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ARTICLE

Does Tenure Security Reduce Disaster Risk? A Comparative Study of the Nairobi Settlements of Kibera and Kawangware

Rónán McDermott¹ · Pat Gibbons¹ · Dalmas Ochieng² · Charles Owuor Olungah² · Desire Mpanje¹

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Abstract While scholarship suggests that improving tenure security and housing significantly reduces disaster risk at the household level within urban settings, this assertion has not been adequately tested. Tenure security can be conceived as being composed of three interrelated and overlapping forms: tenure security as determined by legal systems; de facto tenure security; and tenure security as perceived by residents. This article traces the relationship between tenure security, the quality of housing, and disaster risk on the basis of a mixed methods comparative case study of the settlements of Kawangware and Kibera in Nairobi. Although the findings suggest that owner-occupancy is associated with the structural integrity of dwellings to a greater extent than tenancy, no association was found between the length of occupancy by households and the structural integrity of the dwelling. Moreover, tenancy is not found to be closely associated with fires and flooding affecting the dwelling as extant scholarship would suggest. Formal ownership is linked with greater investment and upgrading of property with significant implications for disaster risk. Our findings highlight the complex relationship between tenure security and disaster risk in urban informal settlements and provide impetus for further investigation.

Keywords Disaster risk · Fire and flood risk · Tenure security · Urban hazards · Urban informal settlements

1 Introduction

Urban informal settlements are characteristically located in areas exposed and vulnerable to a range of hazards, including fire and flooding (Doberstein and Stager 2013; Flower et al. 2018). Residents of such settlements are particularly susceptible to the impacts of fire because of poor housing, infrastructure, and governance (Wamsler 2004; Paller 2019). While the chief immediate causes of fires such as commonly used sources of light and heat combined with densely packed and flammable materials have been well documented (Paller 2019), the underlying drivers of fire risk in informal settlements remain under-explored (Selmeczi 2009; Chance 2015). In relation to flooding, Amoaka and Inkoom (2018) note that scholarship to date has been overly rooted in the hazard paradigm, neglecting the complex role of actors, relationships, and governance within informal urban settings.

Within this context inadequate land tenure has been considered an important but often overlooked anticipator of vulnerability to disasters (Reale and Handmer 2011; Sarmiento et al. 2020). However, the relevance of tenure security to reducing vulnerability has been recognized by its inclusion as an indicator for the achievement of United Nations Sustainable Development Goal (SDG) 1, which is focused on poverty eradication.¹ Within both the SDG framework and extant literature, there is a relative consensus that tenure security is a complex multidimensional concept. Tenure security can be considered a legal status, a

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¹ Indicator 1.4.2: Proportion of total adult population with: (1) secure tenure rights to land; (2) with legally recognized documentation; and (3) who perceive their rights to land as secure, by sex and by type of tenure. <https://unstats.un.org/sdgs/metadata/files/Metadata-01-04-02.pdf>.

de facto situation, or can be viewed from the perspectives of residents themselves. How each of these dimensions inter-relates in generating positive outcomes for residents of informal settlements has been insufficiently explored within the literature (Gelder 2010; Nakamura 2016). Further research is required in relation to the causal origins of everyday hazards such as fire and flooding that affect households in informal settlements, including the role of tenure security (Adelekan et al. 2015; Oliver-Smith et al. 2016; Fraser et al. 2017).

Against this backdrop, the question that this article addresses is: how does tenure security relate to the occurrence of fire and flood risks that affect the people dwelling in urban informal settlements? To answer this question, the following objectives were pursued. First, the article identified how tenure security is to be conceptualized in terms of its legal, de facto, and perceived dimensions. Then the relationship between tenure security and quality of housing and its resilience with respect to disaster risks is traced within the literature. The existing understanding of this relationship is then empirically tested in order to generate new insights into how tenure security relates to disaster risk in urban settings.

2 Tenure Security and Disaster Risk

Tenure security has been defined by the United Nations Special Rapporteur on the Right to Adequate Housing as “tenure of land and/or housing which ensures a secure home and enables one to live in security, peace, and dignity.”² Nonetheless, the definition of tenure security has been subject to considerable scholarly discussion and contestation. There has been a shift in how tenure security is conceptualized from a binary legal status, whereby tenure is considered either secure or not, to a tenure continuum that accommodates a range of gradations within national/subnational law and policy (Payne 2001). For example, it has been recognized that the lack of planning during colonial rule in Kenya has been perpetuated in planning generally in the post-colonial context such that a stark dichotomy between the formal and informal is not helpful (Ayonga 2019). In addition, owner-occupiers, tenants, and freeholders each have different legal claims over the land and housing that they occupy.

Understanding the factors beyond formal legal status that explain tenure security has been pursued by a rich vein of scholarship. Within this body of scholarship, it is

understood that residents of informal settlements can, under certain circumstances, enjoy moderate tenure security, irrespective of and even despite their legal status (Doebele 1987; Varley 1987; Razzaz 1993; Lanjouw and Levy 2002; Payne 2002). Such factors include firstly the factual circumstances of households and secondly the cognitive processes, behaviors, and attitudes of households.

In relation to the first category, residents may under certain circumstances still enjoy significant de facto protection from forced eviction, even in the absence of a legal basis for the occupation of informal settlements. Indeed, some scholars would contend that formalization initiatives could be counterproductive as this can lead to the commodification of housing and the acceleration of gentrification, resulting in the displacement of poor or low-income households (Choi 2016). Valuable social movements within informal settlements are thereby disrupted (Varley 2017). In many contexts, an informally derived form of tenure security in the absence of legal protection of housing is the norm rather than the exception. Gilbert (2002) demonstrates that in Latin America evictions are only likely to occur in urban squatter areas when settlements threaten powerful vested interests, for example through their geographical proximity to elite residential areas, or when military or authoritarian governments are in power. Similarly, in sub-Saharan Africa, communal or customary land systems tend to guarantee a reasonably good level of security, even when these are not formally recognized by the state (Durand-Lasserve 2006). In all cases, such informal tenure security is threatened by expanding formal urban settlements and processes of gentrification.

Myriad factors militate in favor of de facto tenure security. Jean-Louis van Gelder categorizes these factors (Gelder 2010), distinguishing between intrinsic factors that emerge from within the locality on the one hand and external factors that have their origin from outside the locality on the other. Intrinsic factors are invariably linked with the duration of residence, the implication being that the longer a locality is in existence, the greater the legitimacy it tends to have (Varley 1987). As households maintain residence in informal settlements over time, their occupancy tends to increase in terms of social legitimacy and is more likely to be tolerated by governments and landowners (Nakamura 2016). As the length of residence increases, the permanence of dwellings within informal settlements tends to also increase, which in turn generates financial and political costs to remove occupants. While Caldieron (2013) states that the relationship between duration of residence and tenure security requires further research to understand the causal mechanism in more detail, Nakamura (2016) is more confident of the relationship.

² Report of the Special Rapporteur on Adequate Housing as a component of the right to an adequate standard of living, and on the right to non-discrimination in this context, 24 December 2012, A/HRC/22/46, para. 23. <https://digitallibrary.un.org/record/861179>.

While the *de facto* understanding of tenure security serves to broaden the concept of tenure security, the legal and factual circumstances alone do not fully capture how tenure security is understood and experienced by residents themselves. As such, a more interpretivist understanding of tenure security is required. This is important *per se* for residents but also in relation to the range of positive and, under certain circumstances, negative outcomes that accrue as a result of residents' perceptions of tenure security. While the duration of residence in informal settlements is clearly of relevance in determining *de facto*/actual tenure security, it also influences perceived security of occupants who gain confidence about their own tenure security with the passage of time (Nakamura 2016).

Having discussed the concept of tenure security, its relationship with disaster risk is now considered. The relevance of tenure security to vulnerability to disasters is increasingly recognized (Reale and Handmer 2011) and the positive effects of tenure security can be divided into two categories: improvement of services (such as water, electricity, communications, and education) and improvement of the quality of housing (Gelder 2010). This article focuses primarily on the relationship between tenure security and quality of housing (Field 2005; Huchzermeyer 2008; Gelder 2009; Nakamura 2014). It particularly concentrates on quality of housing from the perspective of mitigation of vulnerability to hazards such as fire and flooding. Each of the three dimensions of tenure security carries important implications for the structural integrity of housing and the resilience of housing to a range of hazards. The causal mechanisms are complex and have been dealt with extensively within the literature.

Field (2005) relies on a quasi-experimental situation in Peru to identify a causal link between formal tenure security and investment in housing, confirming that the provision of property titles to squatters stimulated housing investment in informal settlements. Similarly, Nakamura (2014) identifies a positive link between slum notification in India and the levels of investment by residents in upgrading their dwellings. It has also been suggested that tenure type (also referred to as dwelling occupancy), that is, whether a household owns or rents its home, itself is directly related to a home's level of preparedness for and vulnerability to hazards. The tenure trap describes the concept that tenants as opposed to owner-occupiers have higher degrees of vulnerability (Burby et al. 2003). The literature offers a range of explanations. Owner-occupiers have greater incentives to invest in housing than owners of rental properties (Iwata and Yamaga 2008; Fussell and Harris 2014). Such investment can often take the form of repairing structural damage, maintaining roofs, and enhancing building materials (Fussell and Harris 2014). The influence of tenure type on quality of housing arises

also due to the fewer incentives that tenants have to invest in housing, as any improvement of housing accrues to the owner in terms of the financial value of the home, even when such improvements could enhance their own safety. The need to obtain permission from the landlord or to persuade the landlord to make improvements are also barriers and landlords also have a reduced incentive to do so (Burby et al. 2003). In the aftermath of a disaster it has also been identified that low-income tenants are less likely to have their homes repaired (Comerio et al. 1994). The positive link between land tenure conditions and tenure type, however, and hazard exposure and structural integrity of dwellings is not straightforward with mixed evidence emerging (Sarmiento et al. 2020).

In terms of *de facto* tenure security, the length of time an individual or household has lived in a locality has been associated with the quality of housing and its resilience to hazards. As owner-occupiers are more likely to spend a longer period in the area, they tend to be more aware of disaster risks and the measures required to mitigate them (Burby et al. 2003). Tenants, tending to be more recent residents of their neighborhoods, may be less likely to have learned about the disaster risks and experienced the disasters that affect the neighborhood. They also tend to be less likely to have developed social attachments in the neighborhood that can yield information about how to prepare for and respond to such disasters. Experience of disasters and social attachments are highly correlated with preparedness and risk mitigation (Perry et al. 2001; Burby et al. 2003; Aldrich and Meyer 2015).

In terms of the perception of tenure security and how it impacts on quality of housing, there is considerable evidence suggesting that where land tenure is perceived to be insecure, investments in housing quality and land are less likely to be made (Feder and Nishio 1998; Brasselle et al. 2002; Deininger and Jin 2006; Reale and Handmer 2011). This has particular implications for the vulnerability of housing to a range of hazards (Burby et al. 2003; Fussell and Harris 2014). On the basis of quasi-experimental research designs implemented within informal settlements in Buenos Aires, Gelder (2009) and Galiani and Schargrodsky (2010) highlight the importance of the cognitive dimension of tenure security in determining household decision making concerning investment in quality of housing. In the absence of formal land tenure, perceived land tenure has been found to be crucial in driving housing self-improvement (Gelder 2010; Caldieron 2013).

Tenants tend to move home more frequently than owner-occupiers. This results in shorter time horizons and the discounting of the benefits of actions in the longer term (May et al. 1998). In such contexts, households renting their home have been found to be more likely to downplay disaster risks, even when they become aware of them

(Mileti 1999; Burby et al. 2003). Tenants are more likely than homeowners to have characteristics such as low income, ethnic minority status, and lack of attachment to their community that are associated with limited preparedness for disasters (Burby et al. 2003). They are also more likely to lack resources and motivation to invest in mitigation as their dwellings are owned by others. Housing improvements can be viewed as potentially leading to increased rent. Owner-occupiers similarly lack incentive to engage in mitigation measures as increased rents may not cover the investment (Burby et al. 2003).

3 Methodology

A comparative diverse case study of two localities in Nairobi, Kibera and Kawangware, was undertaken in order to pursue the study's objectives. In contrast to the typical case method that seeks to minimize variation from the mean of the population of cases, the diverse case method seeks to maximize variance from it in order to highlight the dynamics involved in the causal relationship between the variables of interest (Seawright and Gerring 2008). In this study, the variables of interest are tenure security on the one hand and quality of housing and the risk of disasters affecting housing on the other. The two cases chosen reflected a high level of variation in the independent variable: the tenure security of households. Thus, the two cases were chosen because they represent cases of relatively high and relatively low tenure security within the same city.

3.1 Study Setting and Design

In undertaking the comparative case study, a convergent parallel mixed methods design was adopted. Hence, the analysis of quantitative survey data together with the analysis of data from interviews and focus group discussions were undertaken in order to render findings more comprehensive, as well as to offset the weakness of one set of methods with the other (Bryman 2016). The survey data allowed for a tracing of relationships between tenure security variables, such as tenure type and period spent in the locality, and variables relating to disaster risk. The qualitative data collected helped to gain deeper insight into how tenure security and disaster risks are perceived and experienced by residents.

3.2 Data Collection Process

The survey dataset used in this article was obtained from a wider study conducted to obtain a baseline for the surveillance of urban areas in Nairobi. The survey was

conducted by Concern Worldwide, a partner within the Preparedness and Resilience to address Urban Vulnerability (PRUV) project³ within which the authors participated. A stratified random sampling technique using a probability proportionate to estimated size (PPES) was used. In slum areas one challenge faced by survey research is that a sampling frame usually is not readily available due to shifting slum boundaries, the transience of populations, and the lack of official records. As such, each data collection process needs to be preceded by proper enumeration of households in the area of study. The random sampling was applied for selection of households without replacement, in which each household had the same chance of being selected for inclusion in the survey. In order to determine an appropriate sample size, three main steps were followed: mapping of locality and village boundaries using the Geographical Information System (GIS) tool, stratification involving the segmentation and subsegmentation of each village, and the counting and listing of households. The number of households sampled in each subsegment was calculated proportionally to the total number of households in the village. Kibera has 12 villages and Kawangware has around 16 (Pamoja Trust 2009).

Enumerators recruited from the locality were trained in the use of Open Data Kit (ODK) software and provided with lists of the selected households for interview using the software on hand-held devices. On completing survey administration, the team members met to verify that all sampled households were interviewed. A total of 360 households were surveyed in Kibera and 375 households in Kawangware. Of the households surveyed, 79% were male-headed and the remaining 21% were female-headed. The response rate was 91%.

Several responses to the survey were included within the analysis including self-reported household data relating to tenure type, the period the household had been living in the locality, whether respondents' dwellings had been damaged by an event (fire, storm, or flood), and the respondents' view on the structural integrity of their dwellings. Tenure type responses were grouped into two categories, renting and owning. The period a household was living in the locality was computed with several cut-offs of 0–2; 2–5; 5–10, and > 10 years. Responses relating to the structural integrity of housing were grouped into two categories; whether housing was considered okay, safe, or very safe, or considered unsafe or very unsafe.

In addition to survey data, legal and policy analysis was conducted to measure the indicators related to the legal dimension. Six focus group discussions involving residents of the localities were conducted in Kibera and Kawangware. Forty-four in-depth interviews were conducted with

³ <http://pruv.ucd.ie/>

residents at the household level (heads of households, both men and women). Participants within the focus group discussions and interviews were stratified on the basis of gender and age (18–24 years old in one category and > 24 years in another category). In sum, 286 (54% male and 46% female) adult residents aged 18 and above of Kibera and Kawangware informal settlements were recruited by community mobilizers to participate in the wider project's interviews and focus group discussions. The main inclusion criterion was that the respondent was an adult resident of the informal settlements concerned and capable of providing informed consent. An overview of how the different concepts outlined in the previous section were operationalized on the basis of the mixed methods approach is outlined in Table 1.

3.3 Data Analysis

Cross-tabulations of tenure type and the length of living in the locality on the one hand with the relevant survey variables relating to housing and its exposure to risks of fire and floods were run in IBM SPSS Statistics 24. Chi-square and Fisher's exact tests of independence were performed to examine the relation between the indicators of tenure security and quality of housing across Kawangware and Kibera. Two sets of null hypotheses were tested. The first set of null hypotheses stated that no relationship existed between household tenure type on the one hand and self-reported structural integrity of the household's dwelling and whether the dwelling has been affected by fire or flooding on the other hand. The second set of null hypotheses stated that no relationship existed between the period a household has lived in a settlement on the one

hand and self-reported structural integrity of the dwelling and whether the dwelling has been affected by fire or flooding on the other hand. The quantitative data analysis was complemented by thematic analysis of the qualitative data gleaned from focus group discussions and in-depth interviews. The core themes were derived from the measures outlined in Table 1 and further subthemes were identified. A framework matrix was then created from these themes and subthemes in NVivo and populated with the interview and focus group discussion data.

4 Kibera and Kawangware: Tenure Security Context

Land occupied by slum settlements in Nairobi may be classified into several tenure categories with roots in British colonial rule (Anyamba 2011; Omwoma 2013). These include freehold titled land in the former native reserves; uncommitted public land; land planned and reserved for public utility; land for open space and riparian reserve; regularized leasehold land; land reserved to the city council for residential development; and group-owned land. Kibera is one of the largest informal settlements in subSaharan Africa with weak tenure security and little determinacy with respect to ownership of plots.

While population estimates for Kibera are highly contested (185,000 according to the latest census (Kenya 2019)), Kibera is approximately 225 ha in area and is situated on the outskirts of Nairobi. Comprising 12 villages with distinct ethnic compositions, approximately 95% of households live below the poverty line (Mukeku 2018; Kenya 2019). Results from the survey conducted in June

Table 1 Operationalization of the concepts of tenure security, quality of housing, and disaster risk

Concept	Indicator(s)	Research Method(s)
<i>Legalized tenure</i>	Legal dimension of tenure security	Legal and policy analysis
	Tenure type	Focus group discussions and in-depth interviews
	Renting/owned/free of charge	Household survey
<i>De facto tenure security</i>	Period a household has lived in the locality (years)	Household survey, focus group discussions, and in-depth interviews
<i>Perceived tenure security</i>	Perceived probability of eviction	Focus group discussions and in-depth interviews
	Fear of eviction	
<i>Quality of housing</i>	Structural integrity of dwelling	Household survey
	House ever damaged by a fire, storm, or flood event? If yes, ever repaired?	Focus group discussions and key informant interviews
<i>Disaster risk</i>	Household experiencing fire in last four weeks	Household survey
	Household experiencing flooding in last four weeks	Focus group discussions and key informant interviews
	House ever damaged by a fire, storm, or flood event? If yes, ever repaired?	
	Dwelling affected by hazard	

2015 that also collected tenure security data indicate that the average household monthly income in Kibera was about Ksh 7400 (approximately USD 67) with the majority of households (52.6%) depending on casual labor as their primary source of livelihood. The original settlers were the Nubian people from the Kenyan/Sudanese border who now occupy about 15% of Kibera, are mostly Muslim, and most likely to be owner-occupiers. The mode of occupancy is predominantly squatting on private or public land without permission of the owners. Residents have some quasi-legal tenure through letters of allotment from the Area Chiefs or some form of agreement with the private landowners. Another mode of occupancy in Kibera is the temporary occupation licence. This type of tenure is granted by the central government through the local authorities and can be terminated on short notice.

In contrast to Kibera, land ownership in Kawangware is based on freehold title (Ayonga 2019). This is the form of free tenure or absolute tenure where the owner possesses maximum rights permissible within the tenure system. Limited duration does not apply to this kind of tenure system (Williamson et al. 2010). Kawangware is situated about 15 km to the west of the city center of Nairobi with a population of just over 290,000 as per the Kenya Population and Housing Census (Kenya 2019). Similar to other slums, over 50% of the adult population have no permanent job, have limited access to education, and survive on less than one dollar a day. As shown in Fig. 1, the typical housing to be found in Kawangware consists of a combination of shacks with corrugated sheet roofs and increasingly prevalent concrete multi-story apartment buildings. This contrasts with Kibera where shacks with corrugated sheet roofs are widespread despite recent slum upgrading initiatives.

5 Results

The study's findings are presented in line with the three dimensions of tenure security identified above: legal security of tenure, de facto tenure security, and perceived tenure security.

5.1 Legal Security of Tenure

In Kibera approximately 90% of the residents are tenants and 10% are owner-occupiers. The complexity of the tenure system within Kibera is highlighted by the fact that a significant number of residents, particularly those who rent their dwellings, are unaware of the tenure status of residents living in their vicinity, that is who owns the land on which housing is built and who has access to title deeds. However, the importance of title deeds in defining ownership kept recurring in discussions over tenure. As a result of this uncertainty, disputes over land tend to be resolved by local chiefs. The process of purchasing dwellings involves negotiating with either local chiefs or the land commissioner. In other circumstances, gangs may seize properties and become landlords extorting rent.

The land ownership situation in Kawangware is clearer. Approximately 98% of households living in Kawangware are tenants and the remaining 2% are owner occupied. It was also clear from the interviews and focus group discussions that most households rent their structures. In contrast to Kibera, the qualitative data confirmed that title deeds are more readily available, and that tracing ownership is less contested and more easily identifiable than in Kibera. There are also group projects to obtain title deeds. The preference for ownership over renting was emphasized by the participants:



Fig. 1 Housing typical of Kibera (left) and Kawangware (right). Photographs by José-Antonio Gutiérrez Danton, 30 May 2018

Facilitator: “Why [are you not satisfied being a tenant]?”

Focus group participant (male Kibera resident, over 24 years old): “It’s good when you have land, build a house and be called a landlord.”

5.2 De facto Tenure Security

In Kibera, the government has a tradition of using public land as a form of patronage with unlawful abuse of presidential power when rewarding political supporters with land as indicated in Southall’s (2005) review of the Ndungu Report. Such parcels of land are often allocated without regard to due legal procedures, which serves to deepen tenure insecurity. For instance, despite the passage of an Act of Parliament that allowed the Nubians to own land in Kibera, the political powers at play have since ignored any legal intervention to allow Nubians to possess land titles in Kibera and exercise the rights they claim on the said land (Joireman and Vanderpoel 2011).⁴ As a result of this ownership limbo, there has been limited investment on the land by various occupants, including other indigenous Kenyan communities who have migrated to the settlement since 1963.

Political agency in land ownership within Kibera is mediated by a chain of actors in the provincial administration whose allocation of such parcels has no legal bearing (Syagga et al. 2002). This notion is reinforced by the findings of the United Nation’s Centre on Human Rights and Evictions (CoHRE 2006), which note that provincial administrators are used to allocate land to individuals and institutions without legal basis. This situation points to a decentralized system of patronage concerning land acquisition and ownership.

Essentially, land ownership in Kibera is a product of political patronage rooted in ethnic and political rewards. It is a situation where people in the administrative chain individually benefit while gate keeping for the government as the legitimate owner of the land. The purported landlords/owners can only lay claims to the extent that given regimes, including the informal operating control groups, remain tolerant of their demands. The big question is what this regime of ownership means for investment, securing and shielding the tenants in the wake of emergencies and evictions including compensating the so-called tenants when they lose their property in disasters.

In Kawangware there is limited urban planning control of any form of development on land held under freehold and, in most cases, land is subdivided informally. This is

due to the high transaction costs of formal land conveyance. As a result, there are multiple cases of disputed land ownership within the setting. When owners acquire land titles and apply for a change of user, however, there is the likelihood of improvement in the nature of settlements and this explains the rapid increase in new permanent structures in Kawangware.

In terms of the length of occupation of the localities, Kibera originated as a Nubian settlement during the colonial era. For its part, Kawangware is more distant from Nairobi’s city center and relatively more recently inhabited. Households have been living in Kibera for an average of 8.38 years ($N = 360$, $SD = 6.96$) and in Kawangware for an average of 4.43 years ($N = 375$, $SD = 5.00$). Apart from evictions arising from the 2007–2008 post-election violence, evictions in Kibera have mainly arisen due to new road and housing projects. Displacement has also arisen from intertribal rivalries, particularly in the wake of the 2007 presidential elections. Otherwise, where rent is paid, little concern was expressed in relation to eviction.

5.3 Perceived Tenure Security

The main perceptions of tenure insecurity indicated by the qualitative data arise from households being unable to pay rent, from infrastructure developments in the locality, or from flooding of the nearby river. The survey data indicate low levels of evictions in the four weeks before the survey was administered, which would indicate that the fear of eviction is low. This may indicate a reliance on the informal mechanisms that allow for de facto tenure security.

5.4 Exposure of Housing to Hazards

Kibera has more informal housing than Kawangware and is widely composed of shanties (Concern Worldwide 2016). A diverse range of views concerning housing in Kibera and Kawangware were expressed by residents, even within settlements. Connection to electricity in more formal settlements such as Kawangware follows an official costly process that may be unaffordable to slum dwellers in Kibera. Illegal connections are common as a result in Kibera, which is a cause of many fire incidences in the slums (Concern Worldwide 2016). Not surprisingly, the quality of housing is considered quite poor by residents and there is no significant difference between male and female respondents in this regard. As detailed in Table 2, Kibera households are roughly evenly split between those considering the structural integrity of their dwellings to be okay, safe, or very safe (50.6%) and those considering their dwelling to be unsafe or very unsafe (49.4%). In stark contrast, just less than 25% of households in Kawangware consider their dwelling to be either unsafe or very unsafe.

⁴ The Government of Kenya issued a joint title of 288 acres of land to Nubians on 2 June 2017 following an intervention by the African Commission in 2015.

There is quite a range of views among participants concerning the current quality of housing and whether quality has improved over time in Kibera. Some participants remarked on improvements in quality over recent years with the introduction of metal roof sheets and foundation stones, and in some instances the introduction of flush toilets. While some residents consider the introduction of metal sheets in recent years as an improvement, others note its propensity to catch fire:

Facilitator: “Has the quality of these houses improved, remained the same, or worsened?”

Focus group participant (female Kibera resident, under 24 years old): “...In case of fire, the house may burn completely due to addition of the metal sheet.”

Where housing has improved, several respondents noted that this can result in heightened rents. Several participants also noted the housing projects that involved the construction of new multistory apartments.

Intense dissatisfaction with the current standard of housing was also expressed. For example, the vulnerability of dwellings to disasters has been noted by residents:

Focus group participant (female Kibera resident, under 24 years old): “Sometimes when it rains, houses get carried away.”

A frequent cause of fire is the poor availability of electricity, perhaps a consequence itself of the informality of the locality:

Facilitator: “The other person said that the landlords do not do repairs. I have also seen that there are electric wires hanging...”

Focus group participant (female Kibera resident, under 24 years old): “...Yes, at the story, when they catch fire, they burn up like paper. And it is also a source of shock.”

These concerns over fire and flooding are borne out by the quantitative data. The risk of such disasters is much greater in Kibera than in Kawangware. As detailed in Table 3, 36.9% of households in Kibera experienced fire or flooding in the four weeks prior to the survey, more than twice the percentage of households in Kawangware at 16.3%. Table 4 details that 22.0% of households in Kibera report their dwelling ever having been damaged by fire,

Table 2 Comparisons of tenure security indicators by structural integrity of housing

Locality	Characteristic	Overall Sample	Structural Integrity of Housing		Test of Independence	Test value (df) p-value
			Okay, safe, very safe	Somewhat or very unsafe		
Kibera	Tenure type <i>n</i> (%)					
	Own	32	24 (75)	8 (25)	Chi ²	8.396 (1) 0.004**
	Rent	328	158 (51.8)	170 (48.2)		
		360	182 (50.6)	178 (49.4)		
	Period in Locality <i>n</i> (%)					
	0–2 years	54	31 (57.4)	23 (42.6)	Chi ²	3.848 (3) 0.278
	2–5 years	102	57 (55.9)	45 (44.1)		
	5–10 years	120	56 (46.7)	64 (53.3)		
	> 10 years	84	38 (45.2)	46 (54.8)		
		360	182 (50.6)	178 (49.4)		
Kawangware	Tenure type <i>n</i> (%)					
	Own	7	7 (100)	0 (0)	Fisher’s Exact	(1) 0.199
	Rent	368	274 (74.5)	94 (25.5)		
		375	281 (74.9)	94 (25.1)		
	Period in Locality <i>n</i> (%)					
	0–2 years	162	123 (75.9)	39 (24.1)	Chi ²	0.726 (3) 0.867
	2–5 years	112	81 (72.3)	31 (27.7)		
	5–10 years	64	48 (75)	16 (25)		
	> 10 years	37	29 (78.4)	8 (21.6)		
		375	281 (74.9)	94 (25.1)		

storm, or flooding compared with a mere 2.9% in Kawangware.

Housing in Kawangware is generally characterized by permanent apartment blocks, although the more informal housing that predominates in Kibera can also be found. The residents in Kawangware frequently referred to the “permanent housing” that has developed in the community in recent years. The following extract from a mixed-gender focus group discussion gives an overview of housing in Kawangware and current trends:

Focus group participant (Kawangware resident):

“Most people in Kawangware stay in single-roomed houses made from iron sheets and a few made of mud, others timber houses, but most people living in stone houses are likely those with some income. But as mentioned, landlords are now constructing expensive stone houses and Kawangware is changing to a more urban place, thus people are being driven out to other slums like Kibera and Kangemi where they can afford.”

Where participants identified an improvement in the quality of housing the reasons for the improvements included competition for tenants, improvements being associated with new landowners, as well as an increase in

the population in the locality. As in Kibera, participants in the qualitative study in Kawangware associated building improvements with rent increases and gentrification. Improved quality of housing was not associated with increased tenure security, especially if living cost is factored into tenure security. Overall, there is a strong sense in Kawangware that development of housing in the locality leads to a concern amongst residents around affordability.

5.5 Relationship Between Tenure Security and Exposure of Housing to Hazards

In terms of the relationship between tenure type and quality of housing, the focus group discussions and interviews revealed the desirable position of having ownership, including the ability to make improvements to housing. A significant relationship is identified between tenure type and the self-reported structural integrity of housing in Kibera, $\chi^2 (1, N = 360) = 8.40, p = 0.004$. Those households who rent their dwellings are more likely than households who own their dwellings to consider their housing as somewhat or very unsafe. This is despite the fact that dwellings constructed from metal sheets are owned as well as rented. But tenure type is not considered to have a significant relationship with disasters affecting

Table 3 Comparisons of tenure security indicators by fire or flooding in previous four weeks

Locality	Characteristic	Overall Sample	Household Experiencing Fire or Flooding in Previous Four Weeks		Test of Independence	Test value (df) <i>p</i> -value
			Yes	No		
Kibera	Tenure type <i>n</i> (%)					
	Own	32	14 (43.8)	18 (56.3)	Chi ²	0.532 (1) 0.465
	Rent	328	122 (37.2)	206 (62.8)		
		360	136 (37.8)	224 (62.2)		
	Period in Locality <i>n</i> (%)				Chi ²	8.324 (3) 0.040*
	0–2 years	54	12 (22.2)	42 (77.8)		
	2–5 years	102	36 (35.3)	66 (64.7)		
	5–10 years	120	52 (43.3)	68 (56.7)		
	> 10 years	84	36 (42.9)	48 (57.1)		
		360	136 (37.8)	224 (62.2)		
Kawangware	Tenure type <i>n</i> (%)					
	Own	7	2 (28.6)	5 (71.4)	Fisher's Exact	(1) 0.334
	Rent	368	61 (16.6)	307 (83.4)		
		375	63 (16.8)	312 (83.2)		
	Period in Locality <i>n</i> (%)				Chi ²	3.128 (3) 0.372
	0–2 years	162	29 (17.9)	133 (82.1)		
	2–5 years	112	14 (12.5)	98 (87.5)		
	5–10 years	64	11 (17.2)	53 (82.8)		
	> 10 years	37	9 (24.3)	28 (75.7)		
		375	11 (2.9)	364 (97.1)		

Table 4 Comparisons of tenure security indicators by house damaged by fire, storm, or flood

Locality	Characteristic	Overall Sample	Dwelling Damaged by Fire, Storm, Flood		Test of Independence	Test value (df) p-value
			Yes	No		
Kibera	Tenure type <i>n</i> (%)					
	Own	32	7 (21.9)	25 (78.1)	Chi ²	0.000 (1) 0.992
	Rent	328	72 (22)	256 (78)		
			79 (21.9)	281 (78.1)		
	Period in Locality <i>n</i> (%)					
	0–2 years	54	4 (7.4)	50 (92.6)	Chi ²	12.576 (3) 0.006**
	2–5 years	102	20 (19.6)	82 (80.4)		
	5–10 years	120	37 (30.8)	83 (69.2)		
	> 10 years	84	18 (21.4)	66 (78.6)		
		360	79 (21.9)	281 (78.1)		
Kawangware	Tenure type <i>n</i> (%)					
	Own	7	0 (0)	7 (100)	Fisher's Exact	(1) 1.000
	Rent	368	11 (3)	357 (97)		
		375	11 (2.9)	364 (97.1)		
	Period in Locality <i>n</i> (%)					
	0–2 years	162	5 (3.1)	157 (96.9)	Chi ²	1.300 (3) 0.729
	2–5 years	112	4 (3.6)	108 (96.4)		
	5–10 years	64	2 (3.1)	62 (96.9)		
	> 10 years	37	0 (0)	37 (100)		
		375	11 (2.9)	364 (97.1)		

the household. Whether a household owns or rents their dwelling bears little relevance to whether a household has experienced fire or flooding in the previous four weeks or whether its dwelling has ever been damaged by fire, storm, or flood. Unlike in Kibera, there is no significant relationship in Kawangware between tenure type and structural integrity. Similar to Kibera, however, tenure type in Kawangware is not found to have a significant relationship with fires or floods either damaging or otherwise affecting homes.

In terms of the influence of the period of time that a household has spent in the locality on housing quality and its exposure to disaster risk, a significant relationship is identified in Kibera between this period and whether the household has ever been damaged by a fire, storm, or flood, χ^2 (3, N = 360) = 12.58, p = 0.006. While it might be expected that the likelihood of ever having been affected by fire or flood increases over time, there is also a significant relationship in relation to whether fire or flood has affected household dwellings in the previous four weeks, χ^2 (3, N = 355) = 9.89, p = 0.020. Contrary to what might be expected from the literature, the longer the period a household has spent in the locality the more likely that a house has been affected in the previous four weeks.

Although no significant relationship is found between the length of time a household lives in a locality and the structural integrity of the dwelling, it is clear that the longer the residence of a household in Kibera increases, the greater the likelihood that the household considers the structural integrity of the dwelling to be unsafe. As found in Kibera, the period a household has spent in Kawangware had little to no effect on the self-reported structural integrity of the dwelling, possibly because there is clear ownership and tenants are paying rent. In contrast to Kibera, there is no significant relationship identified between the period spent by a household in Kawangware and whether their dwelling has ever been damaged by a fire, storm, or flood. Furthermore, while a correlation was found between the length of time living in a locality and the dwelling being affected by fire or flood in the last four weeks in Kibera, this is not the case in Kawangware.

6 Discussion

From a legal perspective there is greater tenure insecurity in Kibera than in Kawangware, evidenced by the prevalence of freehold land in Kawangware and the informal

nature of the division and management of plots on formally government-owned land in Kibera. As a result, it is clear that the poorer structural integrity of dwellings in Kibera vis-à-vis Kawangware would tend to reinforce the literature that identifies a positive link between the legal understanding of tenure security and quality of housing (Field 2005; Nakamura 2014). Households in more informal Kibera are also much more likely to report experiencing fires and floods or having their dwellings damaged as a result. The findings show that tenure type is closely associated with self-reported structural integrity of the dwelling. This coheres with findings from other settings indicating that tenants are less incentivized than owner-occupiers to invest in their own homes. However, tenure type was not associated with an increased risk of disaster. This runs counter to literature indicating a “tenure trap” whereby tenants are rendered more vulnerable to disaster than are owner-occupiers.

The literature considers the period a household spends in a locality to be a significant contributor to both de facto tenure security and the perception by a household of their tenure security. Yet the average length of settlement of households in more tenure insecure Kibera is almost twice that of households in Kawangware. In contrast with tenure type, the period a household has spent living in the locality is not associated with outcome variables relating to perceived structural integrity of the dwelling. This runs counter to the expectations within the literature that duration of residence is associated with greater tenure security and improved housing over time (Varley 1987; Caldieron 2013; Nakamura 2016). The lack of improved housing over time may be due to the lack of incentive to improve the dwelling arising from tenancy.

The period households spent in the locality, however, is closely associated with outcome variables concerning disasters affecting the dwelling. While the literature tends to posit that the longer a household spends in a locality the less disaster risk they tend to be exposed to (Perry et al. 2001; Burby et al. 2003), our findings indicate that the longer a household is living in Kibera and Kawangware the more likely their dwelling is to report experiencing a fire or flooding event in the previous four weeks. This may be attributed to households living in the locality for longer periods are living in older dwellings more susceptible to such hazards, but further investigation is required.

7 Conclusion

The study highlights the complex relationship between tenure security and disaster risk. Propositions of unambiguous relationships between indicators of tenure security on the one hand and the disaster risk to which the dwelling

is exposed and the dwelling's structural integrity on the other are to be treated with caution. Findings from this study show that increased tenure security is associated with greater self-reported structural integrity of the dwelling but is not necessarily linked with less exposure of housing to hazards. Improved tenure security is also likely to result in increased rents and effectively displace households to other, more affordable areas that may face greater exposure to hazards. In assessing risk it is important to understand how risk is assessed by residents; in many cases residents choose to reside in areas that are tenure insecure and hazard prone because of housing affordability. This highlights the wicked problem faced by policymakers whereby addressing tenure insecurity and disaster risk might result in the effective displacement of residents with all the implications for social cohesion and livelihoods that this entails. Previous slum upgrading initiatives in Kibera have highlighted the unintended consequences of such initiatives. Current initiatives in Kenya center around the development of community land trusts, infrastructure and service delivery, and the facilitation of social movements of slum dwellers to influence policy. Furthermore, the account of the relationship between tenure type and quality of housing provided should be subject to caution and needs to also recognize possible confounding variables. For example, renting households tend to have lower incomes than homeownership households. Tenure insecurity is also likely to be present in contexts exposed to disaster risks posed by fire and flooding as state actors are reluctant to encourage settlement.

As tenure type was associated with perceived lack of structural integrity, but not with increased exposure to disaster risk, further research is required to understand the complex interplay between tenure type and unsafe housing on the one hand and exposure to disaster risks on the other, particularly in resource-poor settings. This study counsels caution in generalizing findings across contexts and highlights the importance of understanding the complex causal mechanisms at play between tenure security in expanding urban informal settlements and the disaster risks to which they are exposed.

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