Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6, 9062-9072
2024
Publisher: Learning Gate
DOI: 10.55214/25768484.v8i6.3934

Compliance with personal protective equipment use among clay works employees

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Abstract: This study examined how personal factors: knowledge and attitudes; and company factors: commitment, availability of personal protective equipment (PPE), adequacy of equipment, and work arrangements are compliant with the use of PPE among Clay Works factory employees. Failure of compliance results in occupation health problems. Hence, a need to examine both personal and institutional factors in this factory. The study employed descriptive and analytical cross-sectional research designs with qualitative and quantitative data collection approaches. Data was collected from a purposively selected 133 employees and 5 management staff of Unique Clay Works Limited. Quantitative data was collected using a questionnaire, which was distributed to all 133 respondents. Qualitative data were collected using face-to-face interviews. Quantitative data was analysed using descriptive statistics and qualitative data was analysed using coding. The results show that the level of compliance with the use of PPE was low (30.1%). The regression-adjusted Odd Ratio shows that females are 4.95% more likely to comply than males. At the same time, commitment by management accounted for 17.56% ($p < 0.05$). It is recommended that employers need to consider gender as an important factor regarding PPE compliance in the company and that companies uphold PPE compliance and also assess productivity as a consequence of compliance.

Keywords: *Compliance, Occupational health and safety, Personal protective equipment, Workplace.*

1. Introduction

Compliance is crucial in the workplace to prevent accidents for all workers. Globally, 2.3 million people die due to workplace-related accidents [1], and 160 million people die due to work-related illnesses each year. Also, there are 340 million occupational accidents related to unsafe non-compliance with safety regulations, including personal protective equipment (PPE). Construction workers sometimes do not comply with company PPE due to job stress [2].

In 2021, 1.7 million people in Africa were suffering from a work-related illness, where 822,000 exhibited job stress, 470,000 had musculoskeletal disorder, 93,000 suffering from COVID-19, and 2,544 suffered mesothelioma deaths due to past asbestos exposures[2]. ILO annual report on Africa[1] further shows that statistical data on occupational accidents, diseases and work-related deaths include the following: diseases related to work cause the most deaths among workers; hazardous substances alone are estimated to cause 651,279 deaths a year; the construction industry has a disproportionately high rate of recorded accidents with the younger and older workers are particularly vulnerable [3, 4, 5, 6], and this has far-reaching implications for Uganda.

In 2021 in Uganda, 470,000 workers had occupational related health challenges and 123 workers died at work (2021/22), 441,000 working people sustained an injury at work, according to the Uganda Bureau of Statistics [7] Labor Force Survey and there were over 51,000 injuries to employees [8, 9]. Hence, a need to examine the construction materials production company in Uganda, Unique Clay Works Limited (UCWL).

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In 2022, UWCL reported an increase (from 18% to 44% between 2018 and 2021) percentage of incidents leading to loss of lives, injuries, damage to property and equipment, reduced productivity, and loss of revenue, amongst other challenges. In 2021, despite the company introducing advanced user-friendly PPE, it still recorded more injuries and low compliance. It raises the question of whether there are personal and institutional factors which need to be examined in this case, as has been recorded by previous researchers [10, 11]. This low compliance use of PPEs has made the company lose over US Dollars 5000 in medical expenses and over US Dollars 27,000 in compensation between 2018 and 2021 [12]. It is against this background that the researcher sought to establish factors associated with compliance with the use of PPE among employees at UCWL, Busiika Town Council, Uganda.

UCWL produces construction materials and offers construction services and products where compliance with the use of PPE is doubtful due to records of injuries despite the company's interventions in providing user-friendly equipment. Compliance with the use of PPE promotes employee health and safety, and the reverse low compliance badly affects the same, resulting in risks and injuries [12, 13, 14]. Reports have indicated that at UCWL, injuries arising from the non-use of PPE have increased from 23% in 2018 to 46% in 2021 [12].

The general objective of this study was to assess and establish factors associated with compliance with the use of PPE among UCWL employees. The specific objectives were to: 1) examine the level of compliance to the use of PPE demonstrated by employees in this factory; 2) establish the personal and institutional factors related to employee compliance with the use of PPE; and 3) determine the association between the factors (personal and institutional) and compliance with the use of PPE.

This study was based on two theories. First is the side-bet theory [15], which shows that the more side-bet one has, the more commitment. This commitment applies to individual workplaces regarding safety and health practices. The theory stipulates that employers' legal duty is to provide suitable PPEs at work and safety regulations in the company [16]. Second, the Ajzeni and Fishbein theory of reasoned action conceptualizes the functional operation of the attitudinal and normative components in intention formation as separate but contingent [17, 18, 19]. It is because the person's behaviour is determined by the intention to act towards attitudes in complying with the use of PPE.

In line with the above theories, this study focused on assessing and identifying factors associated with employee compliance with the use of PPE at this factory. The independent variables were the personal and institutional factors (which included Education level, Age, Gender, Personal Attitude, Knowledge and Commitment by management, Adequacy of equipment, Availability and use of PPE plus regulations and work arrangements. The dependent variable was compliance with the use of PPE, for example, wearing a helmet, gloves, gumboot, eyeglasses, and overalls.

Different researchers have reported on various individual and institutional factors under different working and professional conditions, especially about the use of PPEs [6, 14, 20, 21, 22] and argue that there is a relationship between individual factors and work safety behaviour among employees. Furthermore, they have reported that where there is 90% use of PPE in different areas generally results in 95% positive compliance to occupation health and safety measures. In addition, in terms of gender and use of PPE, researchers such as Armah *et al.* [23] reported that there is a significant association between gender and work safety behaviour among employees. In terms of age and use of PPE, researchers [3, 24, 25] related the age of the worker and work safety behaviour, arguing that younger workers are more active in avoiding accidents. In contrast, old workers are more experienced in avoiding accidents but prone to physical health challenges. In relationship to levels of knowledge and use of PPE, several authors [26, 27, 28, 29] highlighted the need for management to improve its reputation as a role model in terms of safety by raising employees' appreciation of compliance.

Regarding institutional factors and the use of PPE, some authors state that lack of equipment, low supervision and management support affect the compliance of employees to work safety measures [30, 31]. These researchers also report that the primary causes of risky behaviour include pressure to achieve deadlines and expectations.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 9062-9072, 2024
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2. Methods

The study employed descriptive and analytical cross-sectional research designs with qualitative and quantitative data collection approaches. Qualitative data collection was used to explain and clarify the quantitative data collected and analysed.

This study was conducted at Unique Clays Works Limited, a local company located in Busiika Town Council, Luweero District, in Central Uganda.

A survey questionnaire and an interview schedule were used to collect data in quantitative and qualitative mode respectively. The questionnaire consisted of 3 Sections (A, B and C) with a total of 30 questions. One expert validated the questions, while a pilot study with 20 people was used, and these were not part of the study. A Cronbach Alpha of 0.77 was established, suggesting the instrument was relevant to the study. 3 experts checked the researcher-designed questions for validity.

The study targeted all 174 employees with more than 5 years of experience and excluded newly employed workers because they had little experience with the company's work safety behaviour [12].

The sample size used in the quantitative approach was determined using the Taro Yamane formula [32], which is 133 (including the 10% error figure). This figure of 133 was then duly distributed according to the different departments, as indicated in Table 1 below.

Table 1:
Target population and sample size.

Department	Target population	Sample size
Production	89	68
Accounts	13	10
Sales, marketing & promotion	17	13
Health and safety	21	16
Mechanical	15	11
Electrical	19	15
Total	174	133

The qualitative sample of management staff: (5 Males and 2 Females) general manager (M), the field supervisor (M), the production manager (M), the human resources manager (F) and heads of departments (2 M & 1 F) were purposively selected because they were familiar with PPEs in the company based on the positions they held. The participants were coded as KI 1, where KI represents Key Informant, and 1 means the first key informant to be interviewed and so on.

Quantitative data were collected using a questionnaire, which was distributed to all 133 respondents. The researcher distributed the questionnaires and collected them from all the respondents, having a 100% response rate. Qualitative data were collected using face-to-face interviews. Each interview lasted for approximately 30 minutes, and the proceedings were audio-recorded. Four questions and a few follow-up questions were used to address objective 1, which dealt with participants' personal factors regarding compliance with the use of PPE.

Five questions and a few follow-up questions were used to address objective 2, which dealt with participants' institutional factors regarding compliance with the use of PPE The individual authorisation was obtained from each participant who agreed voluntarily to respond to the questionnaire, permission from the institutional Research Ethics Committee (REC) was obtained (Registration number: MHREC 2336).

Quantitative data were analysed using descriptive statistics: frequencies and percentages, means and standard deviations, addressing objective 1 and a Pearson's chi-square and the regression Adjusted Odd Ratio to determine the level of compliance regarding PPE use among males and females when other factors are kept constant were used for objective 3. Factors with a P-value less than 0.05 were used, and those less than 0.01 were subjected to multivariate analysis. Factors such as sex, age and level of highest education were also subjected to multivariate analysis since they are known confounders. Data collected from the qualitative approach to address objective 2 were analysed using coding [33]. The research

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used open coding through reading line by line to get the gist of the data and created many codes. It was followed by axial coding, where comparisons of similar codes were grouped to form sub-themes [34, 35]. Finally, during selective coding, sub-themes in relation to the research objectives formed the major themes [36].

3. Results

The results show that most workers are young males with inadequate knowledge about PPE and exhibit poor attitudes regarding the use of PPE. Company management had low commitment, which showed low compliance with the use and availability of PPEs in the company. Chi-square results showed that sex, level of the highest education, and attitudes were associated with compliance with the use of PPE, whereas knowledge was not. In addition, the Adjusted Odd Ratio (AOR) showed that females are 5 times more compliant with PPE usage compared to males. Two themes emerged from qualitative interviews: personal and company factors.

Most workers are young males who have inadequate knowledge about PPE and exhibit poor attitudes regarding its use. The personal factors that were considered included sex, age, level of education, knowledge, and attitude (Table 2).

Table 2:
Personal factors of employee.

Personal factors	Status	Frequency (N = 133)	Percentage (%)
Sex	Male	115	86.5
	Female	18	13.5
Age in years	>30	59	44.4
	<30	74	55.6
Level of education	Non-educated	48	36.1
	Educated	85	63.9
Knowledge	Adequate	46	34.6
	Inadequate	87	65.4
Personal attitude	Poor	82	61.7
	Good	51	38.3

The results in Table 2 above indicate that most (86.5%) are males, and they are youth (below 30 years) (55.6%). It further reveals that though most (63.9%) are educated, many (65.4%) have inadequate knowledge about PPE and have equally poor (61.7%) personal attitudes to PPE.

The results show that inadequate knowledge creates a poor personal attitude toward the use of PPE. The implication is that basic level education is needed for all workers to achieve a better attitude towards compliance with the use of PPE.

Other researchers [26, 27, 28, 29] have also reported the importance of education in improving staff attitudes to compliance with the use of PPE. They have also reported that continuous training of the relevant employees is important.

Education and continuous training at the workplace are crucial in improving compliance with the use of PPEs.

Company management with low commitment showed low compliance with the use and availability of PPEs in their companies. (Table 3)

The results on company factors associated with compliance with the use of PPEs included management commitment, adequacy of equipment, availability of PPEs, regulations, and work arrangements (shifts/full time) (Table 3 below).

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Table 3.
The results of company factors associated with the compliance with the use of PPE.

Company factors	Response	Frequency (N = 133)	Percentage (%)
Commitment by management	Good	38	28.6
	Poor	95	71.4
Adequacy of equipment	Adequate	56	42.1
	Inadequate	77	57.9
Availability of use of PPE and regulations	Available	81	60.9
	Unavailable	52	39.1
Work arrangements (shifts/full time)	Full Time	94	70.7
	Shift	39	29.3

The results in Table 3 show that there is very low (71.4%) commitment by management towards compliance with the use of PPE. The implication of the above results, according to other researchers [30, 31], is more likely to be an increasing number of injuries and fatalities. They conclude that low management commitment to maintaining workplace safety results in general low compliance among the employees.

The results show that there is inadequate PPE equipment (57.9%), which indicates that some workers who need them cannot access them. Once the relevant PPE equipment is not available, then there will be potential for low compliance with its use even if it becomes available later. The above results agree with many earlier researchers [6, 14, 22, 30]. Companies can only effectively enforce the use of PPE when the PPEs are available in a user-friendly form. This study reinforces the importance of having enough user-friendly PPEs to enable compliance with their use.

Chi-square results show that sex, highest level of education, and attitudes are associated with compliance with the use of PPE, whereas knowledge is not (Table 4). The third and last objective of this study was to establish the personal and company factors associated with compliance with the use of PPE at this facility. This was achieved using Pearson's chi-square test (Tables 4 and 5 below).

Table 4.
The association of related factors with compliance to the use of PPE.

		PPE Compliance				
Demographic (personal) factors		**High compliance N (%)**	**Low compliance N (%)**	**χ^2**	**Df**	**P-value**
Sex	Male	31(27.0)	84(73.0)	3.930a	1	0.047**
	Female	9(50.0)	9(50.0)			
Age	<30	11(18.6)	48(81.4)	16.60	1	0.010**
	>30	29(39.2)	45(60.8)			
Education level	Non-educated	23(47.9)	25(52.1)	10.29	1	0.001**
	Educated	17(20.0)	68(80.0)			
Knowledge	Adequate	23(26.4)	29(63.0)	1.583a	1	0.208
	Inadequate	23(26.4)	64(73.6)			
Attitude	Poor	12(14.6)	70(85.4)	24.244a	1	.000**
	Good	28(54.9)	23(45.1)			

Note: **Significant level at 0.05.

The study results above (Table 4) show the personal factors analysis as follows: sex ($\chi2 = 3.930$, df = 1, $p = 0.047 < 0.05$), Age ($\chi2 = 16.6$, df = 1, $p = 0.010 < 0.05$), level of the highest education ($\chi2 = 10.29$, df = 1, p = $0.001 < 0.05$) and attitude ($\chi2 = 24.244$, df = 1, $p = 0.001 < 0.05$), are statistically significantly associated to the compliance with the use of PPE. However, knowledge ($\chi2 = 1.583$, df = 1, $p = 0.208 > 0.05$) is not statistically significantly associated with compliance with the use of PPE.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 9062-9072, 2024
DOI: 10.55214/25768484.v8i6.3934

Sex, highest level of education, and attitude are the only personal factors statistically significantly associated with compliance, suggesting that when undertaking recruitment and training, these need to be clearly emphasized.

However, most research has only indicated that higher education and attitude are the most important personal factors in compliance with the use of PPE. This may be related to the challenges associated with gender equity.

The association between the company factors and compliance was tested using Chi-square (Table 5).

Table 5.
The association between the company factors and compliance with the use of PPE.

		PPE Compliance.				
Company factors		**High compliance N (%)**	**Low compliance N (%)**	**χ^2**	**Df**	**P-value**
Commitment by management	Poor	12(12.6)	83(87.4)	48.109a	1	0.000**
	Good	28(73.7)	10(26.3)			
Adequacy of equipment	Inadequate	27(35.1)	50(64.9)	2.165a	1	0.141
	Adequate	13(23.2)	43(76.8)			
Availability of use of PPE and regulations	Unavailable	15(28.8)	37(71.2)	0.061a	1	0.804
	Available	25(30.9)	56(69.1)			
Work arrangements (shifts/full time)	Shifts	10(25.6)	29(74.4)	0.516a	1	0.473
	Full time	30(31.9)	64(68.1)			

Note: **Significant level at 0.05.

Table 5 clearly shows that in this facility, only the availability of PPE and regulations ($\chi2 = 1.27$, df = 1, $p = 0.260 > 0.05$) is not statistically significantly associated with compliance in the use of PPE at the bivariate analysis level. However, the rest of the company factors: commitment by management ($\chi2 = 24.42$, df = 1, $p = 0.001 < 0.05$), adequacy of equipment ($\chi2 = 42.29$, df = 1, $p = 0.001 < 0.05$) and work arrangements ($\chi2 = 6.32$, df = 1, $p = 0.012 < 0.05$) are statistically significantly associated to the compliance in the use of PPE.

Management's commitment, the adequacy of the equipment, and work arrangements are significant company factors that encourage workers to comply with PPE. These three factors could be because females are fearful of the negative consequences of not complying.

Some researchers [30, 31] have clearly indicated the challenges that arise when commitment by the company is absent, for example, increasing accidents and injuries hence costs of treatment and care which directly affect production and income of the company.

The significant factors identified above, both personal and company, were subjected to the multivariate analysis with the cell counts equal to or above 5 to maintain the asymptotic assumptions for the analysis. Furthermore, crude odd ratios (COR) and adjusted odd ratios (AOR) were considered too and analyzed at a 95% confidence level (Table 6).

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 9062-9072, 2024
DOI: 10.55214/25768484.v8i6.3934

Table 6.
Multivariate results for the association between related factors and compliance with the use of PPE.

Variables		PPE compliance					
		High N (%)	Low N (%)	COR (95%CI)	P-value	AOR (95%CI)	P-value
Sex							
	Male	31(27.0)	84(73.0)				
	Female	9(50.0)	9(50.0)	2.71(.99-7.45)	0.053	95(1.29-18.90)	0.019**
Age							
	<30	11(18.6)	48(81.4)				
	>30	29(39.2)	45(60.8)	2.81(1.26-6.29)	0.012**	2.31(.83-6.40)	0.107
Education							
	Educated	17(20.0)	68(80.0)				
	Non-educated	23(47.9)	25(52.1)	0.27(.13-.59)	0.001**	1.25(.38-4.06)	0.714
Attitude							
	Poor	12(14.6)	70(85.4)			1.82(.59-5.59)	0.295
	Good	28(54.9)	23(45.1)	7.10(3.12-16.19)	0.000**		
Commitment							
	No	12(12.6)	83(87.4)				
	Yes	28(73.7)	10(26.3)	19.37(7.55-49.69)	0.000**	17.56(4.64-66.42)	0.000**

Table 6 above shows that while sex is not significantly associated with PPE compliance at COR (COR = 2.71, 95%CI = 0.99-7.45, $p = 0.053 > 0.05$), at AOR it was statistically significant (AOR = 4.95, 95%CI = 1.29-18.90, $p = 0.019 < 0.05$). It showed that female employees are 4.95 times more likely to comply with PPE usage compared to male employees. The results in Table 6 above further show that commitment by management was significantly associated with compliance with the use of PPE at COR and AOR (COR = 19.37, 95%CI = 7.55-49.69, p = 0.001<0.05), (AOR = 17.56, 95% = 4.64-66.42, p = 0.001<0.05). The employees who reported good management commitment are 17.56 times more likely to demonstrate compliance compared to others.

The fact that females are more likely to comply with using PPE than men (Table 6) suggests that management should employ women more than men. Therefore, it means compliance with company regulations is a good gesture to employers.

These observations resonate with several researchers [37, 38] who reported that females are more likely to comply with the use of PPE because they are more concerned about the disciplinary actions management may take. Management's commitment is very important, especially for employees.

The differences in compliance regarding the use of PPE, where females are more compliant than males, are crucial in the development of the safety training program for staff in this industry.

Qualitative results on the two themes—personal and company factors—were documented. The respondents reported low use of PPEs (60.9%) and low compliance (69.9%) among personal factors. The higher percentage (70.7%) of full-time employees in the company enables the workers to work in shifts, which is crucial in ensuring compliance with the use of PPEs.

4. Discussion

On a personal level, the results show that only 60.9% used the PPEs, which is very low. One key informant explained this as follows:

"*There are sometimes trainings on how to use PPEs though the posted rules are very old and not clear (KI 1; Male, 2022).*

This low level of compliance with PPE use is directly related to low education, attitude towards compliance, and the absence of training for the employees.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 9062-9072, 2024
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Several researchers [6, 14, 22, 30] have clearly indicated the significant role of education and regular training of employees in the use of and importance of PPE for their own lives and the good of the company.

This comment suggests that leadership expectations differ significantly with the subjects they lead. These subjects may neglect company rules, suggesting the need for constant reminders and further training. These observations resonate with other researchers,[21, 22, 24] who reported that the primary causes of risky behaviour in this industry are pressure to achieve deadlines and expectations. The need for constant training to enhance compliance is not surprising since some authors [14, 39] show that low compliance with proper work procedures is due to negligence, disobeying the rules, and, at worst, taking risks due to the unavailability of and poor compliance with the use of PPE regulations. Also, according to the theory of reasoned action,[17] some subjects saw a need to comply, while others reasoned it differently and did not comply. It is here that the leadership, in line with Becker's Side-Bet theory [15], strive to enhance safety in the company regarding PPEs. These authors suggest that challenges can be reduced and enhance positive attitudes among workers through teaching and guidance from the concerned company.

This study implies that it is important to consider subjects' feelings to improve compliance. The workers were negligent and failed to comply because management pushed the regulations onto the subjects without any consensus. So, the subjects did not follow the company's regulations. This study suggests a down-up approach [40, 41, 42] to enhance subject ownership that can lead to compliance with the company's PPE regulations.

Another personal factor result was that many employees (69.9%) at this facility reported low compliance. It was explained by two key informants who said that (KII 2 and KII 5):

"It is faster and convenient working without some types of PPEs, since putting on a helmet plus bricks or roof tiles, becomes heavier than carrying them alone but with gloves" (KI 2, female 2022).

"When I put on gumboots in the sunshine, they end up burning my feet, so that is why I do not always put them on" (KI 6, male 2022).

The key informants indicated that the low compliance rate with PPE use is due to a lack of information. However, relevant equipment, such as carrying/transferring bricks and stockings while using gumboots, is also absent. If these were made available, there would be a higher percentage of compliance with PPE use. Hence, there is a need for more education and the provision of relevant and complete safety kits.

The literature from various sources [30, 31] clearly indicates that the absence of relevant complete PPEs is a major hindrance to compliance, and indeed, this is what is happening at this facility. It is in line with Becker's Side-Bet theory, which states the importance of higher compliance use of PPE through complete provisions of PPE by the company. The internal report from UCWL[12] confirms this through data of increasing cases of injuries from 18% to 44% between 2018 and 2021, which included loss of lives, damage to property and equipment, reduced productivity, and loss of revenue.

The work arrangements at this factory show that 70.7% are full-time employees. The working conditions are friendly because the workers are given paid time off to rest.

Having many full-time staff is good in terms of offering them training and for ease of monitoring since they are there for a longer time. It also offers management an opportunity to effectively manage shifts, identify those who are not adhering to the use of PPE, and hence find ways and means of rectifying the situation.

The full-time staff are easily placed in shifts, which contributes to reduced work stress. This agrees with many other researchers [6, 24, 43] who have reported that having shifts reduces this work stress, yet it is one of the primary causes of dangerous behaviour, which typically leads to worker injuries. They have also noted that the primary cause of unsafe behaviour in the production companies was workers' low compliance with safety precautions.

The results show that gender is significantly related to compliance, that women are more inclined to comply with the use of PPE than males, and that there are various reasons for this. For example, KI 3 and KI 4 stated:

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ISSN: 2576-8484
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"I always put on PPE because the work we do here, you never know where accidents will come from" (KI 3, male 2022).

"Getting injured at work depends on how careful you are, not necessarily PPE overall" (KI 4, male 2022).

The information given by the key informants is true especially for those who are aware of the accidents that may occur and the different effects they may cause physically and emotionally. It is very important because it could be a good and effective issue while conducting education and awareness about complying with the use of PPE.

The above results and interpretation are supported by an earlier study [23], which reported that a gender-sensitive approach recognizes that because men and women have different societal roles, including different expectations and responsibilities, they may react differently to different physical and psychological risks at the workplace.

This study, therefore, argues that compliance with the use of PPE is influenced by sex. The implication here is that gender sensitivity must be considered when developing strategies for education and awareness.

The second company factor was commitment, and most of the respondents (71.4%) reported poor management commitment to compliance regarding the use of PPE. However, some key informants had issues to raise in relationship to commitment by management (KI 5 and KI 6):

"The company does not always train, but we try, and we are soon improving" (KI 6, male 2022).

"When you get injured at work, the company rarely compensates for the medical bills because severe cases are rare" (KI 5, female 2022).

It is crucial that management is not committed to enforcing compliance with the use of PPE. This means new employees may not be adequately reoriented to using PPEs, resulting in a low level of compliance.

The above results agree with earlier researchers [30, 31], who further confirmed that a lack of commitment by management is more likely to increase the number of injuries and fatalities. They conclude that low management commitment to workplace safety inevitably results in low compliance among employees. Commitment influences all the other management-related actions that are significant in ensuring compliance with the use of PPE by workers.

In conclusion, this study shows that gender, availability of equipment, education and awareness, and management commitment are the most crucial factors in ensuring compliance with the use of PPE. Therefore, these should be the factors to address in education and awareness to ensure that all staff adhere to them and hence improve compliance with the use of PPE. A high level of compliance will inevitably result in reduced injuries and lead to improved production and income by the facility. The key areas not addressed in this study include how to effectively conduct education and awareness to both new and continuing staff and how to keep the levels of compliance high in changing times and conditions of service.

Acknowledgements:

The authors wish to thank the support given by Bugema University School of Graduate Studies for the time and resources to research and write this paper. Also appreciated is the top management of Bugema University for supporting and encouraging publications.

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Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 6: 9062-9072, 2024
DOI: 10.55214/25768484.v8i6.3934