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FIRE SAFETY AWARENESS AND MANAGEMENT IN MULTI-STOREY STUDENTS' HOSTELS

AGYEKUM, K.[1], AYARKWA, J.[2] and AMOAH, P.[3]

[1,2,3] *Department of Building Technology, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*

Achieving an acceptable level of fire safety in university students' hostels is of utmost importance. Fire resulting from students' hostels can cause devastating effects if appropriate fire safety management measures are not put in place. This study presents the results of a questionnaire survey which sought to assess the perceptions of students on fire safety awareness and management in multi-storey hostels around the Kwame Nkrumah University of Science and Technology (KNUST) campus. Data obtained from the study was analyzed by mean score rankings and percentages. The findings of the study, showed that majority of the respondents do not attach seriousness to the issue of fire safety in the various hostels surveyed, as such, fire safety awareness and management is low amongst most of the hostel occupants. The results further showed that 'storage of flammable materials in safe areas', 'provision of clear signage indicating exit routes and location of fire safety equipment', regular inspection and maintenance of electrical installations', 'regular inspection and maintenance of fire safety equipment', and 'accessibility to fire hydrants' are key practices which if implemented by management could control the outbreak of fire in the hostels. Although this study focuses on multi-storey students' hostels around KNUST campus, the findings should be relevant to other hostels located within and around the campuses of other universities in Ghana.

Keywords: Fire safety management, Ghana, KNUST, Occupants, students' hostels

1 INTRODUCTION

It is widely accepted that fire is one of the greatest threats not only to building occupants, but also to building fabrics and contents (Salleh and Ahmad, 2009). The occurrence of fire disasters is not a new phenomenon in Ghanaian history. In 1983, the fires that engulfed Ghana has been a main point of reference in the record of the country and the severe hunger that came with those fires left an indelible mark in the minds of many people. A statement issued by the Ghana National Fire Service on Tuesday, 13th January, 2015 indicated that between January 1 and January 7 of that year, 160 fire outbreaks had been recorded (Amoh, 2015). Higher institutions such as universities and colleges have not been left off the hook as far as fire outbreaks are concerned. For instance, halls of residences and hostels situated around Kwame Nkrumah University of Science and Technology (KNUST), where a large proportion of students reside have substantially experienced the fury of these fires recently. The top floor of Crystal Rose, a hostel situated at Kentinkrono, a surrounding of KNUST was gutted by fire. Even though there were no casualties, many items such as television sets, fridges, gas stoves

and cylinders belonging to the students were destroyed, and it took fire personnel more than two-and-half hours to bring the fire under control. In a similar development, students residing at Sir Max, which is also a hostel situated at Kentinkrono were left stranded after fire gutted and destroyed the hostel. Students' laptops, books, electrical appliances, clothes amongst a raft of personal items were totally decimated in the fire. These upheavals give a clear indication of the severity of the impact of fire outbreaks in students' hostels and how necessary it has become to embrace full fire safety management to combat this prevalent problem.

This issue calls to mind the role hostel management and occupants can play in order to ensure complete safety of lives and properties. It is in the light of these problems that this study was undertaken to assess the perceptions of students on fire safety awareness and management in multi-storey students' hostels around the Kwame Nkrumah University of Science and Technology campus. To achieve this aim, the researchers sought to assess the level of fire safety awareness among occupants living in multi-storey hostels, identify the firefighting equipment available in the hostels under study, and to identify fire safety management practices which needs to be put in place by management to control the outbreak of fire in the hostels. Although this study focuses on multi-storey students' hostels around KNUST campus, the findings should be relevant to other hostels located within and around the campuses of other universities in Ghana.

2 LITERATURE REVIEW

2.1 Fire Safety Management

Fire normally takes place without any warning. When this happens, building occupants are restricted in the amount of time they have to either extinguish the fire or to escape (Salleh and Ahmad, 2009). According to Spadaccini (1998), when fire is not effectively controlled people may suffer injuries and at times death. There is also destruction of properties, temporary or permanent closure of buildings, among other things. As a result of this, it is always advisable that proper fire safety management measures are put in place to control the situation.

Fire safety management has been studied by many researchers across the globe (Chen et al., 2012; John, 2012; Kong, 2011; Salleh and Ahmad, 2009; Prashant, 2007; Chow, 2002; Santos-Reyes and Beared, 2001; Lui and Chow, 2000; Howarth and Kara-Zaitri, 1999). This is because the fire safety community has recognized the importance of good fire management to reduce the vast increase in accidental fires (Woon and Suleiman, 2015). The provision of appropriate fire safety measures within buildings has until recent years generally been considered as a legislative issue determined by prescriptive standards for construction and compartmentation (Smith, n.d.). Managing fire safety has to be a continuum covering the whole life of a building starting with the initial design and covering all aspects of its occupation, maintenance, modification and decommissioning and demolition (Smith, n.d.). According to Chow (2001), "the main objectives of fire safety management include: to ensure that the fire safety measures provided are kept in good order; to initiate actions in case of fire which would help

occupants to reach a safe place; and to review adequacy of existing fire safety measures where there is a change of building, a change of building use and new technology on fire services installation".

According to Nadzim and Taib (2004), fire safety management is the combination of or co-ordination of some activities or programs towards the prevention of damage from fire. Such programs include fire drill training, staff training, fire prevention measures, escape routes, etc. Fire safety management can also be defined as "the application by a manager of policy, standards, tools, information and practices to the task of analyzing, evaluating and controlling fire safety" (Howarth, 1999). Shipp (1994) had described it as an "ongoing process throughout the life cycle of a building", a view supported by Todd (1992) who stated that "fire safety management cannot be clipped on from time to time" as appropriate management arrangements may be or are a legal requirement. According to Della-Giustina (1999), when an effective fire safety management is properly and carefully developed, the end results can include reduced property insurance premiums, prevention of business interruptions, boosting customer services and public images, among others. Ramachandran (1999) asserts that safety is the complement of antithesis of risk. Safety will be increased if the risk is reduced. The objective of fire safety/risk management is therefore to reduce risk to life and property to very low levels acceptable to a property owner and society at large. This aim can be achieved by carrying out fire prevention activities which would reduce the frequency of fires significantly and installing passive and active fire protection measures which would minimize the damage when the fire occurs. By effective maintenance, it is necessary to ensure that, when a fire occurs, all the safety measures provided will be available for use and will perform satisfactorily. It is also necessary to provide adequate fire insurance cover for direct and consequential losses (Ramachandran, 1999).

The fire prevention, protection and insurance measures mentioned above are to be undertaken before the occurrence of any fire in a building. When a fire occurs, appropriate actions planned well in advance should be initiated to provide all the help and assistance for occupants to reach places of safety inside or outside the building involved in the fire. These include fire drills and staff training in the use of first-aid fire-fighting methods such as fire extinguishers. Actions to be taken after a fire is extinguished include salvage operations, repairs to parts of the building damaged by the fire, and submission of claim for insurance compensation. These actions are to ensure that the activity interrupted by the fire is restarted as soon as possible (Ramachandran, 1999).

3 RESEARCH METHODOLOGY

The study was undertaken to assess the level of fire safety awareness among students living in multi-storey hostels, identify the firefighting equipment available in the hostels under study, and to identify fire safety management practices which need to be put in place by management to control the outbreak of fire in the hostels. Data for the study was collected through a questionnaire survey. Respondents comprised of continuing students living in 11 multi-storey hostels around Kwame Nkrumah University of Science and Technology campus. For the purposes of this study, multi-storey hostels were classified as those hostels that were three or more storeys high. There are quite a

number of multi-storey hostels around the school. However, only those that were registered with the school were considered. Hostels that fell within this category were only eleven, and continuing students who were in 2nd to 6th years of their studies were considered. At KNUST, students are obliged to move out of their halls of residences after their first years in school. Hence conducting a survey on the continuing students would give a clear perspective of the problem under investigation. In all, a total of 220 respondents were conveniently selected for the study. The questionnaire was made up of closed-ended questions. However, the respondents were provided with the options of providing further comments when the need arose. A small scale pilot survey was carried out on the questionnaire with 20 students living in some of the hostels. Some concerns were raised about some few issues, which were later modified and sent out.

The questionnaires distributed to the respondents sought information on the profiles of the respondents. Among the questions asked were their genders, age distribution, levels (years of study) in the university, period of stay in the hostels, and experiences with fire outbreaks. The questionnaire also sought information about the availability of firefighting equipment in the hostels and students' abilities to operate such equipment. Also, the students' level of fire safety awareness in the hostels were sought. Finally, the views of the respondents were sought on the fire safety management practices which need to be put in place by the management of the hostels to control the outbreak of fire.

A quantitative approach to data analysis was employed. Statistical Package for Social Scientists Version 17 (SPSS V 17) was used to analyze the data by means of mean score rankings and percentages. For this study, a factor was deemed significant if it had a mean value of 2.5 or more. Where two or more variables had the same mean, the one with the lowest deviation was assigned the highest significance ranking. Similarly, the significance level was set at 95% in accordance with orthodox risk levels (cf. Ahadzie, 2007). Field (2005) suggested that with a sample size of more than 50, the sampling distribution would most of the times approach normal distribution. Seemingly, this study's sample size (N = 220) is in accordance with that recommended by Field.

4 RESULTS AND DISCUSSION

4.1 Profile of respondents

A total of 220 target respondents were identified and survey questionnaires were administered to them. Effectively, only 177 responded to the questionnaire, achieving an 80% response rate. The high response rate is attributed to the fact that the questionnaires were administered to respondents and successive follow-ups were made thereafter. Table 1 presents the demography of the respondents. From Table 1, it can be seen that majority of the respondents representing 92% were males whiles a relatively small proportion representing 8% were females. Generally, the percentage of males at KNUST outweighs that of females. It is not very surprising that this result was attained for the genders. With respect to the ages of the respondents, 53% fell within the age group of 21-25 years, whiles 38% fell below 20 years old. Only 9% were above 25 years old. Of late, most of the matured candidates prefer the distance learning education as compared to the regular ones. This could possibly be a reason why the respondents

who fell within the age category of above 25 years were few. The results also give an indication of a very youthful student population.
With reference to the levels of the respondents in the university, Table 1 shows that 59% of the respondents were 2nd years, 26% were 3rd years, 14% were 4th years whiles 1% were in their 5th to 6th years. With the period of stay of the students in the hostels, twenty of the respondents, representing 11% had stayed in the hostels for less than a year, 121 representing 68% had stayed between 1-2 years, 31 representing 18% had stayed for a period of 2-3 years, and 5, representing 3% had stayed for 3-4 years. This result obtained is very good. This is because about 89% of the respondents had stayed in their respective hostels for about 1-4 years. As a result, they knew the conditions in the hostels, and were in better positions to give more reliable data.

Table 1: Respondents' information

		Frequency	**Percent**
Gender	Male	162	92
	Female	15	8
	Total	177	100.0
Age distribution of respondents	Below 20 years	68	38
	21-25 years	94	53
	Above 25 years	15	9
	Total	177	100.0
Level in the university	2^{nd} year	104	59
	3^{rd} year	46	26
	4^{th} year	25	14
	5^{th} - 6^{th} years	2	1
	Total	177	100
Period of stay in the hostel	0-1 year	20	11
	1-2 years	121	68
	2-3 years	31	18
	3-4 years	5	3
	Total	177	100.0
Experience with fire outbreak	Yes	5	3
	No	172	97
	Total	177	100.0

With respondents' experiences with regards to fire outbreaks in their respective hostels, 3% had experienced outbreaks in one way or the other. However, 97% had not experienced any outbreaks at all.

4.2 Availability of Firefighting Equipment in the Hostels

Firefighting equipment are provided in buildings to provide means of controlling fires at the initial stages even before personnel from the fire departments are called unto the scene of the incident. Such equipment provide first-aid means to extinguish flames before the situation is aggravated. A list of commonly used first aid firefighting equipment were listed in the questionnaire for the respondents to indicate whether such equipment were available in their respective hostels or otherwise. An option was also provided for those who could not confirm the existence of these equipment.

Table 2 presents the views of the respondents on the various firefighting equipment present in the hostels. On the average, only 12% of the respondents within all the hostels could identify carbon dioxide extinguishers, dry chemical extinguishers, fire alarm systems, in that order as the major firefighting equipment available in their hostels. The results further show that the carbon dioxide firefighting equipment (68%) was the most common from the views of the 12% respondents. Table 2 further shows that 46% of the respondents from the hostels surveyed could not identify any of these firefighting equipment in their respective hostels. Also, on the average, 42% of the respondents did not know whether any of these firefighting equipment existed in their respective hostels or not. In summary, it can be seen from Table 2 that majority of the respondents were of the opinion that firefighting equipment were either unavailable or they could not confirm their existence in their respective hostels. An obvious explanation is the fact that most of the management of these hostels do not attach importance to issues regarding fire safety and as such have failed to provide these equipment. On the part of the students residing in such hostels, they had not bothered to find out if these equipment are available or not, an indication of the passive attitude of occupants towards their own fire safety. This scenario is very dangerous, as the unavailability of firefighting equipment, and the lack of knowledge of these equipment among some students in various hostels pose greater risks in case of any fire outbreaks.

Table 2: Availability of firefighting equipment

Fire Equipment	**Available**			**Unavailable**			**Do not know**			**Total**
	Freq.	**Percent.**	**Ave.**	**Freq.**	**Percent.**	**Aver.**	**Freq.**	**Percent.**	**Ave.**	
Dry chemical extinguishers	27	15%	12%	65	37%	46%	85	48%	42%	177
Carbon dioxide extinguishers	120	68%		12	7%		45	25%		177
Hose reels	-	-		98	55%		79	45%		177
Sprinklers	7	4%		97	55%		73	41%		177
Fire blankets	10	5%		86	49%		81	46%		177
Dry rises	1	1%		96	54%		80	45%		177
Fire detectors	4	2%		93	53%		80	45%		177
Smoke detectors	11	6%		87	49%		79	45%		177
Heat detectors	10	6%		87	49%		80	45%		177
Fire alarm system	22	12%		93	53%		62	35%		177

4.2.1 Ability to operate firefighting equipment

Table 3 shows that for the most common firefighting equipment that were present, the respondents could either operate them or not. The results further show that for the dry chemical extinguishers, 23% of the respondents could operate them, with 77% not able to do so. For the carbon dioxide extinguishers, 37% of the respondents could operate them, whereas 63% could not. The same scenario can be seen for the foam cylinders, hose reels and the fire blankets. Table 3 further shows that for all the common firefighting equipment, majority of the respondents (above 60%) could not operate them. This finding shows that in the case of fire outbreaks, the fire is likely to spread because the occupants could only make minimal efforts to extinguish it in the absence of the fire department. This is because respondents are not well equipped to operate first aid firefighting equipment even in a situation where they may have been installed. It is very important for hostel managements to organize fire training sessions for occupants in various hostels even after the various first aid firefighting equipment have been installed.

Table 3: Ability to operate firefighting equipment

Fire Equipment	Able to operate/use		Unable to operate/use		Total
	Number	Percent (%)	Number	Percent (%)	
Dry chemical extinguishers	41	23	136	77	177
Carbon dioxide extinguishers	66	37	111	63	177
Foam cylinders	27	15	150	85	177
Hose reels	18	10	159	90	177
Fire blankets	18	10	159	90	177

4.3 Level of fire safety awareness

Fire safety awareness helps to recognize the danger of fire, know what to do to prevent fire, as well as what action to take in case one happens. People with knowledge about fire safety will purchase fire devices and also prepare their families and employees to take immediate action to prevent death, injury and destruction of property whenever disaster strikes (Jones 2005). The awareness of respondents of fire safety are presented to include:

Occupants' perception of fire disaster preparedness: Respondents were asked how prepared they were in case of fire disasters. Table 4 shows the results obtained from the data. The findings show that all the respondents saw the need to prepare for fire disasters in case there is one.

Awareness of existence and location of emergency exits: The views of the respondents were also sought on the awareness of existence and location of emergency exits within their hostels. Only 60% of the respondents responded 'yes', indicating that they were aware of any such exits. The remaining 40% were not aware of any thing of such sort in

their hostels. The result is not encouraging. This is because fire exits or escape routes is supposed to be a necessity in every building, be it residential or commercial. Students not being aware of such exits could mean that the exits do not exist or the students had not been trained for the need and use of such exits.

Configuration of doors to escape routes: Respondents were further asked how the doors in their hostels were configured to enable them escape in terms of fire outbreaks. Table 4 shows that 31% of the respondents had the doors to their hostels opening inwards, 22% had their doors opening outwards, only 1% had it to be sliding, 5% had it to be revolving, with 42% not knowing how their doors were configured. From this finding, it is presumed that about 42% of hostel occupants are likely to be stranded at emergency exits even if they are able to make it to the escape doors.

Keys to the escape doors: It is always important if occupants to a building have extra keys to escape doors within the building. Escape doors in most cases are provided to enable occupants flee in case of fire outbreaks. The views of the respondents were sought on who kept the keys to the escape doors within the hostels. The results show that more than half of the respondents (52%) were not aware of the person who held the keys to escape doors. This 'I do not care' attitude on the parts of students is very serious. In the case of this finding, students are highly unlikely to be able to access escape doors in case of any fire emergency.

Number of fire training sessions organized by hostel management: The views of the students were further sought on the number of fire training sessions organized for them. The results show that about 88% of the respondents had not had any fire training sessions organized by hostel management for them at all. It can be deduced from the results that while fire safety training is instrumental in enhancing the fire safety awareness of occupants, hostel management have not been very responsible in organizing these sessions for the students residing in their hostels.

Table 4: Statistics on fire safety awareness

Fire safety awareness		**Frequency**	**Percent**
Occupants' perception of the fire disaster preparedness	Very important	154	87
	Important	22	12
	Fairly important	1	1
	Total	177	100.0
Awareness of existence and location of emergency exits	Yes	106	60
	No	71	40
	Total	177	100.0
Configuration of doors to escape routes	Inward	55	31
	Outward	38	22
	Sliding	2	1
	Revolving	8	5
	Do not know	74	42
	Total	177	100.0

Fire safety awareness		**Frequency**	**Percent**
Keys to the escape doors	Hostel manager	1	1
	Porter	62	35
	Security man	15	9
	Hostel president	7	4
	Do not know	92	52
	Total	177	100.0
Number of training sessions organized by hostel management	One	23	10
	Two	2	1
	Four	2	1
	None	150	88
	Total	177	100.0
Number of times you attended training sessions	Once	25	14
	Twice	8	5
	Thrice	2	1
	Never	142	80
	Total	177	100.0
Condition of existing firefighting equipment	Yes	53	30
	No	13	7
	Not sure	111	63
	Total	177	100.0
Frequency of inspection and maintenance of escape routes	Very often	2	1
	Often	1	1
	Rarely	16	9
	Less often	2	1
	Not often	4	2
	Do not know	152	86
	Total	177	100.0

Number of times you attended training sessions: respondents were further asked about the number of times they attended such training sessions. Table 4 again shows that majority (80%) of the respondents had not attended any fire training sessions at all. This could possibly be due to the fact that only few training sessions are organized among some hostels, with majority not organizing any at all. Since these trainings are not organized most of the times, students do not bother themselves to request hostel management to do so for them.

Condition of existing firefighting equipment: As part of the creation of awareness, respondents were asked to indicate the conditions of existing firefighting equipment available in their various hostels. The results show that only 30% of the respondents indicated that the firefighting equipment available in their hostels were of good condition. However, 63% were not sure whether the equipment in their hostels were in good condition or not. This could probably be due to the fact that such equipment were not available at all in the hostels, or were available but they could really not access their conditions because they were not experts in doing so. This notwithstanding, about 63% of hostel occupants who cannot confirm the current state of existing firefighting equipment, leaves much to be desired when it comes to proactive attitudes towards fire safety.

Frequency of inspection and maintenance of escape routes: With regards to the frequency of inspection and maintenance of fire escape routes within the hostels,

majority of the respondents (89%) indicated that they did not know whether such inspections and maintenance of escape routes were conducted in the hostels or not. Only a small minority, constituting 14% were able to give any definite responses regarding the frequency of inspection and maintenance of escape routes.

4.4 Fire safety management practices

When fire occurs, appropriate actions planned well in advance should be initiated to provide all the help and assistance for occupants to reach places of safety inside or outside the building involved in the fire. The views of the respondents were sought on the fire safety management practices which should be put in place by the management of the hostels to control fire in case of any outbreaks. The results are presented in Table 5.

Table 5: Fire safety management practices employed by most management

Fire safety management practices	Mean	Standard Deviation	Rank
Storage of flammable materials in a safe area	4.03	0.850	1
Provision of clear signage indicating exit routes and location of fire safety equipment	3.79	1.140	2
Regular inspection and maintenance of electrical installations	3.65	0.811	3
Regular inspection and maintenance of fire safety equipment	3.57	0.942	4
Accessibility to fire hydrants	3.51	1.120	5
Existence of emergency assembly point/shelter for this building	3.48	1.285	6
Availability of an emergency fire disaster kit	3.28	1.263	7
Emergency communication systems	3.22	1.256	8
Existence of emergency population warning methods	2.65	1.524	9
Regular fire and evacuation drills	2.54	1.411	10

Table 5 shows that the mean scores of all the fire safety management practices evaluated by the respondents are greater than the mean value of 2.5 (Field, 2005). This indicates that in the opinion of the respondents all the ten practices are considered as important in managing fire. The results further show that 'storage of flammable materials in a safe area', 'provision of clear signage indicating exit routes and location of fire safety equipment', regular inspection and maintenance of electrical installations', 'regular inspection and maintenance of fire safety equipment', and 'accessibility to fire hydrants' are the five key practices which if implemented by management could control the outbreak of fire. Other practices such as 'existence of emergency assembly point/shelter for the buildings', 'availability of an emergency fire disaster kit', 'emergency communication systems', 'existence of emergency population warning methods', and 'regular fire and evacuation drills' were also considered as significant practices.

These measures identified by the respondents have been presented in Figure 1, which is a brain storming diagram indicating the fire safety management measures which the respondents considered as significant in controlling the outbreak of fire in the hostels.

5 CONCLUSION

This study was undertaken to assess the perceptions of students on fire safety awareness and management in multi-storey hostels around the Kwame Nkrumah University of Science and Technology campus. To achieve the aim, the researchers sought to assess the level of fire safety awareness among students living in multi-storey hostels, identify

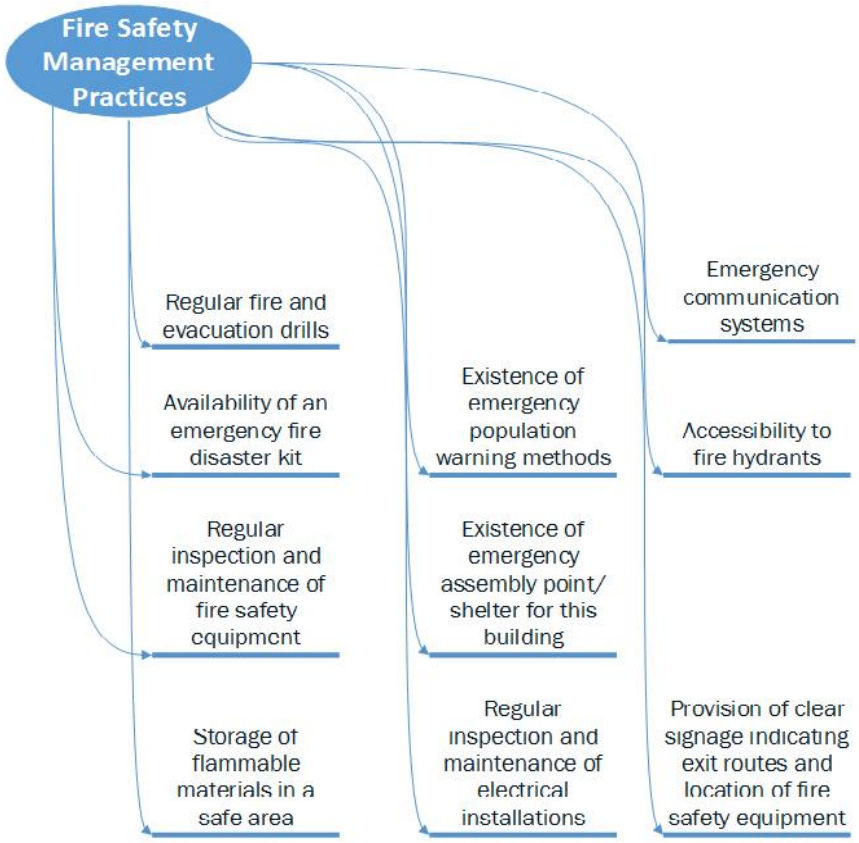

Fig 1. Fire safety management practices [brainstorming diagram]

the firefighting equipment available in the hostels under study, and to identify fire safety management practices which need to be put in place by management to control the outbreak of fire in the hostels. Based on the findings of the study, it is clear that majority of the respondents do not attach seriousness to the issue of fire safety. As a result of this, fire safety awareness is low amongst most of the hostel occupants. Similarly, fire disaster preparedness is obviously low and the likelihood of extreme danger to life and property in any fire incidence is high. Evidently, hostel management who are directly responsible for fire safety management have ineffectively executed their responsibilities to keep the students safe. The situation at hand in most of the

hostels is alarming and pragmatic steps should be taken to reduce to the barest minimum, the possibility of fire outbreaks. As a limitation of this study, the researchers appreciate the fact that the issue of generalizability is restricted by the geographical location. Due to the nearness in proximity of respondents, the survey was conducted on only one campus out of the several universities in Ghana. Future works on fire safety awareness and management can be expanded to other university campuses to know the situations on such campuses. Further research can also be carried out to investigate the factors that influence fire disaster preparedness amongst hostel occupants.

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