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Tropical Journal of the Built Environment (TJBE) is a biannual publication of high-quality peer reviewed journal that is published by the College of Environmental Sciences, Joseph Ayo Babalola University (JABU), Nigeria. Tropical Journal of the Built Environment provides a platform where academics and built environment professionals can publish well-researched empirical and theoretical papers on issues related to the built environment. TJBE encourages prospective authors to submit original articles that offer feasible solutions and planning implications for improving the environment.

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Assessment of the Level of Compliance with Fire Safety Measures in Residential Buildings in Minna, Niger State

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Abstract

Fire safety within the home is an extremely important issue, especially in mixed use premises and where unrelated occupiers, who live independently from one another, share common areas of the same building. Most residential fires are caused by the misuse of domestic equipment or by a wrong behaviour of the occupants in residential buildings. These factors are multiplied by the number of units or occupants. The study assessed the level of compliance with fire safety measures of residents in residential buildings in Minna, Niger State. Geographic Information System was adopted to identify residential buildings affected by fire in Minna. Structured questionnaires were also used to examine causes of fire disaster and occupants' level of fire safety provision in residential buildings in Minna, Niger State. The result of the findings shows that candle light, electrical faults, kerosene stove and fuel explosion are some of the causes of fire disaster in the area. The level of fire safety provision, in terms of fire prevention and firefighting, in residential buildings in Minna was revealed to be low. It was thus concluded that the level of compliance with fire safety measures in residential buildings in Minna, Niger State is low. The study therefore recommended that public enlightenment should be carried out to sensitise building occupants about effective fire prevention and firefighting in the area.

Keywords: Firefighting, Fire prevention, Fire safety, Fire vulnerability and Residential building.

Introduction

In Nigeria, there has been serious disasters confronting the homes, lives and property of people. The most common ones are flood, building collapse and fire. According to Shittu *et al.* (2016), a lot has been written on flood and building collapse, but the incidence of fire is still scarce in literature. Fire is the result of flammable materials being combusted and the essential ingredient for the propagation of fire is air, which is sufficient to start ignition or means of ignition and oxidation (Shittu *et al.*, 2015). The slightest contact of highly inflammable liquid contents, such as gasoline (petrol), paraffin (kerosene), or gas with fire brings explosive consequences of

destruction, inferno and loss of lives and properties (Adeleke, 1993). It was in this light that Aqua Group (1984) reported that there must be presence of the three basic elements or ingredients of fire, which is referred to as fire's own external triangle before fire can break out.

Therefore, in the event of fire or other emergencies within building, provisions must be made for the safe and rapid exit of occupants, at least from dangerous areas. The design of escape routes should allow occupants to move away from the fire across the floor of the compartment containing it and reach a fire-resistant door that leads into a protected escape route (Butcher, 2001). Provision must also be made for fire

warning system in any building that can provide acoustic and visual warning signals to the occupant in case of fire. Smoke is also a major by-product of fire and means of its control in the engineering design stage are required. This will bring about a well-maintained active system and passive systems providing a building with a high degree of fire safety both in terms of life safety and property protection at all times.

Unfortunately, there is a real problem from a life safety perspective in residential buildings as identified by past studies (Shittu, 2009; Shittu *et al.*, 2013a; Shittu *et al.*, 2013b; Shittu *et al.*, 2017; Shittu, 2018). Most residential fires are caused by the misuse of domestic equipment or by a wrong behaviour of the occupants (wrong reactions or behaviour deviances) in residential building. These factors are multiplied by the number of units or occupants. In addition, findings by many researchers, among which are Mogbo (1998), Anyawata (2000), Shittu (2001) and Shittu *et al.* (2013 a and b), confirmed the fact that fire incidences affect buildings of individuals, corporate organizations, government parastatals, and incidence of fire leads to damage to lives and property and eventually financial losses. In addition, Oluwaseun and Ojoye (2019) linked the severity of fire outbreak in all the neighbourhood in Minna to lack of proper fire management capacity and inadequate provision and use of firefighting equipment.

In view of the above, the negative consequences of fire disasters are enormous and tremendous. Based on this, there is a great need to curb the occurrence of fire disasters in our societies. There is the need to have better understanding of the nexus between fire outbreak and the factors that pre-disposes the societies to fire outbreaks. It is equally necessary to ensure better preparation for, as well as rapid and well-coordinated response to complex fire outbreaks. For a long time, researches have neglected the cause-and-effect relationship between fire disaster and social and economic development. There is therefore a great need to assess the level of compliance

with fire safety measures in residential buildings in Minna.

Review of Related Literature

Causes of Fire Outbreak

Fire safety with regards to fire disaster is cardinal and crucial in terms of growth and development. Fire disaster can significantly impede the effectiveness of development resource allocations (Akintunde, 1990). The damage caused by fire disaster reflects in many ways and the impacts can be as complex as the economy itself. It is pertinent and paramount to acknowledge the fact that for any meaningful development to occur, the issue of fire safety should be accorded great attention. In view of this, Shittu *et al.* (2013a) advocated for the identification of the major causes of fire outbreak as the first step towards fire prevention and mitigation. On this note, the major causes of fire incidences have been attributed to electrical and gas faults, resulting in financial and non-financial losses by several studies (Shittu, 2007; Shittu *et al.*, 2013b; Shittu *et al.*, 2015; Shittu *et al.*, 2017). Fire incidents were also reported to have occurred more in public and private residential buildings than in other building types, this has also been attributed to the non-compliance of building clients and occupants to the requirements of fire safety regulations (Shittu *et al.*, 2013b). On the other hand, the characteristics of the inhabitants (such as young children, elderly, people with disabilities, sleeping people) could be obstacles to a safe and quick evacuation. The building design or construction could lead to the fast spread of fire and smoke to the surrounding rooms, corridors and stairs exposing people to smoke and heat.

In the recent past, Simon (2020) submitted that at least 49 shops, 4 residential houses with 16 rooms, and 2 motor cycles have been engulfed by fire at Lambata in Gurara Local Government Area of Niger State, following a tanker explosion in the area. In the same vein, Oladipo (2021) reported that tragedy occurred in Minna, Niger State Capital in March 2021 following a fire incident that occurred at a two-bedroom

apartment in Kaffin Tella area of Tunga community in the metropolitan area of the city. The incident started by an electrical spark when Abuja Electricity Distribution Company (AEDC) restored high-voltage power supply after about 24 hours of power outage (Oladipo, 2021). Still on the recent issue of fire outbreak in Niger State, it was reported by Adams and Yunusa (2022) that an early morning fire outbreak occurred at Mokwa main market in Mokwa Local Government Area of Niger State, engulfing no fewer than 57 shops, destroying into losses of goods worth millions of Naira.

Fire Safety

Nick (1999) identified four fundamental issues on fire safety; these are prevention of fire, prevention of spread of fire, provision of firefighting equipment and finally, safety of occupants in case of fire. Nick (1999) suggested that in the prevention of fire, there are a number of particular risk areas that must be identified including where fire may break out, possible size and intensity of fire, and possible consequences of fire. Examples of high-risk areas in a building are kitchens, large storage areas, dangerous goods stores, plant rooms, switch room, manufacturing areas and undercover car parks. Once these high-risk areas have been identified, we can then put into perspective how large the fire may become and whether to allow fire for evacuation, fire

According to the studies of Musa (1999); Nick (1999); Babalola (2000); Clinton (2000); Erik (2000); Morgan (2000); Bankole (2004); Evans (2004); Gbenga (2007); Usman (2007); and Uduak (2008), the key and essential principles of active and passive fire safety are:

- i. Avoidance of outbreak of fire
- ii. Provision of escape routes which are protected from smoke and fire and allow occupants to leave the building safely.
- iii. Early detection of fire and early warning to occupants to facilitate safe evacuation.
- iv. Early suppression of fire where feasible.

- v. Limitation of the development and spread of fire.
- vi. Containment of fire and smoke to the room or unit where the fire originates.
- vii. Management of fire safety.
- viii. Use of a simple user-friendly interactive computerized medium

Fire Prevention and Mitigation

According to Muhammad and Eze (2021), fire prevention strategies must be considered first when assessing the safety of the occupants in every building and the duration occupants can take to escape before any fire hazard occur should also be put into cognizance. In view of this, the following active fire prevention features were identified: fire extinguisher, alarm system, sprinkler system, fire hydrant, fire hose system, fire detectors and escape chute system. On the other hand, Muhammad and Eze (2021) identified the following passive fire prevention features: Building form, Shape of the roof, Types of fire resistance materials applied, Types of wall materials, Types of roof materials, and Types of materials used for Floor finishes. Muhammad and Eze (2021) concluded that in order to achieve effective fire prevention strategies, a combination of both active and passive means of fire prevention should be adopted.

Mtani and Mbuya (2018) suggested ways for combatting the incidence of fire outbreak. In line with this Mtani and Mbuya (2018) reported these include the development of guidelines for mandatory fire risk assessments and building regulations specific to informally settled areas, improvements in household energy practices in terms of lighting and cooking sources, clarification of landlords' responsibilities for fire prevention facilities, neighbourhood re-planning and upgrading of densified settlements, promotion of community-based strategies on fire outbreak control and management, promotion of coping strategies to fire risk control that show potential, outreach to sensitising the community about the importance of maintaining access roads for

fire outbreak control, encouragement of changes in fuel use to adopt safer sources and the establishment of a sub-ward committee for a community.

In addition, Rush *et al.* (2020) reported that many attempts to mitigate fire risk prior to a comprehensive political response that tackles the causes of fire must also be community led. The complex socio-politico-economic landscape of each settlement means solutions that fit one situation cannot necessarily be used in another. Therefore, community involvement is vital to ensure that any potential intervention is appropriate, achievable, and sustainable within the local context. Also vital is the participation of fire services and their roles in both risk management and response to fires, and their active engagement in developing new strategies and working methods for urban fires is essential if we are to reduce fire risks. In the light of this, Rush *et al.* (2020) suggested that the challenges posed by urban fires need to be addressed through effective evidenced-based fire engineering strategies implemented post-fire will help increase communities' resilience to urban fire risk, and ultimately help to create sustainable cities.

Furthermore, Nouban and Yunusa (2020) observed that most of the public and residential buildings in Minna including the Engr. Abdulkadir Abdullahi Kure Ultra-Modern Market fire incidences and fire spreading is triggered by the absence of or failure in compliance with construction standards or regulations that require a competent person to complete a fire risk assessment or evaluation by considering all aspects of fire safety, including the design and construction in conjunction with the materials used. Therefore, the regulatory bodies responsible for construction control and regulations should ensure compliance with fire safety regulation to prevent further loss of resources and human lives in the country. In line with this, Nouban and Yunusa (2020) recommended that construction regulations agencies in the country need to use some set of safety

indicators such as Means of Warning and Fire Protection Devices; Internal Fire Spreading; External of Fire Spreading; Fire Resisting Door; and Access and Facilities for Fire Service, to evaluate the fire safety of any construction work.

Research Gap Identified

A lot has been written on flood and building collapse but the incidence of fire outbreak is still lax in literature, in spite of the fact that fire disaster occurs more frequently than flood and building collapse. Efforts have been made by many researchers to address the menace of fire outbreak. As a result of this, Shittu (2001) found that the amount of fire outbreak in residential and public building of Kwara State and revealed that the amount of financial loss due to fire incidences on the average was about 4% of capital expenditure from 1990-1999. Shittu (2007) studied the incidence of fire outbreak in Niger State from 1993-2004 between the military and civilian political dispensations and found out that the incidence of fire outbreak in domestic and public buildings were significantly more frequent during the civilian era. The study of Shittu *et al.* (2013a) revealed that building clients and users do not comply with fire safety regulations with respect to the provisions of firefighting equipment's and number of escape routes in buildings. Shittu *et al.* (2015), on the other hand, studied the relationship between cost of fire incidences and capital expenditure in Kwara State and discovered that there is no improvement in the trend of fire incidence in Kwara State over the last two decades. The study of Oluwaseun and Ojoye (2019) discovered that fire hazards elements are feasible in all the neighbourhood in Minna which makes it highly susceptible to fire hazard because there is no fire management capacity, most of the buildings have no facilities and means of preventing fire hazards. The study therefore suggested that Niger State Fire Service should carry out fire awareness and sensitization within the study area to orient the residence on the risk of fire disaster, its prevention, usefulness of fire safety and firefighting equipment.

These researches did not study the incidence of fire outbreak in relation to level of compliance to provision of fire extinguishers and safety measures in residential buildings. Although Shittu *et al.* (2013b) made an effort along this direction but did not consider the major building types mostly affected by the incidence of fire outbreak which are public and private residential buildings. In addition, Shittu *et al.* (2017) assessed the level of fire safety provisions in selected public buildings used for commercial and official purposes in Minna, Nigeria. The study identified the problem of fire incidents which always occur more in public and private residential buildings as a result of non-compliance of building clients and occupants to the requirements of fire safety regulations. It was concluded that fire safety requirements are not adequately provided or complied with in public buildings in Minna. It was upon the recommendations suggested by this study that this research was built.

Therefore, in order to fill this gap in knowledge, this study set out to assess the level of compliance with fire safety measures in residential buildings in Minna, Niger State with a view to improving fire safety compliance. In order to achieve this, the study formulated following objectives:

- i. To map out fire disaster occurrence areas in Minna, Niger State from 2005 – 2019.
- ii. To determine the major causes of fire disaster in the Minna.
- iii. To examine the effectiveness of fire safety measures in residential buildings in Minna.
- iv. To recommend effective firefighting and fire mitigating measures in Minna.

Research Methodology

The study adopted the quantitative research approach. The respondents for the study were comprised of 480 occupants of residential buildings in Minna and 10 staff members of Niger State Fire Service

Agency which were identified through purposive sampling technique. The basic criteria for the selection of the occupants are age of the building, fire disaster experience in the building and years of tenancy of the occupants. On the other hand, the criteria for the selection of the staff members of Niger State Fire Service Agency was years of experience and rank of staff. Data collection was undertaken with the use of Geographic Information System (GIS) and structured questionnaire. The data collected from the staff members of Niger State Fire Service Agency were on the number of fire outbreak recorded annually in Minna from 2005 – 2019, number of lives and property loss during the event of fire outbreak in Minna from 2005 – 2019, and the causes of fire outbreak in Niger State from 2005 – 2019. The data collected from the occupants were on occupants' perception on the causes of fire outbreak in residential buildings in Minna, and the provision of firefighting and fire prevention measures in residential buildings in Minna. GIS was used to identify residential buildings affected by fire disaster in Minna, Niger State. Data on the causes of fire outbreak and fire safety measures (firefighting and fire prevention) in residential buildings in Minna were collected with the use of questionnaire. Analysis of data was carried out with the use of frequency count, average and percentage.

Results and Discussion

Mapping out of Fire Disaster Occurrence Areas in Minna from 2005 – 2019

The available data from Niger State Fire Service (NSFS) was used for field survey, in order to identify residential building affected by fire disaster and to develop a geospatial map of fire disaster of Minna. Geospatial coordinate of residential houses affected by fire disaster between the years 2005 and 2019 were captured and referenced on Minna township map to show the spatial location of fire disaster in the area as shown in Figure 1.

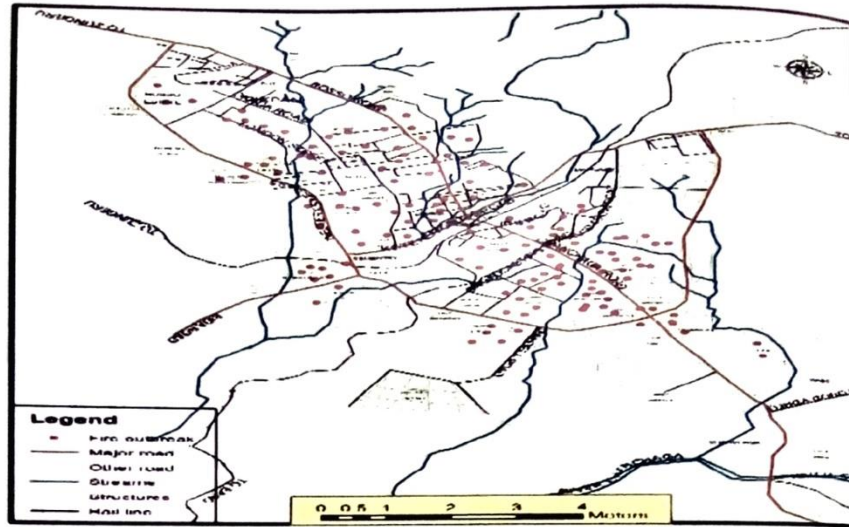


Figure 1: Spatial location of Fire Disaster Areas in Minna (2005 - 2019)
 Source: Authors' Analysis (2021)

Monthly Fire Outbreak in Minna (2005-2019):

As shown in Table 1, fire outbreak in Minna occurred throughout the years round. A total of 197 cases of fire incidence were recorded between 2005 and 2019. February had the highest frequency of fire disaster in Minna municipal with 38 cases of fire outbreaks (19.29% of total cases of fire) followed by March with 26 cases (13.20% of total cases of fire). The month of May had the least case of fire disaster with only 4

cases of fire disasters (2.03% of total cases of fire). All the months had cases of fire disaster but the months of the dry season recorded the highest incidence of fire outbreak in the different locations in Bosso Estate, London Street, F-Layout, Dutsen Kura, GRA, Oduoye Quarters, Emir's Place Road, Limawa, Kateren Gwari, Kpakungu, Old secretariat, Minna Central Market, Abdul Street, Tunga, Top Medical, Broadcasting Road, Farm Centre, Shango, IBB Road and College of Education, Minna.

Table 1: Monthly Occurrence of Fire Outbreak in Minna form 2005 – 2019

Month	Frequency	Proportion (%)
January	21	10.66
February	38	19.29
March	26	13.20
April	17	8.63
May	4	2.03
June	8	4.06
July	7	3.55
August	12	6.09
September	9	4.57
October	6	3.05
November	18	9.14
December	31	15.74
Total	197	100.00

Sources: Researchers' Field Survey (2021)

Monthly Loss of Lives and Property due to Fire Outbreak in Minna (2005 to 2019):

Table 2 shows a clear attestation of the fact that fire disaster is associated with loss of lives and properties of worrying proportion. In relation to loss of lives, the period recorded 39 deaths. The month of December had 8 cases of deaths (20.51% of total deaths) while October had 7 (17.95% of total deaths). The months of March and June did not record cases of death. It can also be seen from Table 3 that millions of Naira was lost to fire disaster about =N= 82.9million was lost to fire disaster, the month of December recorded the highest lost in terms

of properties to the tune of =N= 19.9 million (14.48% of the total loss) and followed by November with 12million (24% of the total loss). The findings here are in line with the studies of Simon (2020); Oladipo (2021); and Adams and Yunusa (2022) were it was evident that fire outbreaks in Minna, Niger State always result into destruction of goods running into millions of Naira. However, on the other hand, the findings of Simon (2020); Oladipo (2021); and Adams and Yunusa (2022) did not report recorded cases of death thereby disagreeing with the finding of this study where it was evident that fire outbreak in Minna usually results into loss of lives.

Table 2: Number of Lives Lost due to Fire Disaster in Minna from 2005 – 2019

Month	Frequency	Proportion (%)
January	4	10.26
February	2	5.13
March	0	0.00
April	4	10.26
May	1	2.56
June	0	0.00
July	3	7.69
August	3	7.69
September	4	10.26
October	7	17.95
November	3	7.69
December	8	20.51
Total	39	100.00

Sources: Researchers' Field Survey (2021)

Table 3: Number of Property Lost due to Fire Disaster in Minna from 2005 – 2019

Month	Frequency (=N= million)	Proportion (%)
January	5.00	6.03
February	3.00	3.62
March	6.00	7.24
April	4.00	4.83
May	7.00	8.44
June	3.50	4.22
July	4.00	4.83
August	2.00	2.41
September	10.00	12.06
October	6.50	7.84
November	12.00	14.48
December	19.90	24.00
Total	82.90	100.00

Sources: Researchers' Field Survey (2021)

Causes of Residential Fire Outbreak in Minna, Niger State

Table 4 shows the causes of residential building fire outbreak in the whole of Niger State from 2005 - 2019. From Table 4, five major causes of fire disaster were identified in Niger State; fire disaster caused by candle light, electrical faults, kerosene stove, fuel explosions and motor accidents. It was discovered that 81 fire cases were reported in 2005, 60 cases in 2006, 115 cases in 2007, 93 cases in 2008, 120 cases in 2009, 184 cases in 2010, 101 cases in 2011, 88 cases in 2012, 117 cases in 2013, 113 cases in 2014, 95 cases in 2015, 113 cases in 2016, 64 cases in 2017, 110 cases in 2018, and 52 cases in 2019. It was discovered that 2010 has the highest reported fire cases during the period under review. In addition to this, Table 4 also shows that the major cause of fire outbreak in residential buildings in Niger State is electrical fault with a total number of recorded cases of 692 representing 45.95% of the total causes of fire during the period under review. This is widely followed by fire outbreak due to candle with recorded cases of 304

representing 20.19% of the total causes of fire during the period under review. Fire outbreak due to motor accidents recorded the least case of incident of 89 cases representing 5.91% of the total causes of fire from 2005 - 2019.

Feedback obtained from the respondents indicates that there is high vulnerability of fire disaster in Minna. Residential fire safety assessment is therefore important in determining the vulnerability rate of fire outbreak in the study area. 40% of the respondents were of the view that vulnerable rate of fire outbreak in Tunga area is high, while 30% says the rate of vulnerability in Tunga is at average, 20% indicates that it is moderate and 10% says the vulnerability rate is low. Since the record obtained on the causes of fire only shows the total number of fire outbreaks in Niger State, opinion of 480 occupants considered for the study was sought on the causes of fire outbreak in Minna. The result of the perception of these occupants is presented in Table 5.

Table 4: Causes of Residential Fire Outbreak in Niger State from 2005 – 2019

Year	Candle	Electrical Fault	Kerosene Stove	Fuel Explosion	Motor Accident	Annual Total
2005	30	15	27	6	3	81
2006	19	31	6	2	2	60
2007	34	53	12	11	5	115
2008	21	42	9	17	4	93
2009	9	68	13	21	9	120
2010	28	77	32	29	18	184
2011	24	49	11	11	6	101
2012	17	31	22	15	3	88
2013	18	58	13	19	9	117
2014	14	67	17	8	7	113
2015	20	39	20	12	4	95
2016	27	60	14	10	2	113
2017	8	35	8	7	6	64
2018	22	48	19	13	8	110
2019	13	19	8	9	3	52
Total	304	692	231	190	89	1506
Proportion (%)	20.19	45.95	15.34	12.62	5.91	100.00

Sources: Researchers' Field Survey (2021)

Table 5: Occupants' Perception on Causes of Fire out Break in Minna

Causes	Number of Respondents	Percentage
Bush burning	108	22.5
Power outage	127	26.5
Storage of flammable	147	30.6
Carelessness	98	20.4
Total	480	100.0

Source: Researchers' Field Survey (2021)

As indicated in Table 5, 22.5% of the respondents attribute the cause of fire outbreak to bush burning, 26.5% of the respondents said its power outage, 30.6% said its storage of flammable product while 20.4% said is careless handle of candle. This is in line with the causes of fire identified and documented by the Niger State Fire Service. The study of Oladipo (2021) who attributed the cause of a particular fire incident to electrical spark is also in line with the finding of this research.

Figure 2 shows the analysis of respondents' views of experience of fire outbreaks in

Minna. It was shown that 31% of the respondents have not experienced fire outbreak before, while 69% of the respondents have experienced fire outbreak.

From the Table 6; 69.4% of the respondents have experienced fire outbreak from 1 - 2 times, 16.3% of the respondents have experienced fire outbreak from 3 - 4 times, while 14.1% of the respondents have experienced fire outbreak for more than 4 times. This indicates that the respondents are experienced enough to provide reliable information required for the study.

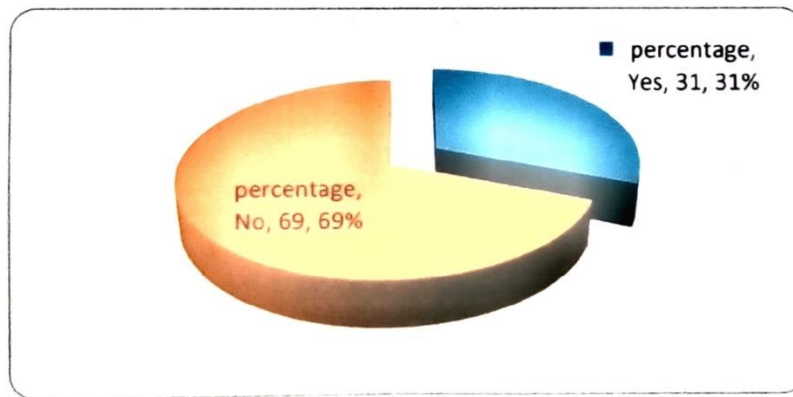


Figure 2: Experience of Fire outbreak by the respondent

Source: Researchers' Field Survey (2021)

Table 6: Frequency of Fire Experienced by Respondents

Times	Frequency	Proportion (%)
1 - 2	333	69.4
3 - 4	79	16.5
Above 4	68	14.1
Total	480	100

Source: Researchers' Field Survey (2021)

**Effectiveness of Fire Safety Measures
 Precautionary Measures for Fire
 Outbreak:**

In the context of this study, the precautionary measures have to do with the measures of providing and using firefighting equipment in the event of fire outbreak. One of the precaution measures adopted by the residents in Minna, Niger State for fire outbreak is the use of fire extinguishers. It can be seen in Figure 3 that 48 (10%) of the respondents have fire extinguishers in the homes, while 432

(90%) of them do not have fire extinguishers. This is clear evidence of lack of compliance to fire safety provisions. This is in line with the findings of Shittu *et al.* (2017); Nouban and Yunusa (2020); and Muhammad and Eze (2021) where it was also established that most of the public and residential building fire incidences and fire spreading in Minna is triggered by the absence of or failure in compliance with construction standards or regulations. Therefore, there is a need for a proactive fire mitigation strategy by building owners, occupants and fire regulatory bodies.

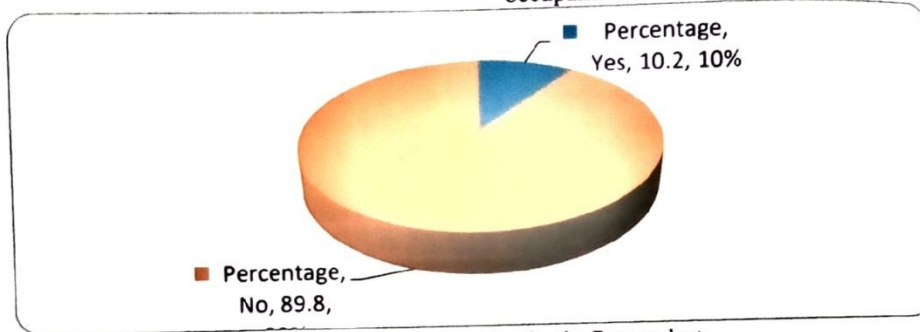


Figure 3: Fire Extinguisher by the Respondent
 Source: Researchers' Field Survey (2021)

Mitigation Strategies:

Mitigation strategies, in the context of this study, are the measures taken to reduce the severity of fire outbreak by quenching the fire before spreading. Mitigation strategies adopted by the respondents in the study area for fire outbreak were also studied. The result obtained from the data analysis is shown in Table 7. It was revealed that 65.3% of the respondents reported that the mitigation strategies for the fire outbreak they experienced came as a result of efforts from friends and neighbours, 24.5% reported that the mitigation strategies for the fire outbreak they experienced came as a result of the use of soap water, 6.1% reported that their mitigation strategies came as a result of the use of sand while 4.1% of the respondents submitted that their mitigation strategy was the use of water and Omo detergent (see Table 7).

Fire Prevention Strategies:

Fire prevention in the context of this work has to do with the measures for ensuring that

the incidence of fire outbreak is avoided. From the analysis in Table 8, it is shown that 29.0% of the respondents identified carefulness as the best way to prevent fire outbreak, 28.5% of the respondents identified the avoidance of bush burning as a way of preventing fire outbreak, while 32.3% is of the opinion that the storage of flammable materials should be avoided and 10.2% has no response.

It is also evident from this finding that building owners and occupants in Minna are not in compliance with the standard provisions of fire safety measures. This is possibly due to lack of awareness and enforcement of the regulations by the appropriate authority. Therefore, there is a need for the regulatory bodies responsible for enforcement of fire safety regulations to ensure compliance with fire safety regulation to prevent further loss of resources and human lives in Minna, Niger State.

Table 7: Mitigation Strategies by Respondents

Strategies	Frequency	Percentage
Friends/ neighbours rescue efforts	313	65.3
Soapy water	118	24.5
Sand	29	6.1
Water and Omo detergent	20	4.1
Total	480	100.0

Source: Researchers' Field Survey (2021)

Table 8: Fire Prevention Strategies

Fire Prevention Strategies	Frequency	Percentage
We are careful	139	29.0
Avoid bush burning	137	28.5
Avoid flammable materials	155	32.3
Non	49	10.2
Total	480	100.0

Source: Researchers' Field Survey (2021)

Conclusion

The study has revealed that the incessant cases of fire disaster in Minna, Niger State resulting into loss of lives and properties need to be addressed appropriately. Lack of adequate equipment have been identified has a major barrier to effective firefighting. It was also observed that in virtually all the houses visited there was absence of fire extinguishers. The study therefore concludes that the level of compliance with fire safety measures in residential buildings in Minna, Niger State is low. This suggests a relatively low level of awareness and compliance on the part of the building owners and occupants as well as negligence on the part of the fire regulatory agencies. This trend is unacceptable and detrimental to safety and security of lives and property in the Minna, Niger State.

Recommendations

Based on the findings and conclusion of this study, the following recommendations were made:

- i. In order to enhance the level of compliance of building owners and occupants to fire safety regulations, public awareness campaigns should be organized at local levels to educate the populace on the causes, effects and preventive measures for fire outbreaks in our communities.
- ii. Niger State Fire Services should put in place cogent mechanism to identify places with high

vulnerability to fire disaster and put in place effective measures to prevent fire disasters.

- iii. Geospatial database of residential properties and street guides in Minna and its environs should be provided by the Niger State Fire Service to ease the spotting of fire disaster prone areas and the fighting of fire in the society.
- iv. Adequate funding should be made available to firemen and agencies responsible for fire disaster in order to enhance their level of performance towards effective firefighting.
- v. In view of the limitations of the study, it is recommended that further research should be carried out to compare the fire safety provisions in residential buildings in Minna with housing standard compliance requirements.

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