



Evaluating the Effectiveness of Fire Safety Training on Occupants' Response to Fire in Selected Public Buildings in Nairobi County, Kenya

Olipha Nyankuru^{a*}, Stanley Omuterema^b, Nicodemus Nyandiko^c

^aState Department of Public Works, P.O Box 41191-00100 Nairobi, Kenya

^{b,c}Masinde Muliro University of Science & Technology, P.O Box 190-50400 Kakamega, Kenya

^aEmail: knyankuru@yahoo.com, ^bEmail: omu53@yahoo.com, ^cEmail: nomoyo2005@yahoo.com

Abstract

Fire incidents involving occupied premises often result in injuries, loss of assets, business disruption and sometimes death. In the recent past, the country has experienced an unprecedented increase in fire incidents involving both public and private buildings and institutions in Kenya. To counter this problem the government of Kenya has embraced various strategies such as providing fire safety training for occupants of public buildings. However, the impact of this fire safety training is not well documented. This paper presents findings of a study on the effectiveness of fire safety training on occupants' response to fire incidents in selected public buildings in Nairobi County, Kenya. The results were based on a survey carried out in thirty (30) selected public buildings in Nairobi County, Kenya. The response rate was 78% (N=139). Data were analyzed using descriptive statistics with the aid of the Statistical Package for Social Sciences (SPSS). Overall, the current study shows that fire safety training contributes positively towards improvement of occupants' knowledge and response to fire. Results from this survey showed that there was a significant relationship between training and occupants' response to fire. Conclusions drawn from this research have implications for various fire prevention and safety organizations that are in the business of promoting fire related information to the public in terms of instituting interventions aimed at fire disaster risk reduction in Nairobi County and the nation of Kenya at large. The study recommends that policy makers, implementers and relevant stakeholders take deliberate steps to improve programs on fire safety training to all people occupying buildings throughout the country as a whole.

Keywords: fire safety training; occupants; response; public buildings; Nairobi County; Kenya.

* Corresponding author.

1. Introduction

The impact of fire outbreaks in any organization can be significant with far reaching consequences. Not only do fires result in deaths and personal injuries but also cause substantial property and environmental damage. Large fires occurring in both private and public premises especially in urban areas require a large deployment of resources in terms of equipment and personnel to contain them. According to the Kenya Red Cross Society, the increase in the incidences of fire in Kenya since 2009 is attributed to various factors including human error and carelessness, overcrowding in informal settlements, lack of access roads and firefighting services among others [1]. Despite the significant measures taken to control fire incidents, firefighting operations unfortunately often fail to prevent extensive damage and loss to property [2]. However; it is easy to prevent such situations through the actions of appropriately trained occupants who are usually on the scene in the early stages of a fire's development. In the context of building fire safety, fire impact is considered to be any threat to life and property caused by heat or smoke and may include adverse environmental impact from toxic products stored on the premises [3]. An essential part of any building fire safety system is training and education of the occupants in matters of fire safety. Every possible device for fire prevention can be provided in a building but if the occupants are ignorant of what a fire alarm sounds like, what safe and unsafe work practices are or where the exits are, then the devices will not achieve a fire safe building. All too often occupant training, fire drills and safe work practices (all required by Occupational Safety and Health Act in Kenya) are overlooked or given only superficial attention. The situation in Kenya is that between the year 2010 and 2014, more than one hundred (100) fire incidents involving public buildings from across the country in which property of immense value was destroyed were reported to the Ministry/ State Department of Public Works [4]. Unfortunately many more other fire incidents go unreported. Most of these incidents could be avoided and or contained if only fire prevention measures were observed.

According to fire safety management writers [5] the best insurance against loss of assets and lives caused by fire is to adopt a pro-active fire safety and prevention plan coupled with sound risk management practices. One suitable program to deal with the threat of fire is to improve fire safety knowledge for all occupants of buildings. The government of Kenya, through the fire prevention unit of former Ministry of Public Works now a state department in the larger Ministry of Land, Housing & Urban Development, has invested considerable resources to improve and maintain this awareness for occupants of its buildings. Scheduled fire safety training programmes for occupants of government buildings focusing on subjects such as fire prevention, fighting fire at the initial stages and workplace evacuation are often organized and delivered to client departments in order to fulfill the requirements of the Occupational Safety and Health Act [6]. Unfortunately no one is able to fully describe the outcomes of these fire safety trainings. Organizers who currently deliver this training do not know whether the training actually results in recipients taking effective action in the event of a fire in their workplace; a gap that this study sought to fill by evaluating the effectiveness of fire safety training on occupants' response to fire in the selected public buildings.

1.1. Scope and limitations

The study covered only 30 selected public buildings in Nairobi County where training of occupants on fire safety had been done. It was assumed that:

1. The level of fire safety awareness of occupants is the same across all public buildings
2. The fire prevention measures and training are the same in all public buildings
3. All fire incidents occurring in public buildings are reported

The training on fire safety was based on topics covered in the training curriculum thus - fire prevention, firefighting and evacuation. The level of fire knowledge was measured by what occupants knew on fire, its causes and how to prevent it. Response was evaluated by the probable reactions by occupants when faced with fire. The parameters were chosen because they are usually the main focus of any fire safety awareness program.

2. Methodology

The study used descriptive survey design because of its ability to elicit cross-sectional data on the subject. One hundred and thirty nine (139) questionnaires were used to collect data in 30 selected public buildings in Nairobi County. Of these, one hundred and nine 109 (78%) were returned and used in the analysis. Observation checklists were used to assess the extent of the provision of fire prevention and protection facilities in the selected buildings.

They were utilized in checking whether fire-fighting devices were available, whether safety notices were prominently displayed and whether fire escape routes existed. The data were coded and analyzed on Statistical Package for Social Sciences (SPSS version 16) platform.

Descriptive statistics focusing on frequencies and percentages were used to describe and summarize variables such as age and education level of respondents. Logistic regression and Chi square test were used to analyze the relationship between variables.

3. Results & Discussion

The findings of the study showed that fire safety training had positive effect on how occupants of buildings respond to fire. The respondents correctly answered questions on evacuation procedures, summoning emergency responders and operation and use of firefighting equipment.

3.1. Logistic regression analysis

A logistic regression analysis with fire safety training(FST) as the independent variable, response to fire as the dependent variable and safety training rating and fire drills as the explanatory variables was performed to determine whether fire safety training influences occupants' response to fire.

Logistic regression models fitted on each level of response of the outcome variable (response).Occupants responded to fire by shouting, operating a fire alarm or calling the fire brigade. The outputs are presented in

tables and briefly explained below:

Table 1: Logistic analysis of occupants’ response to fire by shouting

Shouting	Coefficient	Std. Error	z	P>z	Confidence Interval	
					(95% confidence level)	
Fire safety training rating	-2.014903	0.5676462	-3.55	0	-3.127469	-0.9023369
Fire drills frequency	-1.504077	0.8249579	-1.82	0.044	-3.120965	0.1128104
constant	1.791759	0.3118048	5.75	0	1.180633	2.402886

When response by shouting is modeled as the response variable, both safety training and fire drills are statistically significant with coefficients and p-value of -2.015 (0.000) and -1.504 (0.044) respectively at 95% confidence level.

Table 2: Logistic analysis of occupants’ response to fire by calling fire brigade

Calling fire brigade	Coefficient	Std. Err.	z	P>z	95% Confident interval	
FST rating	(empty)					
Frequency of fire drills	2.627081	1.476047	1.78	0.075	-0.2659179	5.52008
constant	-4.418841	1.006006	-4.39	0.892	-6.390576	-2.447105

When response by calling fire brigade is modeled as the response variable, fire safety training rating had no influence on the occupants’ response, while frequency of fire drills and response to fire by calling fire brigade are statistically insignificant (p=0.075).

Table 3: Logistic analysis of occupants’ response to fire by operating a fire alarm

Operating fire alarm	Coefficient	Std. Err.	Z	P>z	95% Confident Interval	
FST rating	2.115708	0.5741147	3.69	0	0.9904635	3.240952
Frequency of fire drills	0.9762734	0.8969993	1.09	0.002	-0.7818129	2.73436
constant	-1.892564	0.3234312	-5.85	0	-2.526478	-1.258651

When response by operating a fire alarm shouting is modeled as the response variable, both safety training and

fire drills are statistically significant with coefficients and p-value of ($p=0.000$ and $p=0.002$ respectively) at 95% confidence level.

The strength of the coefficients in the above tables indicates that of all the response mechanisms, operating an alarm is the one most dependent on fire safety training.

3.2. Chi- Square Test on FST and response

A chi square test was also done to ascertain the association between fire safety training and response in case of fire.

Table 4: Chi- Square Test

	Value	Df	Asymp. Sig. (2-sided)
Spearman CC	16.459 ^a	4	.002
Likelihood Ratio	14.712	4	.005
N of Valid Cases	109		

a. 4 cells (44.4%) have expected count less than 5. The minimum expected count is .33.

The Spearman Correlation Coefficient(SCC) value of ($P=.002$) confirms that there is a statistical significance between the respondent rating of FST and the opinion on how to raise alarm in case of fire. The results show that how respondents rated FST had an association with their course of action when involved in a fire incident.

Table 5: Symmetric Measures

	Value	Approx. Sig.
Nominal Phi	.389	.002
Nominal Cramer's V	.275	.002
N of Valid Cases	109	

The Phi and Cramer's V were used to test for the strength of association between the respondent rating of FST and their opinion on how to raise an alarm in case of fire. The Phi value of .389 and the Cramer's V of 0.275 show that there is a strong relationship between respondent rating of FST and their response in case of fire. In both measures, $P=0.002$ implying a significant relationship between the two variables. These results compare well with those of the logistic analysis above and are in agreement with similar studies on the importance of fire safety training in enhancing occupants' response to fire.

3.3. Discussion

The above findings show that people who had been exposed to fire safety training would respond more accurately to a fire: that is, they would make more rational and appropriate decisions at a time of emergency and danger. The findings demonstrated that people who had previously been exposed to fire safety training were more likely to warn others and evacuate a burning building during a fire incident. This agrees with NFPA [7] report that occupants who have been trained on fire safety change attitude and behaviour in a fire situation by instructing others to evacuate by following proper evacuation procedures. This change will lead to the best chance of a safe and methodical evacuation being conducted during emergencies [8]. This finding could be explained through the naturalistic decision making theory which states that being exposed to fire safety training enables individuals to better assess the situation and accurately interpret the information in the environment [9].

The fire safety training provided to occupants of public buildings in Nairobi comprises of both theoretical and practical lessons on fire development and human behaviour in fire. All the selected public buildings have a designated fire exit / escape, fire safety signage indicating the route to follow to reach the place of safety on each floor. Through training majority of occupants know what to do especially when a fire alarm sounds. Failure to act correctly when a fire alarm sounds could have serious, possibly life-threatening consequences if there is a real fire [10]. It is imperative that occupants participate in mock evacuation drills periodically, to ensure complete evacuation of a building in an orderly manner and within the minimum time in case of a fire.

Generally, fire safety training courses inculcate the needed skills to prevent fire and educate people about the basic elements of fire prevention and protection. The findings of this study indicate that provision of correct and adequate equipment such as fire extinguishers strategically placed in buildings is not the only solution for fire safety. It is necessary that occupants of buildings are given adequate training to help prevent fire accidents and to respond appropriately and quickly when such accidents occur. In relation to topics covered in FST i.e. fire prevention, evacuation and firefighting, more practical aspects of the training need to be included to better prepare occupants to respond more effectively. This resonates well with Kis and his colleagues [11] that the efficiency of an emergency response depends on how well the population is informed and prepared to respond. In order to do so, training and risk communication are essential in preparing the occupants of buildings for an effective emergency response. Investing in fire safety training is a significant approach towards comprehension and acceptance of risks, prevention knowledge and development of response capacity [12].

The data generated by the survey and the respondents' comments reflect a general view that fire safety training has contributed towards equipping occupants of public buildings with knowledge on fire safety precautions, evacuation and basic firefighting skills. However, further probing indicated that the overall awareness of the occupants was not satisfactory and would impose risks on their lives and properties, even though their buildings were equipped with the latest fire safety facilities. Some occupants still lack sufficient knowledge on evacuation since drills are not performed regularly. The evident deficiency in coverage of practical aspects of the training such as firefighting demonstration and fire evacuation drills needs to be addressed to optimize the influence of FST on occupants' knowledge and response to fire.

4. Conclusion and Recommendations

The study set out to establish the extent to which fire safety training influences occupants' response to fire. The findings showed that fire safety training is an essential line of defense against fire as it equips occupants of public buildings with necessary knowledge of how different types of fires start and skills to efficiently combat them. Respondents confirmed the importance of FST in imparting and enhancing knowledge on fire safety and prevention and thus ensuring protection and safety of lives and property. Not only does FST enable people to deal with fire more appropriately but also it improves fire safe behaviour.

In addition to having a comprehensive and effective fire management system in place, it is equally important to have an effective response and evacuation procedure and a trained emergency response team. The impact of a crisis can be substantially reduced when people are trained to respond appropriately. A confident team that is able to respond appropriately in the event of a fire is an invaluable investment for public buildings.

In any training program, it is important to determine the most appropriate message to deliver to a certain target audience. There is therefore need for collaboration between fire service providers and clients to identify what kind of basic knowledge is required for occupants of various specific buildings. By using a standard planning process it is possible to identify the safety message appropriate for occupants of public buildings.

Recommendations

In light of the findings and conclusions of this study, it is recommended that:

1. Fire safety training should be incorporated as one of the programs to better the working environment of occupants of all public buildings in Nairobi County.
2. Relevant training agencies need to update training material to promote fire safety training to all people. There is need to ensure that the information delivered is current and covers all pertinent issues related to all fire risks prevalent in specific occupancies.
3. Fire departments should do self-evaluation based on actual data to find out if the training programs they carry out have an impact on improving people's response to fire emergencies. A program is only as good as the intended results it is capable of achieving. Unless it is evaluated for success, results will go unnoticed.

References

- [1]. Kenya Red Cross Society (KRCS). Fire in urban informal settlements. KRCS, Nairobi, Kenya, 2009.
- [2]. EC. 'JRC Scientific and Technical Reports', European Commission Joint Research Centre- Institute for Environment and Sustainability, Ispra, Italy, 2009.
- [3]. Australian Bureau of Statistics (ABS). Community Preparedness for Emergencies, New South Wales (Report No. 4818.1). Sydney, NSW, Australia, 2003.
- [4]. Government of Kenya. Draft Building Regulations, Ministry of Housing, Nairobi, 2011.
- [5]. K. Coules and C. Eskell. Fire Safety Management Handbook, Butterworths Tolley, U.K, 2000.

- [6]. Government of Kenya. Laws of Kenya-Occupational Safety and Health Act, Section 59- Fire Risk Reduction Rules, Government Printer, Nairobi, 2007.
- [7]. NFPA. Selection from U.S. fires in selected occupancies. Offices. NFPA, Quincy, Massachusetts, 2006.
- [8]. A. Lewis & W. Dailey. Fire Risk Management in the Workplace (2nd ed.). London: Fire Protection Association, UK, 2000.
- [9]. J. E. Driskell & E. Salas. Stress and Human Performance (Applied Psychology), Psychology Press, Australia, 2013.
- [10]. G. Proulx, R. F. Fahy & L. Aiman. 'Panic or not in fire: Clarifying the misconception'. Fire and materials. 2012, 36 (5-6), pp. 328-338.
- [11]. E. Kis, L. T Deaconu., E. Roman, L. Țtefănescu, M. Meltzer, C. Pop & A. Ozunu. 'Assessment of population awareness and preparedness level regarding the environmental emergency situations' Advances in Environmental Sciences 5/2, 2013.
- [12]. IFSTA. Fire and Life Safety Educator. 3rd Edition, Fire Protection Publication, Oklahoma State University, USA, 2007.