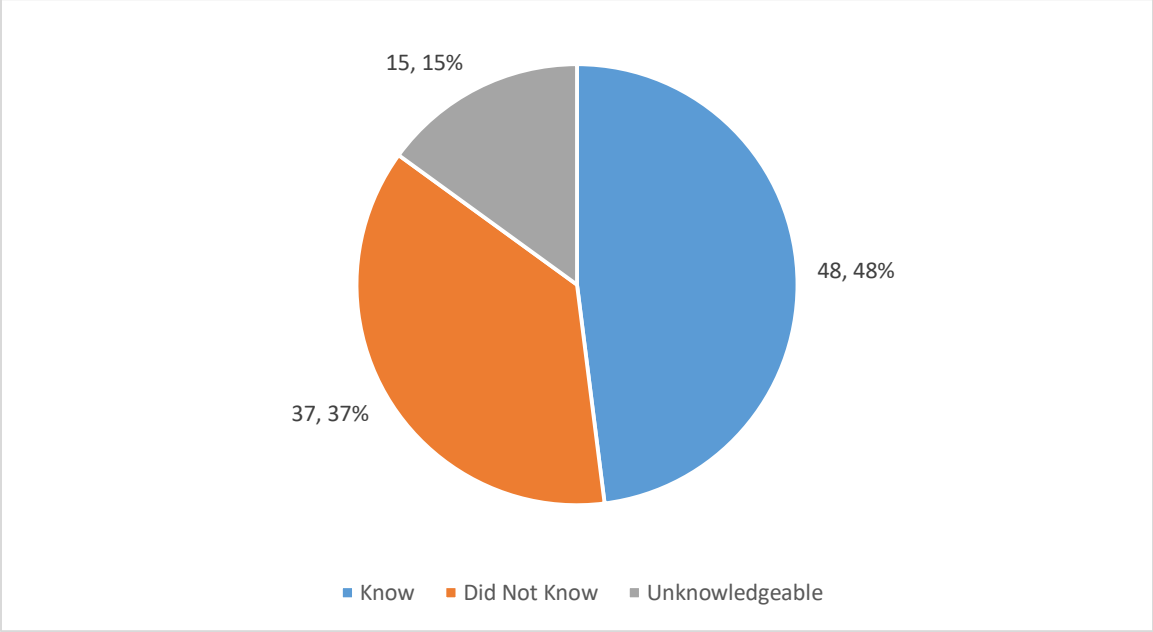

Figure 2: Asbestos safety and health risks knowledge

3.3.2 Perception on Asbestos safety and health risks

The study used a Likert scale to measure perception on asbestos safety and health risks by the maintenance workers. Results indicated in Figure 3 show that 56% of the respondents felt the environment was safe from asbestos safety and health risks with another 32% having the contrary opinion that the environment was unsafe. Finally, a minority 12% felt that they were not sure of the safety of their environment with respect to asbestos and asbestos containing materials at the public universities.

According to observation, the selected universities had old buildings with asbestos roofing materials as well as some area for disposal of asbestos and ACM. There was material evidence that indeed the public universities had designated locations or sites where the disposal of asbestos and ACM appeared to be disposed or dumped generally.

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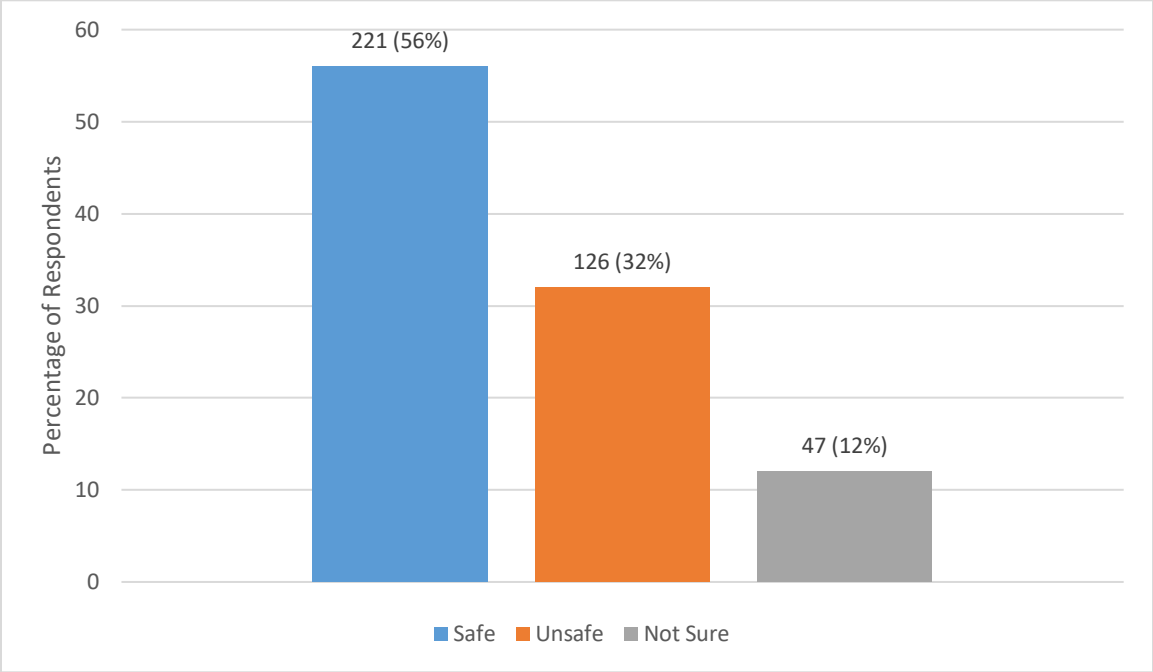

Figure 3: Perception of asbestos safety and health risks

3.3.3 Policy on Asbestos safety and health risks

The study revealed that 142(36%) participants across the public universities knew about environmental occupational safety and health measures at their respective work places regarding asbestos dust/fiber exposure from asbestos containing materials while 195(49%) did not know the safety and health risks policy. As indicated in Figure 4, there was a minority 15% know whether a policy on asbestos safety and health risk existed.

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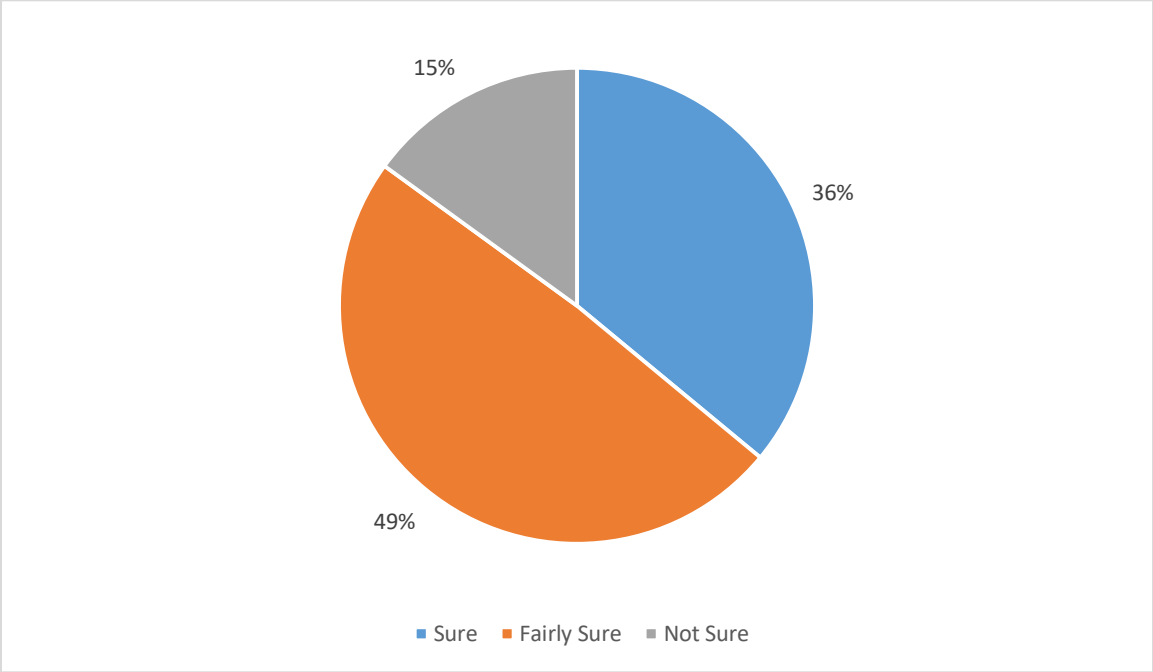

Figure 4: Respondents on Asbestos Safety and Health Risks Policy

3.3.4 Education/training on Asbestos safety and health risks

In terms of education and training, the study revealed that, 137(35%) workers across the universities had been trained on occupational safety and health regarding asbestos containing materials safe handling and disposal as shown in Figure 5. However, 194(49%) participants had not been trained on the safety and health risks of asbestos. There were about 16% who had been trained on other safety and health risks but specifically not covering asbestos and ACM.

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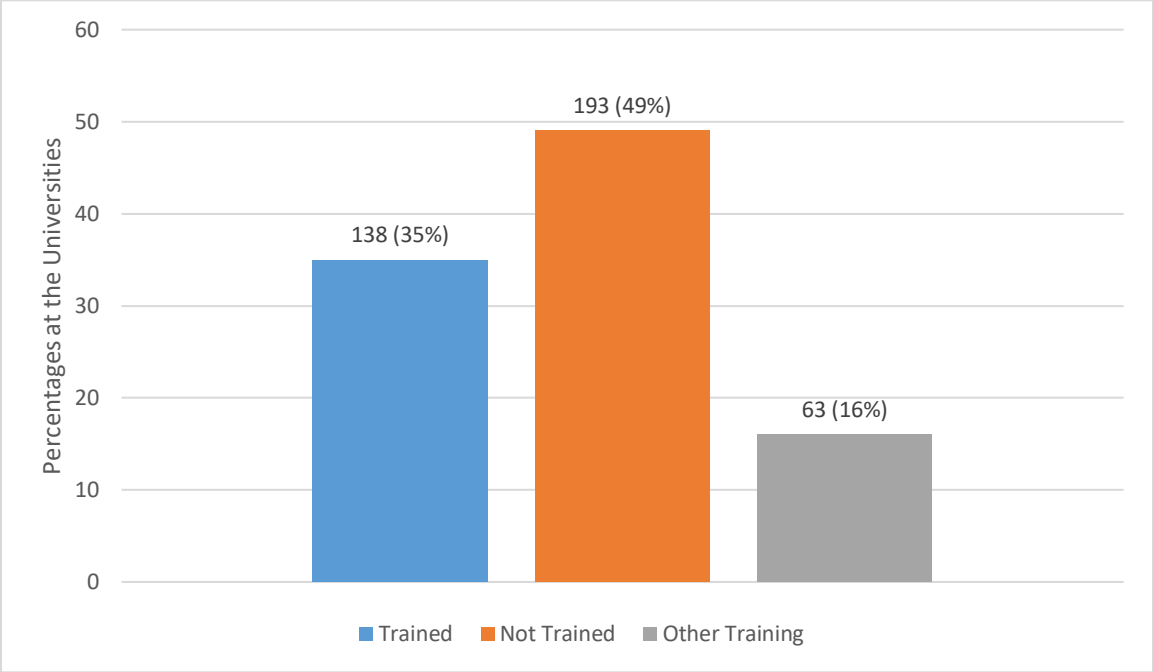

Figure 5: Training on Asbestos Safety and health Risks

3.3.5 Public university comparison on Asbestos safety and health risks Awareness

The four aspects of awareness were compared across public universities in Kenya to ascertain their level of implementation as indicted in Figure 6. Results indicate that the universities were knowledgeable in safety and health risks matters (48%) while their education levels for asbestos safety and health risks was low at 35%. Furthermore, the public universities had a good perception at 56% but with poor policy implementation of the asbestos safety and health risks at 36%.

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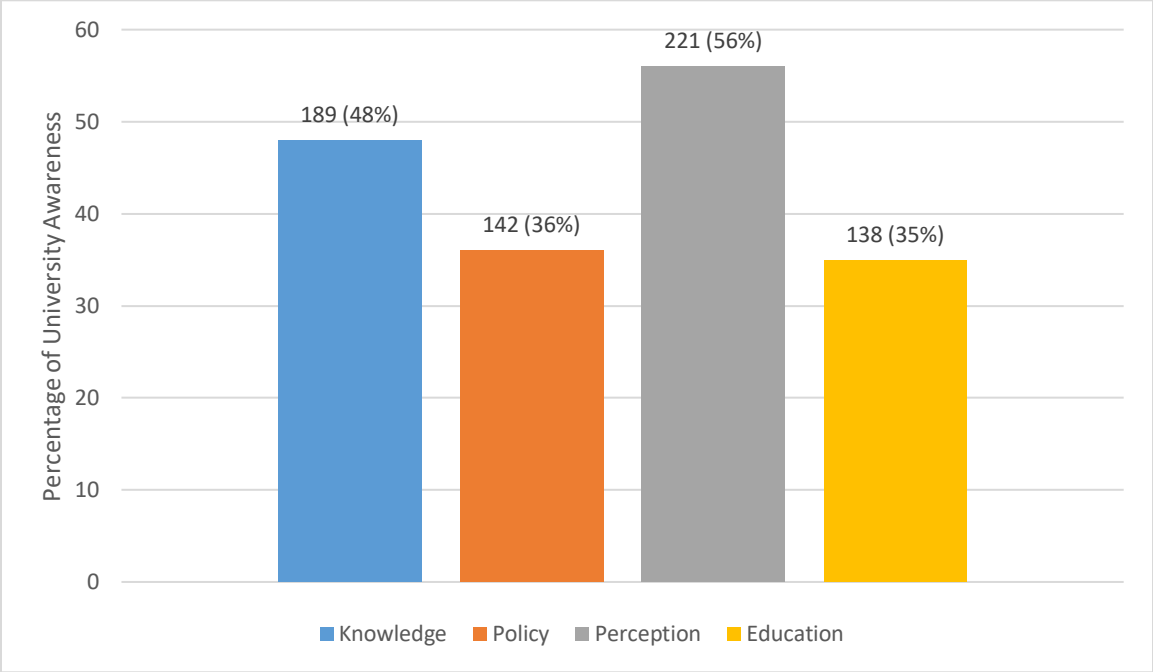

Figure 6: Public universities safety and health risks awareness

3.4 Cross Tabulation of Awareness with respect to Selected Demographics

A comparison was made on the level of safety and health risks awareness with three selected demographic aspects that were deemed key in comparing respondent awareness. These were specifically, the gender, highest level of education and number of years of working experience

3.4.1 Safety and health risks Awareness According to Gender

The awareness levels were checked using cross tabulation across the respondent gender as presented in Table 3. The results indicate that within males, perception was quite high at 47.4 percent while overall while knowledge level was highest at 70.6 percent. Compared to the female respondents, the highest level was perception at 47.6 percent while their highest awareness level was on policy with 44.4 percent. In terms of perception, males had a higher perception at 54.3 percent compared to females at 35.7 percent. On policy level, females had a higher policy understanding at 19 percent compared to their male counterparts at 13.2 percent. Similarly, female respondents at 9.5 percent had higher training and education in safety and health risks awareness compared to the male respondents at 7.9 percent.

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Table 3: Gender of Respondent and Awareness Level

Gender of Respondents		Aspects of Awareness				Total
		Knowledge	Perception	Policy	Education/training	
	Frequency	91	137	38	23	289
Male	% within Gender of Respondent	31.6%	47.4%	13.2%	7.9%	100.0%
	% within Awareness level	70.6%	64.3%	55.6%	60.0%	64.4%
	Frequency	25	50	20	10	105
Female	% within Gender of Respondent	23.8%	47.6%	19.0%	9.5%	100.0%
	% within Awareness level	29.4%	35.7%	44.4%	40.0%	35.6%
	Total Frequency	**116**	**187**	**58**	**33**	**394**
	% within Gender of Respondent	28.8%	47.5%	15.3%	8.5%	100.0%
	% within Awareness level	100.0%	100.0%	100.0%	100.0%	100.0%

3.4.2 Safety and health risks Awareness According to Education Level

Additionally, the study also cross-tabulated for comparison of awareness with respect to the highest level of education as presented in Table 4. Subsequently, the highest knowledge level at 52.9 percent was found at post-secondary education compared to 5.9 percent for primary level respondents. In terms of perception, the post-secondary respondents were also leading at 42.9 percent but closely followed by the secondary level education respondents. This trend was maintained at the policy level with post-secondary level respondents scoring a high 66.7 percent compared to 11.1 percent on the primary education level respondents. Finally, the education and training component was also led by post-secondary level respondents at 60 percent compared to primary level education respondents at 0.09 percent.

Table 4: Highest Education Level and Awareness

Aspect of Awareness		Highest Education Level			Total
		Post-Secondary	Secondary	Primary	
Knowledge	Frequency	61	48	7	116
	% within Knowledge	52.9%	41.2%	5.9%	100.0%
Perception	Frequency	80	73	33	187
	% within Perception	42.9%	39.3%	17.9%	100.0%
Policy	Frequency	39	13	6	58
	% within Policy	66.7%	22.2%	11.1%	100.0%
Education/Training	Frequency	20	10	3	33
	% within Edu/Train	60.0%	40.0%	0.09%	100.0%
	Total Frequency	**200**	**144**	**49**	**394**

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	% within Awareness	50.8%	37.3%	11.9%	100.0%

3.4.3 Safety and health risks Awareness According to Work Experience

Furthermore, the study also tested the cross-tabulation for awareness and number of years worked as presented in Table 5. From the presented cross-tabulation results, knowledge was highest in the working respondents of 0-5 years with the lowest being those who worked for 11-15 years at 15.5 percent. In terms of perception, respondents with over 16 years' experience had the highest perception at 29.4 percent followed by those with 6-10 years' experience at 28.3 percent. Additionally, the highest policy level at 37.9 percent was achieved by respondents who had worked for over 16 years while the highest education and training level at 30.3 percent was achieved by respondents who had worked between 11 and 15 years.

Table 5: Working Experience and Awareness

Aspect of Awareness		**Years Worked at University**				**Total**
		0-5	6-10	11-15	Over 16	
Knowledge	Frequency	41	34	18	23	116
	% within Knowledge	35.3%	29.3%	15.5%	19.8%	100.0%
Perception	Frequency	45	53	34	55	187
	% within Perception	24.1%	28.3%	18.2%	29.4%	100.0%
Policy	Frequency	10	16	10	22	58
	% within Policy	17.2%	27.6%	17.2%	37.9%	100.0%
Education/Training	Frequency	9	7	10	7	33
	% within Edu/Train	27.3%	21.2%	30.3%	21.2%	100.0%
	Total Frequency	**105**	**110**	**72**	**107**	**394**
	% within Awareness	26.6%	27.9%	18.3%	27.2%	100.0%

3.5 Significance Test for Safety and health risks Awareness

Finally, the study tested the significance of the 4 constructs of awareness including knowledge, perception, training/education and policy using coefficient or regression with beta values as presented in Table 6. In the regression coefficients model, the analysis showed that knowledge (beta = .242, p-value =.000) and perception (beta = .177, p-value=.002) statistically predicted university awareness for asbestos safety and health risks ($p<.05$). However, both training/education (beta = .018, p-value = .217) and policy (beta =.115, p-value = .380) had poor significance ($p>.05$) indicating that the two constructs could not be relied upon to predict the awareness of asbestos safety and health risks at the public universities.

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Table 6: Coefficients of Asbestos Safety and Health Risks Awareness

Model (N=15)		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	.226	.201		.612	.212
	Knowledge	.242	.009	.235	1.274	.000
	Perception	.177	.150	.172	0.415	.002
	Training/Education	.018	.122	.025	1.923	.217
	Policy	.115	.013	.128	2.673	.380
a. Dependent Variable: Public University Safety and Health Risk Awareness						

4. DISCUSSION AND CONCLUSION

From the current study, health awareness among employees working in hazardous environment is very important. The results of the current study are in agreement with other studies carried out on the subject of awareness including knowledge, perception, policy and education. In seeking to establish the health factors that were caused by the natural occurring asbestos (NOA) in various industrial mining areas of the Italian Alps[16], it was found that indeed the residents and commercial professional in the Alps region knew that NOA was prevalent in the soils and hence forced the mining firms to make provisions on how to prevent the hazardous nature of the NOA materials. Again, the findings established that due to the natural occurrence of NOA, citizens found it difficult in legislative adoption of the global set goals of eliminating the use of NOA, not just in Italy but also in the neighbouring countries including France and Austria.

In terms of perception, studies [17] established that a high percentage of the St. Kitts and Nevis islands residents were aware of the dangers of using the banned asbestos. The residents perceived the asbestos materials to be dangerous but a better roofing material since it did not catch fire easily. Additionally, the study [17] found out that the older islanders were more aware of the risks posed by asbestos as opposed to youthful people under 30 years of age. The study used new evaluation tools for asbestos excavation [18]

Scholars who have established similar results in policy and education results in the coastal state of Ogun in Nigeria[19] confirmed that there was very poor policy implementation by the central government in eliminating the use of ACMs. More specifically, the study[19] found that although the Ogun state was spending large sums of money to train their health staff on matters related to asbestos dangers, very little was being done to effect some of the recommendations on asbestos and ACMs. Local studies in Kenya[20] contextualized in Machakos county, as well as Nairobi capital city[21], Kenya have also established that policy implementation in the usage of asbestos

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and ACMs was almost at zero implementation level. The study showed that knowledge and policy significantly influenced awareness on asbestos safety and health risks. However, both perception and training/education had poor influence. The implication for future studies is that knowledge has been added which can contribute to more awareness of asbestos safety and health risks. Specifically, there is proven establishment that public universities in Kenya have low awareness levels on the safety and health risks associated with asbestos and ACMs.

5. RECOMMENDATIONS

From the study, it was recommended that public universities should train and sensitize all the university maintenance workers to take precaution during renovation or demolition of old buildings containing asbestos or when handling any item containing asbestos especially debris sweeping. Additionally, the public universities should raise their implementation of policies in safety and health risks awareness while also allocating more funds for training of all maintenance workers on asbestos safety and health risks.

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