

# Challenges to Fire Safety Management in Multi-Storey Students' Hostels

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## **Abstract**

*Fire safety management plays an important role in enhancing the safety of buildings against fire outbreaks. The persistent increase in fire related issues amongst students' hostel accommodations calls to mind the role hostel management and occupants play in order to ensure complete safety of lives and properties. Controlling fire outbreaks is associated with a lot of challenges. This study presents the results of a questionnaire survey which sought to assess the perceptions of students on challenges to fire safety management in multi-storey students' hostels around the Kwame Nkrumah University of Science and Technology campus. The findings from the study revealed that, problems with electrical wiring and installations, inadequate water distribution systems, inadequacies in the fire departments, passive attitudes of owners/management towards housekeeping and maintenance, and passive attitudes towards personal fire protection are the five critical challenges to effective fire safety management in the hostels. The results further showed that, fire insurance policies, fire evacuation plans, and regular maintenance and housekeeping, are all measures which when put in place can mitigate the outbreak of fire. Identifying the challenges to effective fire safety management and implementing measures to control such challenges should assist in the control of fire outbreaks in students' hostels and other buildings.*

## **Keywords**

*challenges, fire safety management, KNUST, students' hostels, Ghana*

## **1. Introduction**

Student enrolment in higher institutions has been increasing in recent times. However, the corresponding expansion of residential facilities has not materialized and this has created the existence of two categories of students-residents and non-residents. Statistically, over 60 percent of students in most of the tertiary institutions in Ghana are non-residents (Attakora-Amaniampong et al., 2014). The increasing population of students at the Kwame Nkrumah University of Science and Technology (KNUST) campus has instigated the proliferation of several private hostels in neighboring communities. Ayeduase, Kotei, Bomso and Kentinkrono, all suburbs of Kumasi, provide hostels to an appreciable number of KNUST students. Currently, about 60% of the total student population are non-residents. Worthy of noting is Federal Emergency Management Agency's, FEMA (1999) postulation that in many university communities, off-campus student housing is not under the control of the institutions. This is also true for KNUST, Kumasi. These off-campus facilities are not as regulated as the campus housing facilities, which means that the risks (especially fire risks) to students living in them is probably greater.

The past few decades have witnessed tremendous increase in students' population at Kwame Nkrumah University of Science and Technology. Statistics indicate that the entire student population had

increased by over 29% from 24,188 students in 2008 to 31,189 students in 2012. This has put pressure on facilities on the campus including accommodation. In response to this, several private hostels have been built to absorb the increasing demand for accommodation. Currently, about 60% of the total students' populations reside in hostels built around the school campus. Increased population comes with its associated challenges, one of which is increased fire risk. Fire outbreaks at colleges and universities are tragedies that strike at the bright future of students. Parents send their wards to colleges, trusting that their physical safeties are addressed. However, recent fires in Unity hall of KNUST and hostels like Crystal Rose have shown that, we are slow to heed the lessons that time has given us about fire safety. Even when lives are not lost, valuable properties are lost. In line with tackling these challenges, a Fire Safety Unit has been built at the cost of 15,000 Dollars by KNUST in collaboration with the Ghana National Fire Service (GNFS). However, efforts to fully combat fire disasters cannot end with the sheer provision of a fire tender and some fire-fighters. Pragmatic steps need to be taken within hostels to ensure that the likelihood of any fires are reduced to the barest minimum. The persistent increase in fire related destructions calls to mind the role hostel management and occupants can play in order to ensure complete safety of lives and properties.

## 2. Fire Safety Management

For many years, fire has consistently caused loss of lives, injuries and devastation of properties worldwide (Rubaratuka, 2013). Fire is the rapid oxidation that occurs if a material in the exothermic chemical process of combustion results in the emission of heat, light and various reactive products (Pyne, 1982; Wahab, 2015). According to Supermedia (2011), fires start in three main ways; misuse of appliances, deliberate ignition and equipment failure. Muraliand Vijayalakshmi (2014) stated that fire is a process of burning. It is a chemical reaction initiated in the presence of heat energy in which a substance combines with oxygen in the air to release energy in the form of heat, light and sound (Murali & Vijayalakshmi, 2014). Fire starts in different ways and can serve as a potentially destructive force in peoples' lives (Supermedia, 2011; Wahab, 2015). 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 & 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 & Ahmad, 2009; Prashant, 2007; Chow, 2002; Santos-Reyes & Beared, 2001; Lui & Chow, 2000; Howarth & 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 & 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 (2002), "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".

Fire safety management also involves the combination of, or co-ordination of some activities or programs towards the prevention of damage from fire (Nadzim & Taib, 2014). Such programs include fire drill training, staff training, fire prevention measures, escape routes, etc. Fire safety management can further 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 (1998) 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).

In the last few years, there have been many fire outbreaks in Ghana. These outbreaks had involved business premises, markets, educational facilities, etc. Institutional fires have affected both senior high and tertiary institutional buildings. Though these incidences do occur most often, very little is done to bring the situation under control. However, where efforts are made to put the situation under control, many challenges are encountered. This study was therefore conducted to determine the perceptions of hostel occupants on challenges to effective fire safety management in students’ hostel accommodations.

### **3. Research Methodology**

The study was conducted to assess the perceptions of hostel occupants on challenges to effective fire safety management in students’ hostel accommodations. 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 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.

The questionnaire distributed to the respondents was divided into three main sections. Section 1 sought information on the profiles of the respondents. Among the questions asked were their genders, age distribution, levels in the university, period of stay in the hostels, and experiences with fire outbreaks.

Section 2 further sought information about the perceptions of the respondents on challenges to effective fire safety management in their various hostels. With this question, respondents were asked to score on the Likert scale of 1 to 5 (where 1 = not severe and 5 = very severe) the level of severity of 8 challenges to effective fire safety management in their hostels. These challenges were derived from the review of extensive literature. The final section sought the views of respondents on fire mitigation measures that need to be put in place by the managements of the hostels to control the outbreaks of fire should there be any. Respondents were again asked to score on the Likert scale of 1 to 5 (where 1 = not significant and 5 = highly significant) the significant measures which when put in place can control the problem.

A quantitative approach to data analysis was employed. Data from the survey was analyzed by mean score rankings, one sample t-test and percentages. The mean values were obtained by the formula:

$$\mu = \frac{\sum_{i=1}^n f_i i}{\sum_{i=1}^n f_i}$$

, where, "f" is the frequency of score "i" for the factor concerned. For this study, a factor was deemed significant if it had a mean value of 3.00 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 (Ahadzie, 2007).

#### 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, 177 questionnaires were completed and returned, and these represented an 80% rate of response. The high response rate is attributed to the fact that the questionnaires were personally 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 while a relatively small proportion representing 8% were females. Generally, the percentage of males on KNUST outweighs that of females.

**Table 1. Respondents' Information**

Gender	Frequency		Percentage	
Gender	Male	162	92	
	Female	15	8	
	<b>Total</b>	<b>177</b>	<b>100</b>	
Age distribution of respondents	Below 20 years	68	38	
	21-25 years	94	53	
	Above 25 years	15	9	
	<b>Total</b>	<b>177</b>	<b>100</b>	
Level in the university	2 <sup>nd</sup> year	104	59	
	3 <sup>rd</sup> year	46	26	
	4 <sup>th</sup> year	25	14	
	5 <sup>th</sup> -6 <sup>th</sup> years	2	1	
	<b>Total</b>	<b>177</b>	<b>100</b>	
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
	<b>Total</b>	<b>177</b>	<b>100</b>
Experience with fire outbreak	Yes	5	3
	No	172	97
	<b>Total</b>	<b>177</b>	<b>100</b>

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, while 38% fell below 20 years old. Only 9% were above 25 years old. This result is attributed to the fact that most of the matured candidates prefer the distance learning education as compared to the regular ones, a possible 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 while 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 a more reliable data.

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 Challenges to Effective Fire Safety Management in the Hostels

Under this objective, the views of respondents were sought on challenges to effective fire safety management in the various hostels. Table 2 presents the views of the respondents. The mean values as well as standard deviations of all 177 respondents were calculated for each challenge and have been presented in Table 2. The results show that the mean scores of all the challenges evaluated by the respondents are greater than the mean value of 3.00. This indicates that in the opinion of the respondents, all the eight factors are considered as critical challenges to effective fire safety management in the hostels.

**Table 2. Respondents' Overall Ranking of Challenges to Effective Fire Safety Management**

All the factors were considered to be critically severe	1. Problems with electrical wiring and installations (3.89, 0.247). <sup>a</sup>
	2. Inadequate water distribution system (3.79, 0.199).
	3. Inadequacies in the fire department (3.70, 0.061).
	4. Passive attitude of owners/management towards housekeeping and maintenance (3.67, 0.449).
	5. Passive attitude towards personal fire protection (3.66, 0.526).
	6. High cost of installing fire protection system (3.51, 0.994).
	7. Little/no consideration for fire-resistive building design and construction (3.49, 0.977).
	8. Poorly enforced and ineffective fire-related policies and regulations (3.27, 0.260).

<sup>a</sup> Figures in parentheses are the arithmetic means and standard deviations. Test value = 3.00, significance level at 95% confidence interval. M = Mean, SD = Standard Deviation.

The results further show that “problems with electrical wiring and installations”, “inadequate water distribution systems”, “inadequacies in the fire departments”, “passive attitudes of owners/management towards housekeeping and maintenance”, and passive attitudes towards personal fire protection’ are the five critical challenges to effective fire safety management in the hostels. Other factors such as “high cost of installing fire protection systems”, little/no consideration for fire-resistive building design and construction, and “poorly enforced and ineffective fire-related policies and regulations”, were also considered as critical challenges.

#### 4.3 Fire Mitigation Measures to Control Fire Outbreaks

The views of the respondents were further sought on the fire mitigation measures which when put in place by management can control the situation. The results are also shown in Table 3. The results in Table 3 show that the mean scores of all the five fire mitigation measures were greater than the mean value of 3. This indicates that in the opinion of the respondents, all the five factors are measures which when put in place by management, can mitigate the outbreak of fire. The results further show that “fire insurance policies”, “fire evacuation plans”, “regular maintenance and housekeeping”, “fire safety policies” and “sanctions against those who disobey fire regulations”, are all key measures which can control the outbreak of fire.

Fire risk is an estimation of expected fire loss that combines potential for harm in various fire scenarios that can occur with the probabilities of occurrence of those scenarios (American Standards and Testing Materials international, 2001; Canadian Wood Council, 2002). Insurance is a risk transfer mechanism by which an individual or organization can exchange his or her uncertainty for certainty (Akakpo, 2004). A fire insurance policy can be bought by anyone who is a legal owner of a residential landed property or an apartment (General Insurance Association of Singapore, n.d.). Acquiring a fire insurance policy is a big investment. Hostel owners who decide to opt for this policy are rest assured of their peace of mind because the policy covers for losses or damages resulting from fire.

Fire safety evacuation plans are very important in the quest to escape from fire outbreaks. The purpose of fire safety evacuation plan is to identify actions that should be taken by the occupants in the event of a fire or similar emergency situations. The respondents saw the need for such plans to be instituted in the various hostels. This they saw will ensure their safety through fire prevention and evacuation.

Effective housekeeping can eliminate some hazards and provide a better place for living. Poor housekeeping such as throwing of highly flammable materials around can contribute to the spread of fire in buildings easily. Good housekeeping can be an essential element in fire safety management in the various hostels. Carelessness and neglect causes fire outbreaks and may further create conditions that may allow fire to spread more rapidly. Flammable or combustible materials should not be stored, even as a temporary measure, in escape routes such as corridors, stairways or lobbies, or where it can come into contact with potential sources of heat (Health and Safety Authority, n.d.).

**Table 3. Mean Score Ranking of Fire Risk Mitigation Measures**

Mitigation measures	Mean	Standard Deviation	Rank
Fire insurance policy	4.08	1.110	1
Fire evacuation plans	4.08	1.196	2
Regular maintenance and housekeeping	4.05	0.999	3

Fire safety policy	4.01	1.198	4
Sanctions against those who disobey fire regulations	3.76	1.191	5

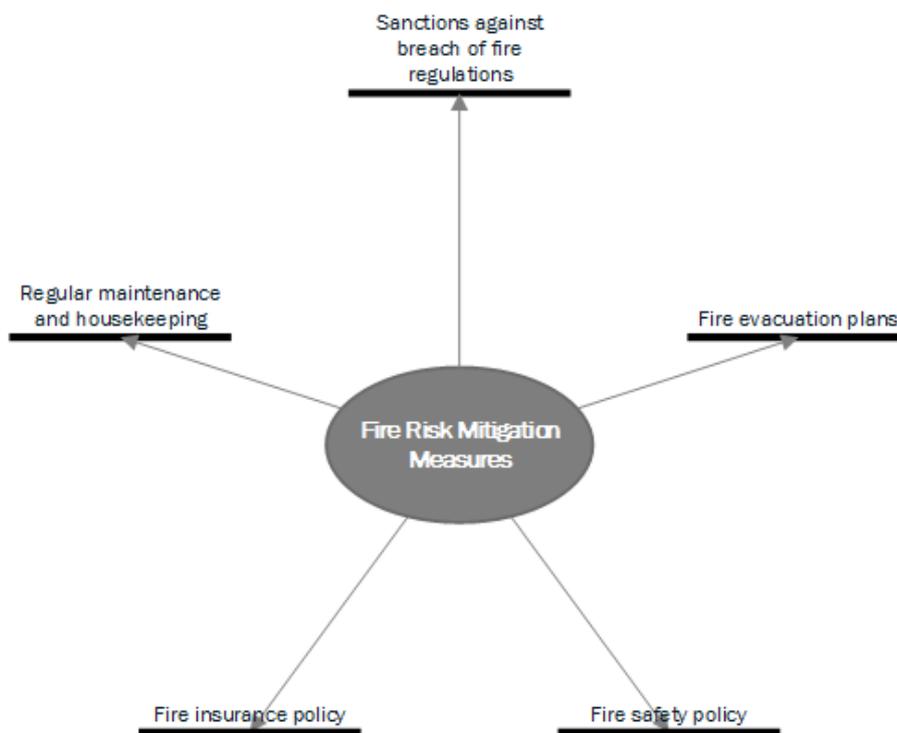


Figure 1. Fire Mitigation Measures

**5. Conclusion**

To provide total safety for hostel buildings, fire safety management should be properly implemented by the hostel managers. This study sought to assess the perceptions of students on challenges to fire safety management in multi-storey students’ hostels around the Kwame Nkrumah University of Science and Technology campus. The study found that there are quite a number of challenges which are encountered in trying to implement fire safety management practices. Key among the challenges identified were problems with electrical wiring and installations, inadequate water distribution systems, inadequacies in the fire departments, passive attitudes of owners/management toward housekeeping and maintenance, and passive attitudes toward personal fire protection. The results further showed that fire insurance policies, fire evacuation plans, regular maintenance and housekeeping, fire safety policies and sanctions against those who disobey fire regulations, are all fire risk mitigation measures which when adopted can help to control fire outbreaks in the hostels. Based on the findings, the researchers recommend that there should be enforcement of fire policies amongst various hostels, there should also be sanctions against hostel managers who disobey fire safety regulation laws, there should be regular education and training for occupants in the hostel buildings, and there should be adequate provision of fire alarm/warning systems in the hostel buildings to check probable occurrences of fire outbreaks.

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