AN INVESTIGATION OF FIRE RISK IN KIANDUTU SLUMS IN THIKA MUNICIPALITY, KENYA.

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REG NO: P57/10511/08

A thesis submitted in partial fulfillment of the requirements for the award of the degree of master in public health in the school of public health of Kenyatta University.

March 2013
DECLARATION

This thesis is my original work and has not been presented for a degree in any other University for any other award.

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To mum, you will forever remain the strong pillar behind my studies, for your support, patience, understanding, unconditional love and encouragement.
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My heartfelt gratitude go to my husband Gachago, sons Wanjohi and Mwangi. I am proud to be part of you. To all other family members and friends whose effort and assistance made this work possible, I remain grateful and may God bless and reward you greatly.

I will forever remain grateful and thankful to God for His prefect will in my life during the entire research and thesis writing process. May the name of God be praised.
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<thead>
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AIDS</td>
<td>Acquired Immunodeficiency Syndrome</td>
</tr>
<tr>
<td>AOR</td>
<td>Adjusted Odds Ratio</td>
</tr>
<tr>
<td>AURAN</td>
<td>African Urban Risk Analysis Network</td>
</tr>
<tr>
<td>CBOs</td>
<td>Community Based Organizations</td>
</tr>
<tr>
<td>CDs</td>
<td>Compact Disks</td>
</tr>
<tr>
<td>CHW</td>
<td>Community Health Workers</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>DfID</td>
<td>Department for International Development</td>
</tr>
<tr>
<td>DiMP</td>
<td>Disaster Mitigation for Sustainable Livelihoods Programme</td>
</tr>
<tr>
<td>FGD</td>
<td>Focused Group Discussion</td>
</tr>
<tr>
<td>GoK</td>
<td>Government of Kenya</td>
</tr>
<tr>
<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
</tr>
<tr>
<td>ISDR</td>
<td>International Strategy for Disaster Reduction</td>
</tr>
<tr>
<td>KII</td>
<td>Key Informant Interview</td>
</tr>
<tr>
<td>Ksh</td>
<td>Kenya shilling</td>
</tr>
<tr>
<td>MANDISA</td>
<td>Monitoring, Mapping, and Analysis of Disaster Incidents in South Africa Database</td>
</tr>
<tr>
<td>NADiMA</td>
<td>National Disaster Management Authority</td>
</tr>
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NGOs - Non Governmental Organizations

PHT - Public Health Technician

SD - Standard Deviation

SPSS - Statistical Package for Social Sciences

UNDP - United Nations Development Programme

UN-HABITAT - United Nations Human Settlements Program

USAID - United States Agency for International Development
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ABSTRACT

Slums play many roles in city life. Slums, poverty and the informal sector are closely related, but are by no means congruent. As the place of residence of low-cost laborers, they keep the wheels of the city working in many different ways. They are adept at producing the services and commercial activities that the formal sector fails to provide through the mobilization of local enterprise and industry. They are the recipients of the city’s externalities: noxious industry, waste materials, ill health, fires, crime and social dysfunction, and fragile, dangerous or polluted land that no one else wants. Slum fires are a major disaster killer in Kenya. This study aimed at a detailed investigation of the factors that cause slum fire risks through analysis of the hazards, social, political and economic reasons underlying resilience and vulnerability to provide basis for the right intervention. The objective of the study was to investigate the risks associated with fire outbreaks in Kiandutu slums. The study undertook to establish the levels of perception, vulnerability, resilience, mitigation and social capital associated with fire risks. A cross-sectional descriptive study was carried out to establish the determinants of fire risk in Kiandutu slums. Quantitative data were solicited through structured focused interviews with respondents in selected households. Focused group discussions and key informant interviews were done to collect in depth data to complement the quantitative data. The study targeted household heads who were residents in the area in the preceding one year. Cluster sampling was used to identify the villages for the study. Simple random sampling was then used to obtain the household samples from two villages and a total of 280 respondents. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 17. The findings of this study will be used to furnish a solid foundation for the Kenya Ministries of Public Health and Sanitation, Local Government, Special Programmes among others to curb slum fires and thus be in line with the rest of the world in implementing the Hyogo 2005-2015 Declaration and Framework of Action: building the resilience of nations and communities to disasters, Millennium Development Goals and Vision 2030.
CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Fire disasters are not mere events striking each particular time but the result of various processes (DfID, 2005). Many fire hazards occur in informal settlements of urban areas affecting millions of people each year through loss of life, serious injury and loss of assets and livelihoods. While the growth of mega-cities and mega-risks like earthquakes capture headlines, far more lives in urban areas are lost to everyday disasters including dirty drinking water, poor sanitation and fires (AURAN, 2006; Bull-Kamanga et al., 2003). The combination of poverty, marginality, overcrowding and limited service provision if any, exposes residents to a range of prevailing hazards particularly informal dwelling fires. Nearly half the world population lives in urban areas, and numbers are accelerating with more than half of the urban population residing in slums (Pelling and Wisner, 2009). Uncontrolled urban growth exacerbates fire hazards and vulnerability (Parnell, 2001; Spaliviero, 2006; UN-HABITAT, 2007a). Moreover, the informal settlements lack formal site planning and service infrastructure that might reduce fire risk and at the same time make mitigation feasible (AURAN, 2006; Boraine et al., 2006).

Though disasters particularly fires are among man’s oldest concerns since pre-history and myth period, they are hardly scrutinized critically to develop effective mitigation strategies (Jaya Kumar, 2000; ISDR, 2002; Shaluf et al., 2003) and these damages have shown a significant increase in the last one and a half decades (Shaluf et al., 2003; Pelling and Wisner, 2009). There is an urgent need for a sustained and comprehensive fire disaster reduction strategy. In achieving this, the needs and concerns of all social groups such as poor, rich, men, women, young, old, indigenous or non-indigenous must
be integrated into the fire disaster reduction policies and measures because the level of vulnerability depends on these social aspects (ISDR, 2002).

Collective local action and proactive interventions to reduce risks are more effective but have rarely been documented in urban Africa. The relative paucity of such collective solutions is probably a function of lack of research studies as much as the weakness of social capital and governance regimes. While many governments in Africa have disaster risk management legislation and national bodies such as Kenya’s NADIMA, there continues to be very little capacity to undertake risk awareness on the ground. Underlying this is a lack of political priority allocated to urban disaster risk (GOK, 2004; ISDR, 2005; Pelling and Wisner, 2009).

Natural fires are not common in Kenya and therefore most of the losses and destruction due to fires can be prevented if only attention is given to minimizing negligence and addressing the needs for fire disaster preparedness. Kiandutu is one of the underprivileged neighborhoods in Thika municipality. Most of the housing structures’ building materials are temporary and highly inflammable increasing risks of fire hazards (GOK, 2004). Fire disasters remain a major threat to survival, dignity, livelihood and security of people and communities, in particular the poor like those living in kiandutu slums.

1.2 Statement of the problem

Weather and climatic conditions contribute to the risk of fires in slum areas. In addition, poverty, exclusion and associated social ills like alcohol abuse and domestic violence create an environment conducive to the fires that occur frequently in informal settlements
(Gulyani and Bassett, 2007). Loss of life, large-scale injuries, damage to property and loss of livelihoods from slum fires is largely the result of inappropriate or no urban management. In slums, structures are developed with minimum compliance to sound planning requirements hence fire outbreaks end up getting out of control resulting in losses that could have been avoided (Action Aid, 2006; AURAN, 2006). Many of the informal settlements citing Kiandutu slums in Thika Municipality, Kenya are constructed with cheap and highly flammable materials including plastic, untreated wood and cardboard that increase the spread and severity of fires. Additionally high population densities coupled with lack of access roads make it easy for fire to spread between dwellings and difficult for emergency services to reach affected areas. This is compounded by lack of fire hydrants and water mains. The spaces between dwellings are often clogged with potential fuel, from flammable household waste to disused cars (GOK, 2004; AURAN, 2006; Pelling and Wisner, 2009). This study gives a clearer assessment of the factors creating vulnerability (and resilience) to disaster and will lead to better interventions and advocacy. Equally important it highlights understanding on how local people cope with and recover from disaster, and how different groups have different needs and capacities.

1.3 Justification

Data on disaster fail to capture the full extent of damage inflicted by smaller, recurrent hazards such as slum fires (AURAN, 2006). Fire disaster aggravate pre-existing poverty, creating a downward spiral of vulnerability hence arresting development (DiMP, 2002; ISDR, 2004). Kiandutu informal settlement suffer frequent fire hazards which lead to loss of lives, livelihoods and untold suffering similar to most slums in Kenya. Most of
these fires can be eradicated through proper urban planning and management. This study aimed at a detailed investigation of the factors that are associated with slum fire risks and subsequently documented baseline information that could be used for urban planning in order to reduce fires and resultant economic losses. This was done through analysis of the hazards, social, political and economic reasons underlying resilience and vulnerability to provide the basis for initiating the right interventions. The situation of fires in Kiandutu slums represents most of the slums in Kenya and therefore knowledge on the levels of fire risk perception, resilience and vulnerability at Kiandutu could be used to develop mitigation measures against fire disasters in slums in Kenya and even in other African countries.

1.4 Research questions.

i) What is the level of perception of fire risk among people living in Kiandutu slums?

ii) Is there resilience to cope with fire risk among the people living in Kiandutu slums?

iii) Does the community living in Kiandutu slums have the social capital to address fire risk?

iv) Are there mitigation measures in place to reduce fire risk in Kiandutu slums?

v) What are the vulnerability factors affecting fire risk in Kiandutu slums?

1.5 Null Hypotheses.

There are no risks associated with fire outbreaks in Kiandutu slums.
1.6 General objective

To investigate the risks associated with fire outbreaks in Kiandutu slums in Thika Municipality of Kiambu County in Kenya.

1.7 Specific objectives.

The specific objectives are to:

a) determine the level of perception of fire risk among the population living in Kiandutu slums;

b) establish if there is resilience to cope with fire risk among the population living in Kiandutu slums;

c) determine if the community living in Kiandutu slums have social capital to address fire risk;

d) establish if there are mitigation measures in place to reduce fire risk in Kiandutu slums;

e) determine the vulnerability factors that lead to high incidence of fires in Kiandutu slums.

1.8 Significance of the study

This study has documented fire risk factors in Kiandutu slums which could be made available to the Government of Kenya for use in establishing a solid foundation and strategies to prevent and control slum fires. This would contribute to the agenda set forth by the Hyogo framework for action 2005-2015 (ISDR, 2005) and the Millennium Development Goals. The study will enlighten stakeholders on how to involve the
community and integrate fire risk reduction strategies with development activities. The study sheds light on a community-centered approach, building on existing knowledge and resourcefulness, and upgrading the skills and status of those at risk, so they can cope with and recover from the full range of fire hazards which confront them.
1.9 Conceptual framework

**Perception**: This includes causes of fire, exposure, frequencies, risk areas and effects of fire.

**Resilience**: This includes source of livelihood, income, credit access, savings and assets.

**Social capital**: This includes local initiatives, communication and communally owned assets.

**Mitigation**: This includes risk reduction strategies, dumping regulations and willingness to upgrade.

**Vulnerability**: This includes reasons for settling, place of origin, duration of stay, barriers to moving out, house ownership and source of fuel.
CHAPTER TWO: LITERATURE REVIEW

2.1 Urbanization, informal settlements and fire risk

Slums have grown as a seemingly inevitable part of modern urban life. Low-income people find the cheap accommodation helpful in their need to keep housekeeping costs low enough to afford. To do this, they tolerate much less than ideal conditions, no doubt hoping to improve and move to a better place. If the cheap accommodation is also well placed for employment, the better. Where they are not well placed for work or where formal work is not available or not sought, slum housing often plays host to a lively community of home-based enterprises of all sorts, providing the services and employment opportunities unfulfilled by planned cities. This however creates and increases vulnerability to fires (McEntire, 2005; MacGregor et al., 2005).

Morrissey and Taylor (2006) pointed out that massive fires are a frequent occurrence in many slum and squatter settlements because of lack of publicly provided fire-fighting systems, extreme proximity and high density of shelters, narrow alleys impeding access by fire fighters, poorly wired electrical systems or use of kerosene stoves and lamps, lack of water sources to douse the flames, and combustibility of construction materials. The absence of municipal development controls to ensure acceptable levels of fire safety further amplifies fire risk. Many slums have experienced such disasters or continue to face serious risks in this regard. Descriptions of recent fire disasters in slums and squatter settlements make it clear that arson may be used as a weapon, either by public or private interests to remove these communities in preparation for commercial development.
Due to lack of adequate formal provision of services within slums, there exist myriad examples of informal provision, ranging from illegal ‘rented’ electrical connections to squatter homes on the shorefront of Asunción, to unauthorized jitney bus services in Bogotá, to clandestine water taps, community wells and open sewers in Mexico City and Nairobi City (Pelling, 2003).

In many slums, especially in poor countries, many people live in narrow alleys that do not allow vehicles like ambulances and fire trucks to pass. The lack of services such as routine garbage collection allows rubbish to accumulate in huge quantities. Lack of infrastructure is caused by the informal nature of settlement and lack of planning for the poor by government officials (Osorio and Hurych, 2004). Slums are generally home to the poorest and most marginalized urban populations. The combination of poverty, marginality, overcrowding and limited, if any, service provision, exposes residents to a range of ongoing hazards, particularly informal dwelling fires, and creates a risk environment in which the effects of even minor incidents can be devastating for the affected households (Robyn, 2009).

Urbanization especially in Africa created more problems than the development it ought to have brought. The speed of population growth in African cities and towns is both a challenge and an opportunity for managing disaster risk. The rate of growth of informal settlements in the cities is beyond the capacity of urban governments to cope with. Similarly, local action has not yet shown itself capable of achieving the scale of change needed to improve resilience for the large number of the urban poor. From the foregoing it is clear that informal settlements are beyond the reach of land-use planning,
construction codes, portable water, sanitation, police and health or education services which are a growing reality (Pelling and Wisner, 2009).

Kenya has witnessed a rapid rate of urbanization (about 6% per annum) since independence in 1963. Independence guaranteed freedom of movement, which has also been accompanied with high rates of rural-urban migration. Against rapid urban growth, the country has registered deterioration in institutional and physical infrastructure hence Kenyan urban centers are characterized by expansive informal settlements, poor water and sanitation infrastructure and services (Obudho, 1997; Odhiambo and Mando, 2003). Informal settlements occupy an ambiguous legal position, being technically illegal but residents are protected by legislation granting them de facto tenure rights by virtue of living on the land, and are broadly characterized by a lack of formal housing and service delivery (Robyn, 2009).

2.2 Fire vulnerability factors

Vulnerability is a set of conditions that affect the ability of countries, communities and individuals to prevent, mitigate, prepare for and respond to hazards (Ariyabandu and Wickramasinghe, 2003). It is seen that all individuals and communities are to varying degrees vulnerable to hazards and all have intrinsic capacities to reduce their vulnerability. Vulnerability acts as the dependant component while the triggering agent stands as the independent component of a disaster. This dependant component is determined by the degree of risk, susceptibility, resistance and resilience (McEntire, 2001).
Slums have numerous economic, social, as well as infrastructure problems which increase their vulnerability to fires. In addition, slum dwellers lack proper housing, water and sanitation and are exposed to serious health risks, and have limited access to credit and the formal job market maybe due to stigmatization, discrimination and geographic isolation all of which increase fire vulnerability. Furthermore, they have limited access to social and economic networks. Slum areas in cities have high population densities and high concentrations of social and economic deprivation, which may include broken families, unemployment, economic, physical and social exclusion making fire mitigation difficult (Gulyani and Bassett, 2007). Other vulnerability factors include faulty and mostly illegal electricity connections and use of flammable energy alternatives when the power is cut off cause fires, which destroy homes and displace, injure or kill many people (USAID, 2004).

Disasters disrupt society with enormous damage to the human life, environment and economic resources, treat women and men differently. Women are more vulnerable to the consequences of disasters because of their social role. This emphasizes the need to achieve gender equality in disaster reduction and integrate a gendered perspective to all policies and measures implemented in disaster management such as fires (ISDR, 2002; Ginige, et.al., 2009).

2.3 Fire Disaster risk reduction

Disaster risk reduction is the conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout society, to avoid or prevent or to limit (mitigation and preparedness) the adverse impacts of hazards, within
the broad context of sustainable development (ISDR, 2004). Disaster preparedness through minimizing vulnerabilities has been identified as a better approach to face disasters than post-disaster responsiveness (ISDR, 1994; Sahni and Ariyabandu, 2003). Creating a culture of prevention is essential to address everyday hazards and the consequences of a disaster. In this regard, fire risk reduction must be more decisively incorporated as an essential component of all development strategies, policies, programmes and investments for national and local governments (Goodyear, 2003). Fire disaster reduction incorporates taking measures in advance, addressing risk reduction, involving environmental protection, social equity and economic growth, the three cornerstones of sustainable development, to ensure that development efforts do not increase vulnerability to hazards (ISDR, 2002).

Disaster management research reveals a close inter-relationship between disaster risk reduction and sustainable development. Studies established that many development activities have responsibility and inter-relationship with disaster risk reduction due to the fact that both development and disaster management are aimed at vulnerability reduction (Stanchion, 1997). Further, it is indicated that development can increase and/or decrease disaster vulnerability (McEntire, 2004). It is essential, therefore, to take measures of disaster risk reduction into consideration in all development activities. Sustainable development, poverty reduction, good governance and disaster risk reduction are mutually supportive objectives. In order to meet the challenges ahead, it is necessary to build capacity at the community and national levels to manage and reduce risk (DfID, 2005; ISDR, 2005; Pelling and Holloway, 2006).
Working with local actors to build resilience enables risk reduction work to be tailored to the varied needs of those living with the risk. Capacity building is more effective when undertaken within a wider framework of social development. Government or municipality-sponsored social safety nets, the upgrading of slums, social housing or community development programmes have great potential for bringing multiple benefits including risk reduction. Gaining access to land title provides security and stimulates investment by the urban poor (Khatun, 2003; UN-HABITAT, 2007b).

In view of the great risks and high cost of hazards including fires, a disaster risk reduction approach has led to the adoption of frameworks and strategies reaffirming the close links between disaster risk reduction and sustainable development (UNDP, 2004).

### 2.4 Fire Resilience

The term ‘resilience’ is used to describe the capacity to survive, adapt and bounce back from crisis (UN-HABITAT, 2007a; Winser, 2006). Development aid has shifted towards people centered approaches based on local capacities. Meanwhile, the unplanned acceleration of urban areas is concentrating new risks. International media tend to portray disaster-affected communities as helpless; saved only by external/foreign aid. Rural development and famine studies of the 1970s and 1980s shifted their analysis from what people lacked to what actions they took to survive crisis, what their priorities were and how to build on what was already there. In the field of disasters, most emphasis has remained on assessing needs, hazards and vulnerabilities; at the expense of analyzing the strengths, skills and resources available within communities which constitute resilience (Wisner, 2006).
Despite best intentions, identifying what is missing in a crisis (needs, vulnerabilities) is more tempting and perhaps better rationalizes the intervention than identifying what is already in place (capacities). Why has disaster management not been able to reorient itself over the last 20 years, despite all the efforts made in this direction? If we focus only on needs and vulnerabilities, we remain locked in the logic of repetitive responses that fail to nurture the capacities for resilience contained within every community. Much has been talked about building capacity and resilience for decades. It is now time to turn rhetoric into reality: to dispel the myth of the helpless victim and the infallible humanitarian, and put disaster-affected people and their abilities at the centre of policy makers work (Spaliviero, 2006).

As much as the density and settlement patterns in informal settlements increase their risk to fire disasters, urbanization provides a critical mass of human skill and capacity that could be directed towards reducing risk and coping with the impact of disasters. Urbanization thus generates both risk and pathways for resilience (La Trobe and Faleiro, 2007). People’s science (local, vernacular or lay knowledge) shapes local coping as well as perceptions of safety and blame for risk and is an important determinant of local action and policy advocacy.

Communities continually adapt to crisis, coming up with creative solutions. They prioritize livelihoods and household assets rather than the quick fix. Supporting resilience means more than delivering relief or mitigating individual hazards. Local knowledge, skills, determination, livelihoods, cooperation, access to resources and representation are all vital factors enabling people to bounce back from disaster. This implies that even the
use of aid in reducing disasters must be integrated to focus on the priorities and capacities of those who need help (Villacis and Cardona, 2004).

Bruneau et al, (2003) found that disaster impacts aggravate pre-existing poverty, creating a downward spiral of vulnerability, arresting development. Clearer assessments of the factors creating vulnerability (and resilience) to disaster could lead to better interventions and advocacy. Equally important is understanding how local people cope with and recover from disaster, and how different groups have different needs and capacities. For this reason, the only sustainable way to boost resilience is to integrate disaster risk reduction within the wider development process. Such an approach mirrors the outlook of vulnerable people, who are often more concerned about reducing chronic, long-term risks like poverty or ill health, than they are about mitigating one-off disasters. This approach also entails working in cooperation with local government wherever possible. Sometimes, initiatives started at a local level do well such that the government may pick them up and apply them elsewhere Kreimer et al., (2003).

2.5 Social capital and fire risk

The way in which society acts collectively to confront hazards and reduce risk is a complex, yet extremely important factor in determining vulnerability. The ability to act collectively is often described in terms of “social capital”, a problematic term with many different definitions and interpretations. According to Lochner et al., (1999), social capital “consists of the features of social organization - such as networks of secondary associations, high levels of interpersonal trust and norms of mutual aid and reciprocity - which act as resources for individuals and facilitate collective action.” Paldam and
Svendsen (2000) defined social capital as “the density of trust” which “determines how easily people work together”.

According to Alexander (2000), social capital (reciprocity, affiliations, trust) includes networks that provide informal safety nets during difficult times and help people access resources urgently needed after disaster, such as credit or labor. The most resilient communities are those which work together towards a common aim. Groups of similar class, ethnicity, livelihood or wealth are more likely to cooperate in building resilience than divided communities. Creating community consensus is as valuable as building physical infrastructure. Strengthening social capital should be the key objective of disaster interventions, whether in relief, recovery or risk reduction – rather than a by-product.

2.6 Fire Risk perception and disaster preparedness

According to Burns and Sullivan (2000) perception of chances that a disaster could occur has long been held as a critical factor prompting individuals and families to avoid physical threats of disasters as well as prepare for them. In our imperfect world, the physical environment can be conceived as being ‘risky’, with risk level dependent on how we evaluate each situation (Thompson and Mingay, 1991; Ewald, 1991). Disaster related behavior is guided by social rationality and affects how people socially construct a disaster experience and what they learn from it. Risk perception of an impending disaster and consequent behavior is a collective social phenomenon (Alexander, 2000). What is perceived as risky depends to a great extent on historical experiences that are
culturally embedded in various social frameworks such as the community and family (Slovik, 1987).

Research on response to disaster warnings has likewise stressed on how situational perceptions of risk seem to be triggered by the manner in which risk is communicated and interpreted through social interaction with neighbors (Mileti and Serensen, 1990; Kirschenbaum, 1992). However, as argued by Whitehead and others in 2001, the link between the risk perception of an impending disaster and actual preparedness is unclear. Available evidence has shown that a wide range of behaviors is not consistently predicted by risk perception (Wogalter et al., 1999).
CHAPTER THREE: MATERIALS AND METHODS

3.1. Research design

A cross sectional descriptive study was carried out to establish the determinants of fire risk in Kiandutu slums. The survey allowed for the collection of extensive data within a short time period. Quantitative data was solicited through household interviews with household heads or spouses. Key informant interviews and focused group discussions was used to collect qualitative data to complement quantitative data.

3.2. The study area

The study was done in Kiandutu slums within Thika Municipality of Kiambu County in Kenya (figure 3.1). Kiandutu slum was purposively selected since it is the largest slum in Thika municipality and has had at least one reported fire incident each year for the past ten years. Table 3.1 shows fire incidence records derived from the fire register of Thika Municipal Council from 2005 to 2009.
Table 3.1 Fire incidences in Thika Municipality and Kiandutu slums (Thika fire station register, 2005-2009).

<table>
<thead>
<tr>
<th>Year</th>
<th>total number of fires reported</th>
<th>Kiandutu fire incidences in Thika Municipality</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>19</td>
<td>4</td>
</tr>
<tr>
<td>2008</td>
<td>37</td>
<td>3</td>
</tr>
<tr>
<td>2007</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>2006</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>2005</td>
<td>18</td>
<td>3</td>
</tr>
</tbody>
</table>
Figure 3.1 Map of the study area, Inset: map of Kenya showing location of the Study area
3.3 Variables

3.3.1 Dependent variables

The outcome variable (dependent) was slum fire risk.

3.3.2 Independent variables

The predictor variables (independent) of the study included fire mitigation measures, fire vulnerability factors, perception on fire risk, resilience to fire disasters and social capital.

3.4. Target population

The target population consisted of household heads/ spouses in the study area.

3.4.1 Study population

The study population consisted primarily of household heads/ spouses in the selected households who were twenty years and above and having been residents for the preceding one year in the study area.

3.5. Sampling technique

According to the 2009 census, Kiandutu slums have a population of 14,517 people. Purposive sampling was employed to select the study area. Cluster sampling was used to identify the villages/block that were included in the study. A village/block for the purpose of this study was signified as a cluster. Kiandutu has four villages namely Mtatu, Center, Molo and Maziwa which are further subdivided into eight blocks for ease of administration. Each block formed a cluster. Four clusters out of the eight were selected randomly. All the names of the eight clusters were written on separate pieces of paper.
after which they were folded and put in a container and two people (researcher and one research assistant) picked the clusters to be included in the study to avoid bias. Simple random sampling was used to select households that were included in the study to yield 281 respondents.

3.6. Sample size determination.

The sample size was calculated using the formula by (Fisher et al, 1998), i.e.

\[ n = \frac{z^2 pq}{d^2} \]

The prevalence was a calculation of Kiandutu fires versus all the fires that occurred in Thika Municipality (Thika municipal fire station register, 2002 to 2009).

The prevalence of slum fires (24%) and a design effect of 1 (which doubles the sample size). The design effect is brought about by the fact that cluster proximity means that the choice of households was not independent from the choice of other households and therefore doubling the sample size counteracts this effect.

The sample size was calculated based on 95% confidence level and a precision of 5%.

\[ n = \text{Sample size} \]

\[ z = \text{Standard normal deviate (1.96) which corresponds to 95% confidence interval.} \]

\[ p = \text{proportion in target population estimated to have particular characteristic (24%) for this study } p = 0.24 \]

\[ q = 1-p=0.76 \]
\[ d = \text{degree of accuracy} = 0.05 \text{ for this study} \]

\[ n = \frac{(1.96^2 \times 0.24 \times 0.76)}{0.05^2} \]

\[ n = 281 \]

### 3.7 Logical and Ethical considerations

Clearance for research was sought from the Ministry of Education, Kenyatta University and the Office of the President (Provincial Administration). The target households in the study area were given adequate explanation on the purpose of the research. They were given time to seek clarifications and/or ask questions before being recruited into the study. Informed consent was sought from the sample population before conducting interviews. Participation was fully voluntary and confidentiality was maintained at all levels during the study.

### 3.8 Instruments and methods

#### 3.8.1 Construction and research instruments

Three types of instruments were used to collect data including an interview schedule, focus group discussion (FGD) guide and key informant interview (KII) guide. Structured interview schedules were administered to respondents to collect quantitative data. FGD guides were used to collect indepth information from male household heads, female household heads, the youth and fire brigade staff basically regarding their attitude, beliefs and practices on fire vulnerability, preparedness and resilience. KII guides were used with the area chief, PHT, Council representative, church leaders. FGD and KII gave quantitative data.
3.9. Data collection techniques

The area provincial administration was briefed about the purpose of the study and their authority sought before commencing the study. They were used in social mobilization to minimize resistance from the community. Study guides or CHWs (community health workers) from the area were sought and recruited to introduce the researcher and the research assistants as they are well known in the community. Since they are familiar with the blocks, they led the research team while moving around. Three research assistants were recruited and trained to assist in data collection for the study. A pilot study was done in a few households outside the four clusters chosen to pretest all the research instruments. All the research assistants familiarized themselves with the research tools during the pilot study. This also enabled potential problem to be identified and addressed assessed the effectiveness and reliability of the research instruments and determined their suitability for use in the study. Data obtained from the pilot study was used to moderate the final research instruments.

3.10 Data Quality Measures

3.10.1 Validity

Cluster and simple random sampling were used to select blocks (clusters) included in the study. Simple random sampling was then used to obtain the desired sample size. Interview schedule, key informant interviews and focus group discussion guide were used to collect data on the determinants of fire risk in Kiandutu slums. All the research instruments were pretested before the actual study.
3.10.2 Reliability

The research assistants were trained prior to actual data collection to ensure they collected the desired data. Each assistant was accompanied by two people for security purposes. For accuracy the researcher accompanied each group on alternate days. All used research tools were counterchecked by the researcher at the end of each day for any mistakes and errors.

3.11 Data management and analysis

3.11.1 Data management

The quantitative data was coded and double entered into a computer database designed using MS-Access application. Data cleaning and validation was performed in order to achieve a clean dataset that was then exported into a Statistical Package format (SPSS 17). A clean dataset was stored in a computer hard drive for analysis. Back up files were stored in CDs and external hard disk regularly to avoid any loss or tampering.

3.11.2 Data analysis

Data analysis was conducted using SPSS statistical software. Exploratory data techniques were used at the initial stage of analysis to uncover the structure of data and identify outliers or unusual entered values. Quantitative data was coded and processed using SPSS version 17.0. Descriptive statistics such as frequencies, standard deviation and means were used to summarize, organize and simplify the data collected. Correlation analysis was employed to test the relationship between dependent and independent variables. A significance level of 0.05 was used. Quantitative data was presented using frequency tables and graphs while qualitative data was used to reinforce the quantitative data.
3.11.2.1 Univariate analysis:

Descriptive statistics such as proportions and summaries of categorical variables and get
measures of central tendency for continuous variables. The dependent variable was
generated by weighting and scoring of the respondents perception if fire risks to obtain an
overall score.

3.11.2.2 Bivariate Analysis:

All exposure variables (Independent factors) were associated with the dependent variable
(fire risks score) to determine which ones have significant association. Odds Ratio (OR)
and 95% Confidence Interval (CI) were used to estimate the strength of association
between independent variables and the dependent variable. The threshold for statistical
significance was set at $\alpha = 0.05$ and a two-sided p value at 95% confidence intervals (CI)
reported for corresponding analysis.

3.11.2.3 Multivariate Analysis:

All independent variables identified to significantly associate with fire risk at bivariate
analysis were considered together in a multivariate analysis. This was performed using
Binary logistic. Adjusted odds Ratios (AOR) together with their respective 95%
Confidence Interval (CI) were used to estimate the strength of association between the
retained independent factors and fire risk.
CHAPTER FOUR: RESULTS

4.1 Social - demographic characteristics, Education and Social economic status of study population

A total of 280 households were sampled from four out of eight blocks of the expansive Kiandutu slum in Thika municipality. In each of the household, a respondent who must have stayed in the area one year prior to our study and was 18 years and above was identified and worked with the research team to fill in the structured questionnaire. Table 4.1 shows socio-demographic characteristics of the respondents. The age of respondents had a range of (18 – 88), a mean of 38.9 yrs, a SD (standard deviation) of 2.7 and a median of 36.

Table 4.1: Socio-demographic characteristics, Education and Socio-economic status

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>description</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marital status</td>
<td>married</td>
<td>170</td>
<td>62.2</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>56</td>
<td>20.9</td>
</tr>
<tr>
<td></td>
<td>widowed</td>
<td>28</td>
<td>7.1</td>
</tr>
<tr>
<td></td>
<td>Divorced/separated</td>
<td>26</td>
<td>9.7</td>
</tr>
<tr>
<td>Level of education</td>
<td>Primary complete</td>
<td>99</td>
<td>35.7</td>
</tr>
<tr>
<td></td>
<td>Primary incomplete</td>
<td>65</td>
<td>23.5</td>
</tr>
<tr>
<td></td>
<td>Secondary incomplete</td>
<td>42</td>
<td>14.4</td>
</tr>
<tr>
<td></td>
<td>Secondary complete</td>
<td>34</td>
<td>12.3</td>
</tr>
<tr>
<td></td>
<td>College certificate</td>
<td>4</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>No education</td>
<td>36</td>
<td>12.6</td>
</tr>
<tr>
<td>Occupation</td>
<td>Business</td>
<td>120</td>
<td>42.8</td>
</tr>
<tr>
<td></td>
<td>Casual laborer</td>
<td>99</td>
<td>35.1</td>
</tr>
<tr>
<td></td>
<td>Housewife</td>
<td>34</td>
<td>11.6</td>
</tr>
<tr>
<td></td>
<td>Farmer</td>
<td>14</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>Formal employment</td>
<td>13</td>
<td>4.3</td>
</tr>
<tr>
<td>Household size</td>
<td>1 person</td>
<td>139</td>
<td>49.6</td>
</tr>
<tr>
<td></td>
<td>2 persons</td>
<td>59</td>
<td>21.1</td>
</tr>
<tr>
<td></td>
<td>3 persons</td>
<td>32</td>
<td>11.4</td>
</tr>
<tr>
<td></td>
<td>4 persons</td>
<td>22</td>
<td>7.9</td>
</tr>
<tr>
<td></td>
<td>5 and above persons</td>
<td>28</td>
<td>10.0</td>
</tr>
</tbody>
</table>
4.2 Measures of perception of vulnerability

Perception of vulnerability was investigated from two broad aspects, (1) perception of the risk of fire occurring within their area, (2) risk perception of the household’s vulnerability of being victims of fire. To determine the levels of vulnerability the responses to the various questions were weighted with those identifying higher risk getting a higher weight.

The aspects that constituted the overall score for the vulnerability to fire occurrence within their area are listed in table 4.2. The scores were also assigned as indicated. Table 4.2 shows the distribution of the scores and responses among the respondents.
### Table 4.2 Respondent’s perception of fire risk factors

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Response</th>
<th>Score</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of exposure to fire risk</td>
<td>Illegal electricity connections</td>
<td>1</td>
<td>21</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>Population density</td>
<td>2</td>
<td>30</td>
<td>10.7</td>
</tr>
<tr>
<td></td>
<td>Poverty/Congestion/Access roads</td>
<td>3</td>
<td>203</td>
<td>72.5</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>0</td>
<td>26</td>
<td>9.3</td>
</tr>
<tr>
<td>Causes of fire</td>
<td>Domestic violence</td>
<td>1</td>
<td>52</td>
<td>17.0</td>
</tr>
<tr>
<td></td>
<td>Electric/cooking fuel faults</td>
<td>2</td>
<td>253</td>
<td>83.0</td>
</tr>
<tr>
<td>Where fire occurs</td>
<td>Business premise</td>
<td>1</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>Residential/Domestic</td>
<td>2</td>
<td>277</td>
<td>98.9</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>0</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Fire frequency</td>
<td>Decreased</td>
<td>1</td>
<td>104</td>
<td>37.1</td>
</tr>
<tr>
<td></td>
<td>Stayed the same</td>
<td>2</td>
<td>13</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>Increased</td>
<td>3</td>
<td>54</td>
<td>19.3</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>0</td>
<td>109</td>
<td>38.9</td>
</tr>
<tr>
<td>Council take measures</td>
<td>Yes</td>
<td>1</td>
<td>102</td>
<td>36.4</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>2</td>
<td>73</td>
<td>26.1</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>0</td>
<td>105</td>
<td>37.5</td>
</tr>
</tbody>
</table>

Based on the scoring of various responses shown in Table 4.2 the total score one would get was a maximum of 13 which means that, the respondent has a high perception of the risks likely to cause fire thus making them less vulnerable. The lesser the score indicated that the respondent did not appreciate the risk factors associated with fire occurrences.
hence they are prone to place themselves within vulnerability. On the overall score for
the perception of vulnerability of fire occurring within their area, the scores ranged from
a low of 0 to a high of 9 (range = 9) with a mean of 4.8, SD 1.4 and a median of 4.5.
Using the median, the respondents were classified into two broad categories of risk
perception as high perception (those with scores above the median) and low perception
(those below the median). On classifying them the distribution was such that the
population was divided in the midline with 50% having high vulnerability and the
remaining 50% with low vulnerability.

4.2.1 Risk perception of the household’s vulnerability

The aspects that constituted the overall score for the risk perception of the household’s
vulnerability are as listed in table 4.3. The scores were assigned as indicated. The table
also shows the distribution of the scores and responses among the respondents.
<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Response</th>
<th>score</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected by fire (n=36)</td>
<td>Yes</td>
<td>1</td>
<td>36.0</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>3</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Less than 1 month</td>
<td>1</td>
<td>25</td>
<td>69.4</td>
</tr>
<tr>
<td></td>
<td>Less than 6 months</td>
<td>2</td>
<td>2</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td>Less than 1 year</td>
<td>3</td>
<td>6</td>
<td>16.7</td>
</tr>
<tr>
<td>When affected (n=36)</td>
<td>No response</td>
<td>0</td>
<td>5</td>
<td>13.9</td>
</tr>
<tr>
<td></td>
<td>Neighbor</td>
<td>1</td>
<td>16</td>
<td>44.4</td>
</tr>
<tr>
<td></td>
<td>Own house</td>
<td>2</td>
<td>15</td>
<td>41.7</td>
</tr>
<tr>
<td>Origin of fire (n=36)</td>
<td>No response</td>
<td>0</td>
<td>6</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>Neighbor</td>
<td>1</td>
<td>22</td>
<td>61.1</td>
</tr>
<tr>
<td></td>
<td>Own house</td>
<td>2</td>
<td>8</td>
<td>22.2</td>
</tr>
<tr>
<td>Effects if fire (n=36)</td>
<td>No response</td>
<td>0</td>
<td>5</td>
<td>13.9</td>
</tr>
<tr>
<td></td>
<td>Loss of live or property</td>
<td>1</td>
<td>22</td>
<td>61.1</td>
</tr>
<tr>
<td></td>
<td>Loss of live and/or property</td>
<td>2</td>
<td>8</td>
<td>22.2</td>
</tr>
<tr>
<td>Notified by (n=36)</td>
<td>No response</td>
<td>0</td>
<td>5</td>
<td>13.9</td>
</tr>
<tr>
<td></td>
<td>Was at site</td>
<td>1</td>
<td>13</td>
<td>36.1</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>2</td>
<td>18</td>
<td>50.0</td>
</tr>
<tr>
<td>Immediate reaction (n=36)</td>
<td>No response</td>
<td>0</td>
<td>6</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>Said reaction</td>
<td>1</td>
<td>30</td>
<td>83.3</td>
</tr>
<tr>
<td>Self obligation (n=280)</td>
<td>Yes</td>
<td>0</td>
<td>244</td>
<td>87.1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>1</td>
<td>36</td>
<td>12.9</td>
</tr>
<tr>
<td>Fire from own house (n=280)</td>
<td>No</td>
<td>0</td>
<td>175</td>
<td>62.5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1</td>
<td>105</td>
<td>37.5</td>
</tr>
<tr>
<td>Aware of measures (n=280)</td>
<td>Yes</td>
<td>0</td>
<td>178</td>
<td>63.6</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>1</td>
<td>102</td>
<td>36.4</td>
</tr>
</tbody>
</table>
From the results presented in Table 4.3, the total score one would score was a maximum of 14 which means that the person had a high perception of the risks factors and measures likely to be taken in case of fire thus making them less vulnerable. The less the score indicated that the person did not appreciate the risk factors and measures in the event of fire occurrences hence they are prone or take the wrong actions. On the overall score for the risk perception of the household’s vulnerability the scores ranged from a low of 0 to a high of 14 (range =14) with a mean of 2.12, SD 3.4 and a median of 1.0. Using the median, the respondents were classified into two broad categories of risk perception as high perception (those with scores above the median) and low perception (those below the median). On classifying them the distribution was up to 75% having low perception (210/280 respondents) and therefore high vulnerability. Those with low vulnerability were 25% (70/280).

4.2.2 Overall perception of vulnerability

From the two perspectives of perception of vulnerability, the scores were used to generate an overall index of household’s perception to fire vulnerability. A possible maximum total score of 27 was generated to represent those with highest perception hence low vulnerability. From the respondents, the scores ranged from 0 – 20 (range = 20) with a mean score of 6.97, SD3.56 and a median score of 6.0. Using the median score again the overall perception was classified into the two main categories as shown in the figure 4.1.
4.3 Resilience ability of household

The study looked into aspects of the household ability to get back on track in the event of a fire in their household. In terms of engagement of economic activities, all respondents were engaged in some form of activity with the majority (40%) being in formal employment although about 49.1% were earning in the range of between Kshs. 1000 – 5000. Table 4.4 shows the distribution of the respondents’ aspects on the household resilience ability in the event they fell to be victims of fire.
Table 4.4 Resilience factors to fire risks

<table>
<thead>
<tr>
<th>Resilience factor</th>
<th>response</th>
<th>N (n=280)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main source of Livelihood</td>
<td>Formal employment</td>
<td>112</td>
<td>40.0</td>
</tr>
<tr>
<td></td>
<td>Casual labor</td>
<td>82</td>
<td>29.3</td>
</tr>
<tr>
<td></td>
<td>Business</td>
<td>73</td>
<td>26.1</td>
</tr>
<tr>
<td></td>
<td>Farming</td>
<td>13</td>
<td>4.6</td>
</tr>
<tr>
<td>Approximate monthly income</td>
<td>1000 - 5000</td>
<td>136</td>
<td>49.1</td>
</tr>
<tr>
<td></td>
<td>5001 - 10000</td>
<td>60</td>
<td>21.7</td>
</tr>
<tr>
<td></td>
<td>10001-15000</td>
<td>44</td>
<td>15.9</td>
</tr>
<tr>
<td></td>
<td>Over 15000</td>
<td>37</td>
<td>13.4</td>
</tr>
<tr>
<td>Access to micro credit</td>
<td>No</td>
<td>186</td>
<td>67.1</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>91</td>
<td>32.9</td>
</tr>
<tr>
<td>Hosting fire victims (relatives)</td>
<td>No</td>
<td>232</td>
<td>83.2</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>47</td>
<td>16.8</td>
</tr>
<tr>
<td>Savings for fire incidences</td>
<td>No</td>
<td>221</td>
<td>79.2</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>58</td>
<td>20.8</td>
</tr>
<tr>
<td>Own any assets</td>
<td>No</td>
<td>227</td>
<td>81.4</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>52</td>
<td>18.8</td>
</tr>
<tr>
<td>Friend who can assist in case of fire</td>
<td>No</td>
<td>91</td>
<td>54.8</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>75</td>
<td>45.2</td>
</tr>
<tr>
<td>Local CBO’s concerned with fire disaster</td>
<td>No</td>
<td>170</td>
<td>60.7</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>75</td>
<td>26.8</td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>35</td>
<td>12.5</td>
</tr>
<tr>
<td>Participate in priority setting related to fire</td>
<td>No</td>
<td>216</td>
<td>77.7</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>62</td>
<td>22.3</td>
</tr>
</tbody>
</table>
The respondent’s responses were weighted to yield a resilience score. The score included all the aspects above apart from the main sources of income. Upon weighting the responses the total possible score a respondent would attain was 11 points. Those who scored highly indicate that their particular household would be more resilient in the event of a fire outbreak. The scores ranged from a low of 1 to a high of 9 with a mean score of 4.2, SD 1.8 and a median of 4.0. This means the population has low resilience levels since the possible score was 11 and the median score of 4 was lower than half of the maximum score. The scored respondents were then grouped in to two main categories using the median score such that those with lower than the median were interpreted to have poor resilience and those scoring above the median being viewed as more resilient. The results gave 61.1% (174/280) were resilient while the remaining 37% (106/280) had low resilience to fires.

4.4 Mitigation

Mitigation of fire occurrences was also evaluated for the respondents. The various aspects which were used to determine the respondent’s levels of mitigation are as indicated in the table below. From Table 4.5 a respondent could only score a maximum of 8 if they had taken measures that would mitigate fire occurrence. Table 4.5 shows the score and proportions of residents per the aspects.
Table 4.5 Mitigation factors to fire risks

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>response</th>
<th>Score</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action to reduce fire risk</td>
<td>No</td>
<td>1</td>
<td>91</td>
<td>55.5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>0</td>
<td>73</td>
<td>44.5</td>
</tr>
<tr>
<td>Waste disposal management</td>
<td>No</td>
<td>0</td>
<td>201</td>
<td>73.1</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1</td>
<td>74</td>
<td>26.9</td>
</tr>
<tr>
<td>Smoke detectors present</td>
<td>No</td>
<td>0</td>
<td>270</td>
<td>98.5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1</td>
<td>4</td>
<td>1.5</td>
</tr>
<tr>
<td>Willingness to upgrade the house</td>
<td>No</td>
<td>0</td>
<td>156</td>
<td>56.7</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1</td>
<td>119</td>
<td>43.3</td>
</tr>
<tr>
<td>Fire warning systems</td>
<td>No</td>
<td>0</td>
<td>190</td>
<td>70.1</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1</td>
<td>81</td>
<td>29.9</td>
</tr>
<tr>
<td>Upgrade the settlement</td>
<td>No</td>
<td>0</td>
<td>268</td>
<td>97.1</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1</td>
<td>8</td>
<td>2.9</td>
</tr>
<tr>
<td>Involved in fire drills</td>
<td>No</td>
<td>0</td>
<td>270</td>
<td>97.1</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1</td>
<td>8</td>
<td>2.9</td>
</tr>
<tr>
<td>Good communication networks</td>
<td>No</td>
<td>0</td>
<td>162</td>
<td>57.7</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1</td>
<td>118</td>
<td>42.3</td>
</tr>
</tbody>
</table>

Those who scored highly indicated that the particular household had poor knowledge and/or had not taken steps to reduce the possibility of fire. Out of a possible high score of 9, the respondents scored a high of 4, mean of 2.1 and a median of 2. This means the population had low mitigation activities/knowledge and a mean score of 2.1 and a maximum score of 4 is lower than the midline of the highest possible score of 9. The respondents were further grouped in to two main categories using the median score to place those with lower than the median having more mitigation and those scoring above
the median being interpreted as having poor mitigation. The results gave 62.5% (175/280) have low mitigating skills while the remaining 37.5% (105/280) have high mitigating skills.

4.5 Household vulnerability

Household vulnerability of fire occurrences was also evaluated for the respondents. The various aspects which were used to determine the household’s levels of vulnerability are as indicated in Table 4.6. The table shows the score and proportions of households per the scores. The individual vulnerability factors were tested for any association with the risk perception of fire occurring, hence determining the factors that increased the risk of fires. The data was subjected to bivariate analysis as shown in Table 4.7 and further multivariate analysis as shown in Table 4.8.
<table>
<thead>
<tr>
<th>Vulnerability indicator</th>
<th>response</th>
<th>Score</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why did you settle here</td>
<td>Affordable housing</td>
<td>2</td>
<td>118</td>
<td>42.1</td>
</tr>
<tr>
<td></td>
<td>Born here</td>
<td>0</td>
<td>162</td>
<td>57.9</td>
</tr>
<tr>
<td>Where were you living before</td>
<td>Upcountry/another slum</td>
<td>1</td>
<td>146</td>
<td>52.1</td>
</tr>
<tr>
<td></td>
<td>Another town</td>
<td>2</td>
<td>134</td>
<td>47.9</td>
</tr>
<tr>
<td>Are you happy living here</td>
<td>Yes</td>
<td>0</td>
<td>163</td>
<td>58.3</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>1</td>
<td>134</td>
<td>41.8</td>
</tr>
<tr>
<td>Barrier of moving out</td>
<td>No GOK help</td>
<td>0</td>
<td>48</td>
<td>17.1</td>
</tr>
<tr>
<td></td>
<td>Lack funds/land</td>
<td>1</td>
<td>141</td>
<td>50.4</td>
</tr>
<tr>
<td></td>
<td>Inability to get work</td>
<td>2</td>
<td>91</td>
<td>32.5</td>
</tr>
<tr>
<td>Own the house</td>
<td>No</td>
<td>0</td>
<td>217</td>
<td>77.5</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1</td>
<td>63</td>
<td>22.5</td>
</tr>
<tr>
<td>Have title for the house</td>
<td>No</td>
<td>0</td>
<td>223</td>
<td>79.6</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1</td>
<td>57</td>
<td>20.4</td>
</tr>
<tr>
<td>Own rental houses</td>
<td>No</td>
<td>0</td>
<td>226</td>
<td>80.7</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1</td>
<td>22</td>
<td>7.9</td>
</tr>
<tr>
<td>Have title deed of the house</td>
<td>No</td>
<td>0</td>
<td>258</td>
<td>92.1</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>1</td>
<td>22</td>
<td>7.9</td>
</tr>
<tr>
<td>Type of house</td>
<td>Semi-permanent</td>
<td>1</td>
<td>240</td>
<td>85.7</td>
</tr>
<tr>
<td></td>
<td>Temporary</td>
<td>2</td>
<td>40</td>
<td>14.3</td>
</tr>
<tr>
<td>Number of rooms</td>
<td>One</td>
<td>0</td>
<td>206</td>
<td>73.6</td>
</tr>
<tr>
<td></td>
<td>More than one</td>
<td>1</td>
<td>74</td>
<td>26.4</td>
</tr>
<tr>
<td>Number of people</td>
<td>One</td>
<td>0</td>
<td>210</td>
<td>75.0</td>
</tr>
<tr>
<td></td>
<td>More than one</td>
<td>1</td>
<td>70</td>
<td>25</td>
</tr>
<tr>
<td>Roofing materials</td>
<td>Plastics</td>
<td>0</td>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>Iron sheets</td>
<td>1</td>
<td>157</td>
<td>56.1</td>
</tr>
<tr>
<td></td>
<td>Iron sheets/grass/plastics</td>
<td>2</td>
<td>120</td>
<td>42.9</td>
</tr>
<tr>
<td>Wall building materials</td>
<td>Earth</td>
<td>0</td>
<td>56</td>
<td>20.0</td>
</tr>
</tbody>
</table>
4.6 Data analysis

4.6.1 Bivariate analysis

Majority of the vulnerability factors were not significantly associated with the risk perception of fire occurring. The origin of respondents for those who reported having moved into the slum from another town were significantly associated with the risk perception P = 0.048, this also showed that they were at least 2 times more likely to have a higher perception of risk (OR 2.426, CI 5.534 – 14.235). The reasons advanced for the respondent as having contributed to their moving to the slum, only those who came there due to eviction showed strong association with the level of risk perception at P = <0.005 and at the same time they were over 3 times more likely to have poor perception of the risks of fire occurring in the slum (OR 0.319, CI 0.186 - 0.545). The duration of stay in the slum was significantly associated with fire risks and seemed to get stronger as the durations of stay increased with P = 0.012 and p = 0.002 for those who had stayed for between 10 to 20 years and those between 21 and 30 years. As the duration of stay increased to 20yrs and 21 to 30yrs the respondents seemed to have a higher perception of risk of fire occurring (OR 3.231, CI 1.531 - 6.819) and (OR 2.581, CI 1.23 - 5.414) respectively. The most significant barrier to moving out of the slum was lack of funds which was significantly associated with the risk perception p = <0.005 with those with low perception being more associated (OR 0.282, CI 0.152 – 0.524). Housing type was also significantly associated with the risks of fire with those dwelling in semi- permanent housing being significantly associated with fire risks at p = 0.036, (OR 1.588, CI 0.989 - 2.55). The type of floor also showed significance with earth and stone floors households showing a significant association with the risk levels at P = 0.002 and < 0.005.
respectively. For households with earthen floors, they had two folds risk perception (OR 2.105, CI 1.283 - 3.454) while those with stone floors seemed to have low risks perceptions (OR 0.188, CI 0.069 - 0.511). Similarly, the type of roofing showed significance for iron sheet as roofing materials at \( P < 0.005 \) with the those with high risk perception being two times more likely to perceive fire risks. The cooking site in the household also was significantly associated with the fire risk perception \( P = 0.007 \) with those cooking from (other places) seemingly having the low perception of fire risks at (OR 0.316, CI 0.129 - 0.773). The source of lighting where gas was used was also significantly associated at \( P = 0.043 \). Having electricity connection within the household was significantly associated with fire risk perceptions \( P = 0.007 \). Having access roads for fire engines and the municipal council collection of waste were also significantly associated at \( P = 0.002 \) and \( P < 0.005 \) respectively. Table 4.7 shows the various vulnerability factors and how they associated with fire risk perception.
4.6.2 Multivariate analysis

Table 4.8 beta coefficient, standard error of beta, odds ratio and p value

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>P value</th>
<th>Exp(B)</th>
<th>95.0% C.I. for EXP(B)</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roofing materials iron sheet</td>
<td>1.149</td>
<td>0.387</td>
<td>8.806</td>
<td>1</td>
<td>0.003</td>
<td>3.157</td>
<td>1.477</td>
<td>6.744</td>
<td></td>
</tr>
<tr>
<td>Council collects waste</td>
<td>1.134</td>
<td>0.484</td>
<td>5.488</td>
<td>1</td>
<td>0.019</td>
<td>3.107</td>
<td>1.203</td>
<td>8.021</td>
<td></td>
</tr>
</tbody>
</table>

*Significant, p< 0.05 level.

Table 4.8 shows beta coefficient (β), standard error of beta (S.E. (β)), adjusted odds ratio and P value for each of the retained factors significantly associated with fire risks. The use of iron sheets as roofing materials was independently and significantly associated with risk of fire occurring (P<0.003). A respondent with low perception of risks of fire was 3 times likely to be dwelling in a house with iron sheets. Similarly the lack of the municipal council to collect waste was independently associated with fire occurrences at p = 0.019 with those who said there is poor collection of garbage being up to 3 times as well likely to have low perception of fire occurrences.
CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 DISCUSSION

5.1.1 SOCIO-DEMOGRAPHIC CHARACTERISTICS, EDUCATION AND SOCIO-ECONOMIC STATUS

The demographic data showed an average age of the respondents of 39 years; meaning that they are people able to work and earn a living. However, their level of education, with 71.8% having only primary education or none, limits them to small scale businesses and casual jobs which pay dismally at a monthly income of Ksh.1000-5000 (49.1%). There is a high level of single parenthood at 37.8% through death of one partner, divorce/separation, especially among women. There is need to achieve gender equality in disaster reduction and integrate a gendered perspective to all policies and measures implemented in disaster management such as fires. This is because women are more vulnerable to disaster consequences considering their social roles and the fact that disasters which disrupt society with enormous damage to the human life, environment and economic resources, treat women and men differently (ISDR, 2002; Ginige, et.al., 2009).

The income of the respondents/breadwinner is low compared to the size of the household which stands at 50.4% with more than one person and sometimes affording a meal a day is difficult let alone sparing money for other necessities like fire risk preparedness. The common international poverty line has in the past been roughly $1 a day. In 2008, the World Bank came out with a revised figure of $1.25 (Ravallion Martin et al, 2009). Going by these figures the average income of Kiandutu slum dwellers is between $0.39-$1.96 per household.
The houses are very congested considering that 73.6% of the households have only one room to themselves. Many of informal settlements originated from illegal invasion of private land. Many urban dwellers live in large, dense informal and illegal settlement with high risk of accidental fires (Bull-Kamanga et al, 2003).

Since independence in 1963, Kenya has experienced an urban growth rate of about 6% per annum which has guaranteed freedom of movement with high rates of rural-urban migration. This has led to deterioration in institutional and physical infrastructure hence Kenyan urban centers are characterized by expansive informal settlements, poor water and sanitation infrastructure and services (Obudho, 1997; Odhiambo and Mando, 2003). Informal settlements occupy an ambiguous legal position, being technically illegal but residents are protected by legislation granting them de facto tenure rights by virtue of living on the land, and are broadly characterized by a lack of formal housing and service delivery (Robyn, 2009).

5.1.2 MEASURES OF OVERALL RISK PERCEPTION OF VULNERABILITY

Most of the factors of identification of exposure to fire risks were against the population. These included poverty, congestion, lack of access roads and a high population density coupled with illegal electricity connections (Table 4.2). High population densities lead to broken families, unemployment, and economic, physical and social exclusion making fire mitigation difficult (Gulyani and Bassett, 2007). When electricity is disconnected, slum dwellers turn to faulty and mostly illegal connections and use of flammable energy alternatives which destroy homes and displace, injure or kill many people (USAID, 2004).
The study population scored poorly on causes of fires and where it occurs because despite knowing the triggers like domestic violence and cooking fuel faults they took no precaution and continued cooking inside the houses from where most fires originates from. According to most respondents, the frequency of fires has been increasing from year 2000 to 2012 (Table 3.1). In summary the population does not appreciate the factors associated with fire risks and are most vulnerable.

Household vulnerability focused on respondents who had been affected by a fire previously within the last two years. The aspects included immediate action after the fire and later thereof, measures taken to avoid a similar occurrence. In summary households took no measures to avoid recurrence of fires as 19.3% of the respondents said fire incidences had increased and 38.9% did not give an answer meaning that they were ignorant or did not know. The overall perception of vulnerability is very low among the population (37.9%) and are therefore prone to fire risks.

5.1.3 RESILIENCE ABILITY OF HOUSEHOLD

The factors put into consideration are social factor of community cohesion, savings in case of a fire eventuality and development(Table 4.4). From the results, the people are not able to bounce back in case of a fire incidence because of their low monthly income of Ksh.1000-5000 (49.1%) and have no access to microcredit (67.1%). The results revealed that vulnerability to fires in the slums is enhanced by numerous economic, social and infrastructure problems. Other factors include lack of proper housing, water and sanitation and these factors lead to serious health risks which exposes the population. The people having limited access to credit and formal job market in addition to
stigmatization, discrimination and geographic isolation. It has been shown that people living in slums have limited access to social and economic networks and this leads to limited/no resilience ability (Gulyani and Bassett, 2007).

Resilience of nations and communities to fire disasters can be built through people-centered early warning systems, risk assessment, education and through other proactive integrated multihazard and multisectoral approaches. Communities that work together and have a common aim are more resilient. Building of physical infrastructure can be equated to creating of community consensus which is key in strengthening of social capital (Alexander, 2000).

Urbanization especially in Africa has created more problems than the development it ought to bring. The speed of population growth in African cities and towns presents both a challenge and an opportunity for managing disaster risk. The speed of growth is beyond the capacity of urban governments to cope with alone, but similarly local action has not yet shown itself capable of achieving the scale of change needed to improve resilience for the large number of the urban poor. Informal settlements beyond the reach of proper land-use planning, construction codes and even potable water, sanitation, police and health or education services are a growing reality (Pelling 2003).

Working with local actors to build resilience enables risk reduction work to be tailored to the varied needs of those living with the risk. Capacity building is more effective when undertaken within a wider framework of social development. Government or municipality-sponsored social safety nets, the upgrading of slums, social housing or community development programming have great potential for bringing multiple benefits
including risk reduction. Gaining access to land title provides security and stimulates investment by the urban poor (UN-HABITAT, 2007).

5.1.4 MITIGATION

The population scored very poorly on the aspects of mitigation including waste dumping (73.1%), presence of smoke detectors (98.5%), willingness to upgrade their houses and settlement (56.7%), communication networks (57.7%), fire drill involvement (97.1%) and priority action in case of a fire where 50.7% said they would go back to the house to try and save property. According to the results it shows that most of the respondents have low mitigation skills. According to GoK (2004), even where fire fighting implements are available, the staff are not adequately trained to handle fires. Any fire starts as a simple and small action and awareness of which can prevent such fires can be very crucial in disaster mitigation. In most instances, ordinary citizens aren’t aware of this and therefore are not helpful in preventing/ mitigating such occurrences due to ignorance and lack of awareness. This calls for collaboration with other stakeholders in dissemination of the information through purpose created campaigns or through convenient fora like schools, churches among others. Also, collaboration with other organizations like the Red cross, the police and the army can provide direct support in fighting fires and reducing loses.

Because governments may be reluctant to recognize the illegal settlements and promote their permanent establishment, they do not enforce rules that would normally govern the development of a legally settled or subdivided area. Most services normally available to legally constituted and occupied areas are not legally available in slums. Informal systems grow in response to essential needs, such as water and electricity, and the
isolated and informal nature of slums makes it possible for criminals to provide illegal services (UN-HABITAT, 2008).

5.1.5 HOUSEHOLD VULNERABILITY

Factors which came out strongly against household vulnerability included movement from another town (47.9%), lack of funds (50.4%) as reason to continue staying in the slums, semi-permanent type of house (85.7%), inaccessible roads for fire engines (73.6%), no electricity connection (41.1%) while 66.1% of the respondents said council does not collect waste. It is observed that households living in underserviced settlements are often operating at the limits of their capacity as they attempt to juggle multiple stressors such as unreliable incomes, food insecurity and the effects of crime and violence (DiMP, 2008). Fire hazards erode whatever attempts have been made to accumulate resources and savings, progressively increasing the vulnerability of households to the effects of hazards over time

In Kenya, water supply systems are often deficient during the dry weather when ironically the risks of fire incidences are highest (GOK, 2004). Moreover the current water act (2002) does not make any provision for firefighting water in the event of a scheme failure. The present study revealed that due to communication problems in most cases, fire calls are made through the police who have to inform the fire brigade which delays the reporting process. Consequently the firemen arrive late and are met by angry and violent crowds. Shortcomings in fire disaster prevention in most municipalities in Kenya include lack of fire engines, inadequate equipment, insufficient personnel with inadequate training and fire fighting facilities.
Studies by Satterthwaite (2006) have reported that in developing countries such as in Africa a high proportion of the population work in the informal economy and live in poor quality and overcrowded housing in informal settlements with high fire risks. Risk-levels are increased by the lack of infrastructure and services in many areas. Local governments do not seem to take any measures that can reduce the risks. Much of the population has limited capacity to pay for housing.

5.2 CONCLUSIONS

The level of perception of fire risk among the people living in Kiandutu slums is 37.9%. From the respondents 72.5% cited poverty/congestion/lack of access roads, 83.0% said electric/cooking fuel faults are the major causes associated with fire occurrences. Based on the above factors, it shows that the respondents are prone to place themselves within vulnerability. The population scored poorly on resilience (20%) bordering on none at all with 49.1% having an income of Ksh.1000-5000, poor source of livelihood and no assets ownership (81%) such as title deed. The community living in Kiandutu slums does not have the social capital to address fire risks because about 67.1% have no means of accessing credit and no CBOs within the community according to 73.2% of the respondents. There are no mitigation measures in place to reduce fire risks in Kiandutu slums as the main factors of communication network is poor with a score of 57.7% having none, and 73.1% said there is no system in place for waste management. The vulnerability factors to fire risk sampled in the slum included movement from another town (47.9%), immigration following eviction, number of years of stay in the slum, lack
of funds (50.4%), semi-permanent type of housing (85.7%), cooking fuel charcoal and paraffin (67.9%), poor access roads (73.6%) and poor waste management (67.9%).

5.3 RECOMMENDATIONS

Since urbanization is a reality that is unstoppable and irreversible, there is need to adopt proactive policies and programmes including good governance, capacity building of the managers so as to avoid the growth of slums or informal settlements (ISDR, 2005).

i). People living in the slums should form social network groups where they meet regularly and thus create trust with one another. In such fora they will discuss factors that predispose them to fire risks and this will increase their level of perception to the same like proper use of fuels for cooking and lighting.

ii). Increase the resilience among people living in Kiandutu slums by facilitation to access credit by micro-finance organizations and giving them priority in making decisions that affect them. Informal settlement problem can be reduced by legalizing land ownership in the areas concerned with the help of the Municipal Council.

iii). Improve the social capital of the people living in Kiandutu slums by their participation as a community in a) local initiatives b) telecommunication and infrastructure.

iv). The municipal council in collaboration with GoK and NGO should put mitigation measures in place to reduce fire risk in Kiandutu slums through upgrading of the settlement, proper waste disposal and fire risk awareness of the population.
v). Vulnerability factors that lead to high incidence of fire risks in Kiandutu slums should be addressed through public barazas by provincial administration, Ministry of Public Health and Sanitation together with media publicity on proper housing; safe and proper use of lighting and cooking fuels. Access to safe drinking water and water mains should be addressed by the municipal council.

5.4 FURTHER RESEARCH

The study recommends further research in the following areas;

i) Evaluation of disaster preparedness among the people living in Kiandutu slums.

ii) Investigation into how the population living in Kiandutu slums can be incorporated in municipal planning when decisions that affect them are made.

iii) Further research as to why the population living in Kiandutu are resistant to upgrading their social and economical status.
REFERENCES


Khatun, H. (2003). Livelihood strategies in disaster risk reduction in Bangladesh; New Delhi, India


Satterthwaite David (2006). Outside the Large Cities: The Demographic Importance of Small Urban Centres and Large Villages in Africa, Asia and Latin America,…..


APPENDICES

APPENDIX 1: PARTICIPANT’S CONSENT FORM

Introduction

My name is Jennifer Gachago from Kenyatta University department of Community Health. We are here to collect data on the factors influencing fire risks in this area. The information gathered from this study will be used for planning strategic intervention programs to mitigate the incidences of fire in this area and eventually reduce or curb losses you incur from the same.

Procedure

We will interview you on issues which will include household data, fire vulnerability factors among others. This will only be done when you sign the section at the end of this form.

Confidentiality

The data and information collected from your household will be held strictly confidential and will not be used for any other purpose outside the objectives of this study. Your name will not be in any report from this study.

Research benefits

The information gathered from this study will be used for planning strategic intervention programs which will go a long way in mitigating if not curbing slum fires.
**Participation information**

Participation is voluntary and there are no risks at all.

If at any time you wish to withdraw from participating in the study, you can do so.

Feel free to ask any questions which are not clear to you regarding this study any time even after consenting.

**Participant statement**

I, the undersigned have understood the above information which has been fully explained to me by the study team. I have agreed to voluntarily consent to participate. I was given the chance to ask questions and I received satisfactory response.

Name of the participant/respondent_________________________________________

Signature___________________________Date_______________________________
APPENDIX 11: QUESTIONNAIRE

Questionnaire No. .............................................

Date of interview.............................................

Block..............................................................

Name of the interviewer.................................

Name of the respondent.................................

PART A: Household Socio-demographic characteristics

1. Give me information about the members of the household starting with the head of the household.

<table>
<thead>
<tr>
<th>Line no.</th>
<th>Name</th>
<th>Sex</th>
<th>Age (years)</th>
<th>Education level</th>
<th>Occupation</th>
<th>Income</th>
<th>Marital status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1=Male</td>
<td></td>
<td></td>
<td></td>
<td>1=Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2=Female</td>
<td></td>
<td></td>
<td></td>
<td>2=No</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>4</td>
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<td></td>
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Scoring structure next page-
Education level:
1=none; 2=primary incomplete; 3=primary complete; 4=secondary incomplete;
5=secondary complete; 6=college (certificate); 7=college (diploma); 8=university
(degree); 9=pre-school; 10=adult education; 11=Does not know

Occupation:
1=farmer; 2=casual labor; 3=Housewife; 4=formal employment; 5=student;
6=business; 7=school leaver; 8=preschool; 9=others (specify)_______________

Marital status:
1=Married; 2=Divorced/separated; 3=Widowed; 4=single ; 5=Single parent; 6=child

Perception

1. What are the factors that increase exposure and vulnerability to fire risk in this area?
   (Multiple responses allowed)
   1.□ Poverty
   2.□ Housing congestion
   3.□ High population density
   4.□ Illegal electricity connections
   5.□ Lack of access roads
   6.□ Solid waste accumulation

2. What do you think are the causes fires in this area?
1. ☐ Domestic violence  2. ☐ Electric faults  3. ☐ Cooking fuels

4. ☐ Others (Specify)…………………………………………………………..

3. According to you, where in the settlement do the fires usually occur?

1. ☐ Residential areas  2. ☐ commercial areas  
3. ☐ Others (Specify)…………………………………………………………..

4. If affected by a fire, where would you stay?

1. ☐ In the streets  2. ☐ with unaffected neighbors  3. ☐ with friends  
4. ☐ with relatives  5. ☐ go to the rural area  6. ☐ Others(specify)….

5.a) Have the frequencies of fires increased, stayed the same or decreased over the past few years?

1. ☐ Increased  2. ☐ stayed the same  3. ☐ decreased

b. Why do you think the situation has been so?

......................................................................................................................................................

6. a) Have you been affected by a fire recently?

1. ☐ Yes  2. ☐ No

b) If yes, when was it?

1. ☐ One week ago  2. ☐ two weeks ago  3. ☐ three weeks ago
4. ☐ one month ago  5. ☐ six months ago  6. ☐ one year ago

7. ☐ Other (specify)…………………………………………………………..

c). Where did the fire originate from?
1. From within the house
2. From the neighborhood
3. Do not know

d) What were the immediate effects of the fire?
1. Loss of lives
2. Loss of property
3. Do not know

e) How did you become aware of the fire?
1. Through a neighbor
2. Through a friend
3. Through the radio
4. Was at the site
5. Other (specify)………………………………..

f) What was your immediate response?
1. Run away
2. Tried to put off the fire
3. Alerted neighbors
4. Nothing
5. Other (specify)………………………………..

g) What do you expect the long-term consequences of the fire to be?

h) What organizations assisted you during the said fire?

7. Do you feel you have any obligation to prevent fire outbreaks?
1. Yes
2. No

8. Has there been any fire originating from your house?
1. Yes
2. No
9. a) How do you usually cope with fire?

…………………………………………………………………………………….
…………………………………………………………………………………….

b) What barriers constrain you from coping?

…………………………………………………………………………………….
…………………………………………………………………………………….

c) What would you like changed to enable you to cope better as a community?

…………………………………………………………………………………….
…………………………………………………………………………………….

10. Do you feel that the municipal council is doing enough to help you in coping with fires?

1. □ Yes  2. □ No

11. Who do you think is most affected by the fires?

1. □ The poor

2. □ Children

3. □ Women

4. □ Drunkards

5. □ Other (specify)………………………………..

12. Are you aware of any measures that you can put in place to stop a fire?

1. □ Yes  2. □ No
13. Do you know of any trained fire-fighters within the community?

1. □ Yes  2. □ No  3. □ don’t know

Resilience

1. What is your main source of livelihood?

1. □ Casual labor
2. □ Formal employment
3. □ Farming
4. □ Business

2. Approximately how much money do you make per month in ksh.?

1. □ 1000-5000
2. □ 6000-10,000
3. □ 11000-15000
4. □ Over 15000

3. Are you able to access some form of micro credit when in need?

1. □ Yes  2. □ No

4. Are you hosting a friend/relative who has lost their possessions to fire?

1. □ Yes  2. □ No

5. Do you have savings that you have put aside for an eventuality like fire?

1. □ Yes  2. □ No
6. a) Do you have any assets?

1. □ Yes       2. □ No

b) If yes, which one?

........................................................................................................................................
........................................................................................................................................

7. Do you have friends/relatives who can assist you to rebuild your life?

1. □ Yes       2. □ No

8. Are there CBOs in this area that are concerned with fire disaster reduction?

1. □ Yes       2. □ No       3. □ Don’t know

9. When priorities are being set for this community, are you given an opportunity to participate?

1. □ Yes       2. □ No

**Social capital**

1. Do you have any local initiatives to reduce fire hazards?

1. □ Yes       2. □ No

2. a) Are you a member of the local initiative?

1. □ Yes       2. □ No

b) Do you think that you benefit from this initiative?

1. □ Yes       2. □ No

3. How do you communicate with the fire brigade in the event of a fire outbreak?
1. ☐ Call them directly via cell phone

2. ☐ Call them directly via landline

3. ☐ Call the police to inform them

4. What do you have collectively as a community that may assist in reducing your vulnerability to fire? .................................................................

................................................................................................................

5. Are there communally owned assets in this area?

   1. ☐ Yes    2. ☐ No

6. Are there a system in the community for garbage collection?

   1. ☐ Yes    2. ☐ No

Mitigation

1. In the event you learn of a fire outbreak, what would be your priority action be?

   1. ☐ Run to a meeting point where everybody runs to in case of fire

   2. ☐ Go back to the house to save the variables

   3. ☐ Run for dear life

   4. ☐ Other (specify).................................

2. Are you taking any action to reduce your risk to fire?

   1. ☐ Yes    2. ☐ No

3. Is there regulation of waste dumping in this area?
1. Yes  2. No

4. Are there smoke detectors in this area?
   1. Yes     2. No     3. don’t know

5. Would you be willing to upgrade your house to make it more fire resistant?
   1. Yes     2. No

6. Are you aware of any fire early warning systems in place?
   1. Yes     2. No

7. Is there upgrading of the settlement going on?
   1. Yes     2. No

8. Have you been involved in any fire drill to prepare you for a fire?
   1. Yes     2. No

9. Are there good communication networks in the event of a fire outbreak?
   1. Yes     2. No

10. What are you doing to reduce your vulnerability to fire?

..............................................................................................................................................
**Vulnerability**

1. Why did you decide to settle here in Kiandutu?
   
   1. ☐ The housing is affordable
   2. ☐ Joined relatives/friends
   3. ☐ Was born here
   4. ☐ Other (specify)………………………………………………

2. a) Where were you living before migrating here?
   
   1. ☐ Upcountry
   2. ☐ In another slum
   3. ☐ In another town
   4. ☐ Other (specify)………………………………………………
   
   b) Why did you migrate here?
   
   1). ☐ Eviction   2). ☐ Rent increase   3). ☐ Lack of drinking water
   4). ☐ Dirty environment   5). Threat to personal safety   6). Loss of job
   7). ☐ Fire   8). Other (specify)………………………………………………

3. How long have you resided in this area?

   …………………………………………………………………………………
   …………………………………………………………………………………

4. Are you happy in your current location?

   1. ☐ Yes     2. ☐ No

5. What barriers are preventing you from moving to a more desirable location?
1. □ Lack of funds
2. □ Lack of land
3. □ Inability to find work
4. □ Lack of government assistance
5. □ Illiteracy
6. □ Large family size
7. □ Other (specify)……………………………………

6. a) Do you own the house in which you live in?
   
   1. □ Yes        2. □ No

   b) If yes, do you have a title deed to the land?
   
   1. □ Yes        2. □ No

   c) How did you acquire the land?
   
   1. Bought
   2. Inherited
   3. Given
   4. Other (specify)……………………………………

7. a) Do you have houses that you rent out?
   
   1. □ Yes        2. □ No

   b). Do you have a title deed to the said land that you have built the houses?
   
   1. □ Yes        2. □ No

8. a) In what type of a house does your household live?
   
   1=Permanent building        2=Semi-permanent        3=Temporary
b). How many rooms are there in the main house?
   1. One
   2. Two
   3. Three
   4. Other (specify)……………………………

9. How many people live in this house?
   1. Two
   2. Three
   3. Four
   4. Five
   5. Six
   6. Other (specify)……………………………

10. The enumerator to observe the main material of the roof, floor and wall and record in
the table below (multiple responses allowed)

<table>
<thead>
<tr>
<th>Floor</th>
<th>Roof</th>
<th>Wall (multiple responses allowed)</th>
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Codes will be used as follows:

1=Earth      2=Cement      3=Timber      4=Iron sheet      5=Grass
6=stones     7=papers      8= plastic     9=Cardboard
10=Others (specify)……………
11. Is your house a standalone structure?

1. ☐ Yes  2. ☐ No

12. a) What fuel do you mainly use for cooking?

5. ☐ Others (Specify)………..

b) Where do you cook your meals?

1. ☐ Inside the home  
2. ☐ Outside the home  
3. ☐ Others (Specify)………..

13. a) What do you use for lighting?

5. ☐ Others (Specify)………..

b) Is there uninterrupted power supply from KPLC?

1. ☐ Yes  2. ☐ No

c). Who pays for the bills?

1. ☐ Self  
2. ☐ Landlord  
3. ☐ Others (Specify)………………………………………

d). To whom do you pay to?

1. ☐ KPLC
2. □ slumlord

3. □ Others (Specify)………………………………………………

14. Does any member of this household take alcohol?

1. □ Yes 2. □ No

15. a) Are there access roads in this area where a fire engine can pass?

1. □ Yes 2. □ No

b) Are these roads in a ride able condition?

1. □ Yes 2. □ No

16. a) Does the municipal council routinely collect the household waste in this area?

1. □ Yes 2. □ No

b) If no, what do you do with your household waste?

1. □ Burn the waste

2. □ Throw the waste away

3. □ Others (Specify)………………………………………………

17. Is there a toilet/latrine for this household?

1. □ Yes 2. □ No

18. Do you have access to safe water everyday?

1. □ Yes 2. □ No
APPENDIX 111: FOCUS GROUP DISCUSSION GUIDE

Introduction

I am a student at Kenyatta University and am interested in finding out the factors influencing fire risks in this area. I would very much appreciate your participation in this discussion. The information obtained will go a long way in making recommendations to the government and other stakeholders to develop appropriate interventions to mitigate and/or curb fire risks in this community and Kenya at large. The information you provide will be treated with confidentiality and will not be used for any other purpose than the objectives of this study.

Target groups

Male household heads

Female household heads

The youth

Fire brigade staff

GROUND RULES

1. This session will take 1-1 ½ hours

2. We will have a note taker and this session shall be recorded (if you agree that we record).

3. Speak clearly one at a time

4. All persons are requested to participate

5. There is no right or wrong answers
6. Assurance of anonymity and confidentiality. You can introduce yourself with whichever name you want not necessarily your real name.

7. Participation is voluntary.

What do you know about fire outbreaks?

What have you heard about ways of controlling/avoiding fires?

What is your opinion about that?

What do you think are the causes of fires in this area?

What puts a community at risk of fires?

Have you witnessed fire incidences?

Could you tell us what happened last time?

What can be done to improve the response to fire?

According to you, why does the council respond the way it does to fires in this region?

What do you think would make the community fail to put in measures to protect themselves from losses arising from fires?

What do you think can be done to improve the situation?

What are the key areas of vulnerability/risk in the settlement with regards to settlement fires?

How do you think vulnerabilities/risk with respect to fire could be decreased?
According to you what can this community do to reduce the incidences of fire?

Does the housing in slum areas follow the laws on planning, construction, registration of property and preservation of agriculture lands?

How is the sanitation in the area? Does the municipal council provide you with water and sewerage services? Garbage collection?

Is there land-use planning in this area?

Is there enforcement for the implementation of building codes for fire resistant building?

What else would you like to tell us?
APPENDIX IV: KII Guide

I am a student at Kenyatta University and am interested in finding out the factors influencing fire risks in this area. I would very much appreciate your participation in this discussion. The information obtained will go a long way in making recommendations to the government and other stakeholders to develop appropriate measures to mitigate and/or curb fire risks in this community and in Kenya at large. The information you provide will be treated with confidentiality and will not be used for any other purpose than the objectives of this study.

**Key informants:** area chief, PHT, Council representative, church leaders

**General information**

Date_____________________________________

District___________________________________

Location__________________________________

Sub-location_____________________________

Interviewer______________________________

Key Informant____________________________

What is the water and water hydrant status in the area?

What is the operational status of the water hydrants if any?

Is there a fire service?

How many firemen are there in this region?
Are fire drills done in this area?

What problems are encountered in fire mitigation efforts in this region?

Who are the stakeholders in fire mitigation? Is there collaboration from the same?

Do buildings plans cover fire mitigation requirements and are they enforced?

How is information on fire outbreaks relied?

Have you seen/aware of the existence of the fire safety manual?

Do you participate in the fire safety week?

Are there disaster management units in the various government ministries serving this area?

Is there any upgrading/regularization that is going on in this area?

Does this area have any formal planning?

Are there any informal dwellings serviced by the municipal council?

Are you aware of the status of the fire policy?