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Understanding Living Conditions and Deprivation in Informal Settlements of Kisumu, Kenya

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Abstract
Informal settlements are a common occurrence in developing countries. Each settlement, however, has unique living conditions which require improvement efforts that are specifically tailored to the settlement. This study, carried out in Kisumu's informal settlements, had two aims: to describe living conditions and to propose areas of improvement within the settlements. The study adopted two approaches: the living conditions framework and the multi-dimensional poverty index. Results indicate that deprivation is widespread at the individual and housing unit level, but the settlements are served with public services such as schools and health centres which residents can access. At the compound level, compounds lack infrastructural services such as water, sanitation and solid waste disposal, and where they are available, these services are shared. This study highlights the importance of basic service provision, upgrading of housing and supporting of existing income-generating opportunities within the settlements. Development efforts should involve all stakeholders, including landlords, tenants, community groups and governmental and non-governmental organisations.

Keywords Deprivation · Development · Informal settlements · Kisumu · Poverty

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Introduction

Background

According to the United Nations (UN), more than half of the world's population now lives in urban areas; and out of every ten urban residents of the world, more than seven are in developing countries (UN-Habitat 2013, p. 25). This increase in the urban population has led to (among others) the urbanisation of poverty, inequality and the growth of informal settlements (UN-Habitat 2014, p. 31; Zhang 2016).

These informal settlements are characterised by poverty, tenure insecurity, informal housing, a lack of basic services and overcrowding (Davis 2006; Nuissl and Heinrichs 2013; UN-Habitat 2003, 2014, p. 31). Apart from urbanisation, their expansion has also been attributed to colonialism, poor urban planning approaches, poor governance and the inability of governments to meet the demands of the growing urban population (Cranby 2012; Fox 2014; Huchzermeyer 2014; UN-Habitat 2003; Watson 2014). These settlements, however, provide shelter to a large portion of a city's population; for instance in Africa, approximately 62–70% of the urban population lives in informal settlements (Turok 2014; UN-Habitat 2013, p. 151; Zhang 2016). It is projected that by 2020, African cities will have expanded by 150 million (Parnell and Walawege 2014), and it is therefore likely that the population in informal settlements in Africa will also grow exponentially.

Countries around the world have their development agenda focused on meeting the Sustainable Development Goals (SDGs) with an aim of ensuring equality and creating a better future for later generations. The first goal particularly aims at ending poverty 'in all its forms' among men, women and children of all ages.

Poverty is usually measured directly or indirectly. The direct method is used to show whether people satisfy a set of specified basic needs, while the indirect method, often called the income approach, determines whether people's incomes fall below a level at which basic needs can be satisfied (Alkire and Santos 2014). The income method has been extensively applied in many countries around the world and the threshold as per the SDGs is set at 1.25 USD per person per day.

Poverty, however, is often times not only about income. It is noted that measurement of poverty is complex and should be extended beyond indicators that measure income or consumption (Alkire and Santos 2014; Gulyani et al. 2014; Sida 2017). Scholars and researchers in admission of the complexity of poverty have used various approaches to define and measure poverty.

The multi-dimensional poverty index (MPI) is an approach proposed for measuring poverty through different 'dimensions' (Alkire and Foster 2011; Alkire and Santos 2014). According to the MPI approach, poverty is defined as *deprivation* in three dimensions: health, education and living standards. Other authors have also defined and measured poverty using different approaches. Gulyani and colleagues (Gulyani et al. 2010, 2014) acknowledge that urban poverty is complex and multi-dimensional and therefore developed three frameworks (the living conditions diamond, the development diamond and the infrastructure polygon) to paint a picture of poverty in informal settlements in Johannesburg, Nairobi and Dakar, and convey the multi-dimensionality of poverty. More recently, the Swedish International Development Cooperation Agency (SIDA) also developed a conceptual framework to highlight the different dimensions of

poverty (Sida 2017). According to SIDA's framework, poverty can be understood in four dimensions: resources, opportunities and choice, power and voice and human security (Sida 2017).

Poverty is often a defining characteristic of informal settlements. Residents of these settlements are faced with vulnerabilities such as inadequate and unstable incomes, payment of high prices for necessities, inadequate protection of rights through the operation of the law, voicelessness and powerlessness within political systems, inadequate provision of infrastructure, lack of collateral for accessing credit, few or no savings and health burdens from undernutrition and the use of poor-quality food, fuel and water (Satterthwaite and Mitlin 2014, pp. 240–241). It is therefore imperative that measurement of poverty and deprivation in informal settlements adopts a multiple dimension approach in order to effectively understand the different vulnerabilities that residents of the settlements contend with. The above-mentioned approaches can be adopted and applied in informal settlements to gain a better understanding of vulnerability and deprivation.

The purpose of this paper is therefore to illustrate living conditions and deprivation in informal settlements in a Kenyan city by adopting the MPI approach and the living conditions framework. A combination of these two approaches is significant as such an approach leads to an understanding of the various forms of deprivation in informal settlements. This information can then be used by policymakers in decisions regarding resource allocation and policy formulation in informal settlements. This paper is structured in several sections: An overview of the two approaches will first be presented, which will be followed by an overview of the study area. Results and a discussion will then follow and conclusions will finally be drawn from these results.

Theoretical and Analytical Approach

The MPI approach, developed by Alkire and Foster (2014), reflects the deprivations that individuals face at the same time, and identifies the poor as those who face multiple deprivations. It uses ten indicators to measure three dimensions of poverty—education, living conditions and health. It leads to identification of the incidence of poverty (denoted as H) and the average intensity of poverty across the poor (denoted as A). In addition, the approach leads to identification of the M_o, which is calculated as $H \times A$. M_o is the sum of deprivations that only the poor experience divided by the total population (Alkire and Foster 2011; Alkire and Santos 2014). The MPI methodology follows a number of steps, including defining indicators, setting deprivation cut-offs, applying the cut-offs, selecting weights for each indicator, calculating weighted proportions for each person, determining the poverty cut-off, computing the proportion of people who have been identified as multi-dimensionally poor (the incidence of multi-dimensional poverty), computing the intensity of multi-dimensional poverty and computing the M_o (Alkire and Foster 2011; Alkire and Santos 2014).

The living conditions framework on the other hand disaggregates living conditions along four vertices of a diamond: tenure, infrastructure, housing unit quality and neighbourhood location (Gulyani and Bassett 2010). The four themes/vertices are interrelated: one affecting the other, and collectively defining living conditions in any settlement. For instance, improvement in tenure security leads to improvement in

housing unit quality, while housing units located in tenure 'secure' locations are likely to be in areas with better neighbourhood facilities (Gulyani and Bassett 2010).

The two frameworks were adopted to describe living conditions and illustrate deprivation in the informal settlements of Kisumu in Kenya.

Study Area

Kisumu, the third largest city in Kenya, is situated in the western region of the country, within Kisumu County. The city has a population of approximately 420,000 people (Republic of Kenya 2013). Over the years, Kisumu has experienced a growth in its population, with a resultant growth of informal settlements that are situated close to the city centre. Of the cities in Kenya, Kisumu is estimated to have the highest proportion of residents living in informal settlements estimated at 47% (NCPD 2013). These settlements are Obunga, Bandani, Nyalenda A, Nyalenda B, Manyatta A, Manyatta B, Manyatta Arab, Kaloleni and Kibos.

Much of the land in these settlements is freehold whose owners obtained through inheritance (Huchzermeyer 2009; UN-Habitat 2005). Over time, some owners have constructed rental housing and continued to live within their pieces of land, while others have constructed rental housing and moved to live in other areas. Consequently, there are resident landlords who live within their premises as well as absentee landlords who do not live within their premises. Housing structures are either constructed in the traditional style, with mud walls and iron sheet roofing, or in more modern styles (UN-Habitat 2005) that include storey buildings with walls of brick/concrete. These houses are located in plots/compounds, with a compound comprising several families under a landlord, who would normally be responsible for provision of basic services. Many compounds, however, lack electricity, water and sanitation facilities (Karanja 2010).

Methods

Sampling and Data Collection

Results from a preliminary study were used to calculate the required sample size for a cross-sectional survey, which resulted in a total sample of 160 compounds (detailed in Simiyu et al. 2017b). Due to challenges of lack of data, the sample size was divided equally among four informal settlements—Nyalenda A, Nyalenda B, Bandani and Obunga. These settlements are divided into 'units' which are geographical sub-sections of the settlements. Two units with the highest population density were purposively selected from each settlement. Twenty compounds were selected from each unit, therefore totalling to 40 compounds from each of the selected informal settlements.

Due to lack of data on population in the units, transect walks were taken in the selected units in order to approximate the number of compounds. The estimated number was then divided by the required sample size (of 20 compounds) from each unit, in order to determine the sampling interval. With this sampling interval, selection of compounds then began systematically from one end of each unit, and progressed

towards the other end. From each compound, one household was randomly selected. An adult head or their spouse was selected from each household.

Selected respondents were interviewed by research assistants, who first informed respondents about their rights and requirements as respondents, as well as the aims of the study. Consent was sought and obtained before any interviews began. Research assistants interviewed the respondents by following the questions outlined in a structured interview guide, and recording the responses given on the same guide. This guide had closed-ended questions that were divided into five themes/dimensions, shown in Table 1.

This process of selection and interviewing of respondents continued in all the settlements and eventually resulted in a sample size of 180 respondents.

Data Management and Analysis

Data were entered into Epi-Info (Centre for Disease Control (CDC), Atlanta, GA, USA) and checked for any errors. After data entry and cleaning, the dataset was transferred to Stata, version 13 (Stata Corp, College Station, TX, USA) for analysis. In Stata, descriptive statistics were used to summarise continuous variables, while chi-square tests were used to assess relationships/associations among categorical variables.

To calculate the deprivation of respondents, the following steps were followed.

1. Identification of dimensions. The themes adopted from the living conditions framework were adopted as dimensions of deprivation, thus, individual, housing unit, compound and neighbourhood level deprivation.
2. Identification of indicators: indicators defining deprivation for each of the dimensions were identified. These indicators were guided by minimum acceptable standards. For example, primary school education in Kenya is compulsory and therefore an individual was considered deprived if they had not completed primary education. Some of the indicators were also subjective, for example, any lack of a sanitation facility was considered deprivation, irrespective of the type of sanitation facility. These indicators have been summarised in Table 2.

Table 1 Themes and variables defining living conditions in interview guide; adopted from the living conditions framework

Theme	Measurement variables
Individual/household characteristics	Age, education, gender, marital status, religion, occupation, spouse's occupation, workplaces, household size, monthly income
Housing unit characteristics	Duration of stay, number of rooms, electricity connection, electricity price, roofing, wall and floor materials, reason for choice of the house
Compound characteristics	Total number of households, main water source, time to main water source, cost of water, second water source, time to second water source, sanitation, waste disposal, security measures, type of residence (tenure)
Neighbourhood	Available markets, time to markets, time to the link road and the main road, time to city centre, time to health centre, schools, form of transport used
General	Main challenges faced

3. Identification of and application of deprivation cut-offs for each dimension. This step entailed identifying who will be considered deprived or non-deprived with respect to each dimension. These have also been highlighted in Table 2.
4. Counting the number of deprivations for each person.
5. Determining the number of deprivations a person must be deprived in order to be considered multi-dimensionally deprived. In this study, since there were four dimensions, an individual was considered multi-dimensionally deprived if they were deprived in at least two dimensions.
6. Applying the cut-off to the data.
7. Calculating the headcount (H), which was calculated by dividing the number of poor people by the total number of people. This is the incidence of deprivation.
8. Calculating the average poverty gap (A), which was calculated by adding up the proportion of total deprivations and dividing by the total number of poor persons. This is the intensity of multi-dimensional poverty.
9. Calculating the Mo, which is calculated as H × A.

Results

Household Conditions

Most of the respondents (82%) were women who were on average 30 years old. The majority of these respondents were married (71%). Over half of the respondents (54%) had basic education and were engaged in some occupational activity, with a portion not involved in any occupational activity (36%). As described in Table 3, the respondents were either involved in casual work, business or in formal employment. Casual work included activities where residents worked for pay on a daily basis as per availability of the employment. Respondents were also involved in business activities which included sale of fast moving items such as grocery. Formal employment which was the lowest included employment at the local government and teaching. The average household size was four individuals, mainly composed of parents and children; and the monthly household income was KES (Kenyan Shilling) 10,588[1] which was from all household members.

Housing Conditions

Most (77%) of the houses were one-roomed. They all had iron sheet roofs, with a greater percentage having plastered walls (57%) and cemented floors (71%). Over half (57%) of the housing units did not have an electricity connection; and the average monthly rent was KES 1211. Respondents mentioned that they chose to live in the settlements mainly because houses were affordable (34%) or because they lacked other alternatives (24%). Bandani residents paid the lowest mean rent (KES 931), while those in Nyalenda B paid the highest mean rent (KES 1356).

[1] 1USD = KES 100

Table 2 Dimensions, indicators and cut-off defining deprivation in Kisumu's informal settlements

Dimensions	Indicators	Definition	Deprivation cut-off
Individual	Completed primary education	Deprived if primary school education is incomplete	An individual was considered deprived if they were deprived in one of the two indicators
	Involved in some form of occupation	Deprived if not involved in any form of occupation	
Housing	No. of rooms	Deprived if living in a one-roomed house	An individual was considered deprived if they were deprived in two of the indicators
	Wall material	Deprived if wall material is mud or iron sheet	
	Floor material	Deprived if floor material is mud	
	Availability of electricity	Deprived if lacking electricity connection	
Compound	Availability of water source	Deprived if it takes over 3 min to get to a water source	An individual was considered deprived if they were deprived in three or more of the indicators
	Availability of toilet	Deprived if there is no toilet in the compound	
	Number of households	Deprived if there are two or more people in the compound	
	Waste disposal	Deprived if practicing open waste disposal	
	Some form of security	Deprived if lacking some form of security	
Neighbourhood	Access to market	Deprived if it takes over 10 min to get to the market	An individual was considered deprived if they were deprived in two of the indicators
	Access to the nearest access road	Deprived if it takes over 5 min to get to an access road	
	Access to the health facility	Deprived if it takes over 30 min to access a health facility	
	Access to city centre	Deprived if it takes over 30 min to get to the city centre	

Upon further analysis, results showed that compared to other settlements, most of the households in Obunga had electricity connection, while Bandani had the least number of households with electricity connection (chi^2 35.29; $p < 0.001$). Housing units constructed with low-quality materials fetched lower rents, for example, housing units with earthen floors (92%) and those with earthen walls (85%) fetched monthly rents of between KES 300 and KES 1000.

These household and housing conditions are summarised in Table 3.

Table 3 Household and housing unit characteristics of respondents in Kisumu's informal settlements ($n = 180$ unless stated otherwise)

1. Household	Mean (range)/freq (%)	2. Housing unit	Mean (range)/freq (%)
Age	30.36 (18–65)	Electricity	
		Connected	78 (43.2)
HH size	3.88 (1–9)	Not connected	102 (56.7)
Gender		Wall	
Male	33 (18.3)	Mud	62 (34.4)
Female	147 (81.7)	Iron sheet	16 (8.9)
		Plastering/roughcast	102 (56.7)
Education			
None	61 (33.9)	Floor	
Primary education	97 (53.9)	Mud	52 (28.9)
Secondary education and above	22 (12.2)	Cemented/concrete	128 (71.1)
Marital status		No. of rooms	
Single/unmarried/single parent	24 (13.3)	1	139 (77.2)
Married	128 (71.1)	2	34 (8.9)
Widowed/divorced/separated	28 (15.6)	3	7 (3.9)
Occupation		Length of stay (years)	4.5 (0.06–36)
None/housewife	65 (36.1)		
Casual worker	33 (18.3)	Rent	KES 1211.7
Self-employed/business	76 (42.2)		(300–3500)
Formal employment	6 (3.3)	House attraction factors	
		None	
Spouse occupation ($n = 128$)		Cost related	43 (23.9)
None/housewife	12 (9.4)	Housing related	61 (33.9)
Casual worker	49 (38.3)	Compound factors	38 (21.1)
Self-employed/business	46 (35.9)	Neighbourhood factors	29 (16.1)
Formal employment	21 (16.4)		9 (5)
Monthly household income	10,588.76	Area	
	(0–90,000)	Bandani	
Areas of occupation ($n = 115$)		Nyalenda A	40 (22.2)
In the neighbourhood	71 (61.7)	Nyalenda B	47 (26.1)
Within the city	41 (35.6)	Obunga	50 (27.8)
Outside the city	3 (2.7)		43 (23.9)
Spouse's workplace ($n = 116$)			
In the neighbourhood	21 (18.1)		
Within the city	89 (76.7)		
Outside the city	6 (5.2)		

Compound Conditions and Services

Residents lived in compounds that had an average of seven households. Approximately, only 8% of the compounds had water connections and households in the rest of the compounds depended on nearby water points, to which they mostly walked for less than

Table 4 Associations between categorical variables explaining living conditions in Kisumu's informal settlements

Categorical variables	*p* values	Explanation
Settlement and electricity connection	Chi^2 (3) = 35.29 $p < 0.001$	Many compounds in Bandani lacked electricity connection, while many in Obunga had electricity
Rent (categorised) and having a toilet*	Chi^2 (3) = 22.19 $p < 0.001$	Respondents from compounds without sanitation facilities paid a lower rent
Type of residence and rent paid	Chi^2 (6) = 13.88 $p = 0.03$	Of tenants paying between KES 800 and 1000, 61% were from compounds with absentee landlords
Residence and having a toilet	Chi^2 (2) = 24.89 $p < 0.001$	71% of compounds without sanitation facilities had absentee landlords
Settlement and type of residence	Chi^2 (6) = 18.71 $p = 0.005$	Most compounds in the settlements had absentee landlords, except Nyalenda B, which had more live-in landlords
Residence and electricity connection	$Chi^2 = 8.57$ $p = 0.014$	Most (56%) compounds without electricity connection had absentee landlords
Residence and house floor material	$Chi^2 = 14.47$ $p = 0.001$	Most (67%) of the housing units with mud floors were in compounds with absentee landlords

*For the purposes of cross-tabulation, rent was converted into a categorical variable, with four quartiles of KES 300–800, 801–1000, 1001–1500 and above 1500

5 min, paying on average KES 3 for a 20-l jerry can. Most of the main water points were not reliable (73%) in the sense that there were times when there was no flowing water in the taps. During such times, residents used other alternatives such as springs and boreholes.

Sanitation facilities, which were all pit latrines, were shared by households in the compound, and approximately 64% of compounds had a designated area where solid waste was disposed. For safety/security purposes, residents either had a gate, fence, dogs or a combination of several of these. In terms of tenure, all the respondents were tenants, and most of the compounds in the settlements (53%) had absentee landlords, meaning that these compounds were occupied by tenants only. Nyalenda B, however, had a higher proportion of compounds with live-in landlords.

Some associations between these compound characteristics were noted, and they have been summarised in Table 4. It was, for example, noted that compounds with absentee landlords more often had poor-quality housing that fetched low monthly rent, and lacked basic services such as electricity and sanitation.

Neighbourhood Conditions

In terms of accessibility, it took an average of 5.7 min for respondents to walk to the nearest link road if they lived far from a main road, and approximately 14.5 min to walk to a main road.[2] The settlements had stalls and mini shops, from where 96% of the

[2] A link road is a road (often times an earthen/dirt road) that provides accessibility within the settlements, while the main road is a paved/tarmac road providing access to areas outside the settlements.

respondents purchased their daily supplies. There were a few schools and health centres in the settlements, which attracted children who were mostly from within the settlements. In terms of transportation, residents used a variety of transportation modes such as walking, using motorbikes, bicycles and three-wheeler cars. The compound and neighbourhood characteristics are summarised in Table 5.

Deprivation in the Settlements

In addition to what has been presented in Table 3, calculation of deprivation in the settlements revealed that 36% of respondents lacked some form of occupation, and 34% lacked basic education. From a housing perspective, 77% were deprived in the sense that they lived in single-roomed houses, 57% lacked access to electricity connection, 43% had housing walls made of mud or iron sheets and 29% lived in houses where the floor material was mud.

In the compound, 49% lacked sanitation facilities in their compounds, 98% lived in compounds with two or more households, 33% took over 3 min to access a water source, 86% lacked some form of security in their compounds and 30% lacked proper solid waste disposal methods.

Within the neighbourhood, 25% took over 5 min to get to the nearest access road, 14% took over 10 min to access a market, 12% took over half an hour to access a health facility and 20% also took over half an hour to access to the CBD.

In applying the cut-off, 56% of all respondents were deprived in the individual dimension, 63% were deprived at the housing dimension, 33% deprived at the compound dimension and 16.6% deprived in the neighbourhood dimension. Results indicated that 108 respondents were deprived in at least two dimensions; thus, the incidence of multi-dimensional deprivation was 0.6 (60%). The intensity of multi-dimensional deprivation was also 0.6 implying that a deprived resident in the settlements would on average be deprived in 60% of the identified indicators. The M_o calculated as a product of the incidence and intensity was 0.36.

General Findings

Most of the challenges mentioned by the respondents were compound-related, for example, residents complained of a lack of sanitation facilities, or of the unhygienic conditions of sanitation facilities. They also mentioned poor solid waste disposal practices at the compound level, which translated to poor waste disposal within the settlements. The second most common category of challenges was related to the neighbourhood, mainly insecurity, flooding during the rainy season and poor waste management. At the household level, respondents complained of houses that were poorly constructed and that leaked during the rainy season.

Discussion

Informal settlements are a common phenomenon in many developing countries. Their improvement is therefore an important area of focus, as it contributes towards several SDGs including eradicating poverty (SDG 1) and making cities inclusive, safe, resilient

Table 5 Compound and neighbourhood characteristics of Kisumu's informal settlements ($n = 180$ unless stated otherwise)

3. Compound	Mean (range)/freq (%)	4. Neighbourhood	Mean (range)/freq (%)
Number of HH	7 (1–25)	Time to link road	5.7 (1–35)
		Time to main road	14.5 (1–60)
Main water source			
Compound connection	14 (7.8)	Transport to work place ($n = 115$)	
Nearby water point	148 (82.2)	Walking	92 (80)
Neighbour's compound	14 (7.8)	Bicycle/motorbike	12 (10.4)
Others	4 (2.2)	Three-wheeler cars/minibus	11 (9.6)
Time to walk to water source			
Compound connection	14 (7.8)	Time to workplace	15.8 (1–120)
Less than 5 min	111 (61.7)		
5 min and above	55 (30.6)	Transport to spouse workplace ($n = 116$)	
Cost of water at main source	KES 3.2 (1–5)	Walking	52 (44.6)
		Bicycle/motorbike	32 (27.6)
Secondary water sources ($n = 132$)		Three-wheeler cars/minibus	32 (27.6)
Nearby water point	31 (23.5)	Transport to city centre	
Springs and boreholes	79 (59.9)	Walking	50 (27.8)
Stored water	22 (16.7)	Bicycle/motorbike	53 (29.4)
		Three-wheeler cars/minibus	77 (42.8)
Water price at second source			
Stored water	17 (12.9)	Time taken to city centre	28.1 (5–120)
No cost	41 (31.1)		
KES 1–3	65 (49.2)	Transport to health facility	
Above KES 3	9 (6.8)	Walking	110 (61.1)
		Bicycle/motorbike	35 (19.4)
Residence type		Three-wheeler cars/minibus	35 (19.4)
Live-in landlord	45 (25)		
Tenants with caretaker	40 (22.2)	Time to health facility	22.1 (0–60)
Tenants only	95 (52.8)		
		Challenges	
Sanitation		Housing unit	42 (23.4)
Available	91 (50.6)	Compound	82 (45.8)
Not available	89 (49.4)	Neighbourhood	55 (30.7)
Security			
Some form of security	25 (13.9)		
No security	155 (86.1)		

and sustainable (SDG11). Before implementing improvement strategies, information about informal settlements is needed to inform these strategies. In line with this need

for information, this study describes living conditions and deprivation in Kisumu's informal settlements in four main areas: Neighbourhood conditions, compound-level infrastructural provision, housing quality and individual-level characteristics.

Following the MPI approach, results indicate that residents have less deprivation within their neighbourhood. Indeed, results indicate that the settlements are served with various social amenities such as schools, markets and health facilities. In addition, the settlements are close to the city centre where residents can also access other services. The availability of such services at the local level is commended because it ensures accessibility of services at the local level. In addition, Kenya's devolution system may have contributed to the availability of such services at the local level.

In terms of service provision at the compound level, results of the living conditions diamond indicate that residents expressed dissatisfaction with services at the compound level due to non-provision or inadequate management structures. Most of the challenges mentioned by residents were also related to service provision at the compound level, such as lack of sanitation facilities and poor solid waste disposal. Results of the MPI, however, showed that approximately 33% of respondents were deprived at the compound level. These results from the two approaches imply that the MPI shows deprivation in terms of lack of access to the set indicators, but it may not be appropriate in indicating the other dynamics such as management challenges. The results are also based on identified indicators which may or may not paint the total picture. In this study, for example, access to any type of water or sanitation facility was not considered as deprivation, yet the type of water and/or sanitation facilities is equally important in defining the level of service.

Access to services such as water and sanitation at the compound level is a responsibility of landowners. Kenya's Environmental Sanitation and Hygiene Policy (Republic of Kenya 2016) mandates landlords, including those in informal settlements, to provide sanitation facilities within their premises. The lack of basic services in these settlements is therefore a reflection of poor enforcement of policies and negligence among landlords. In addition to lack of basic services, users also raised complaints of mismanagement of infrastructure that was shared at the compound level. Users were particularly concerned about inappropriate sanitation behaviour of other compound users that resulted in the toilets being dirty. These results about sanitation are confirmed by studies from informal settlements that indicate that shared sanitation facilities in informal settlements are often dirty due to a lack of cooperation among users (Addo 2015; Parikh et al. 2015; Simiyu et al. 2017a; Tumwebaze et al. 2013). Due to lack of space in most informal settlements, some basic services such as water and sanitation facilities are often shared, thereby the need for management structures at the compound level that are practical and sustainable.

One challenge that hinders improvement in informal settlements is tenure insecurity; hence, the suggestion that land formalisation can lead to tenure security and encourages residents to invest in other services (Handzic 2010). In Kisumu's informal settlements, however, landowners have freehold land titles (Huchzermeyer 2009) suggesting that tenure security is assured. A situational analysis of Kisumu's settlements also alludes to the same by stating that issues of tenure in Kisumu are not 'critical' (UN-Habitat 2005). Because of this security of tenure, landlords can engage in improvement of living conditions within their property. However, there were various categories of landlords, with findings pointing to better service provision in compounds with live-in landlords

compared to compounds with absentee landlords. Absenteeism among landlords affected living conditions in the settlements, since these landlords did not make any improvements to conditions within their premises. It is also possible that these landlords had low incomes, and they used their premises, particularly rental housing, as a means for economic survival or as an opportunity for income generation; a premise that has been noted in other researches in Kisumu (Simiyu et al. 2017b; Smith 2017), Brazil (Lonardoni and Bolay 2016) and Nigeria (Opoko 2014). These results therefore reveal that apart from assurance of tenure security, landlords influence living conditions and deprivation in informal settlements since they are service providers.

In terms of housing, most of the housing in Kisumu's settlements was of poor quality, which was also mentioned as a concern by respondents and reflected by the MPI. Poor-quality housing is a common phenomenon in informal settlements in many countries, for example, Tanzania (Cadstedt 2010), Nigeria (Daniel et al. 2015), Ghana (Abu-Salia et al. 2015; Amoako and Frimpong Boamah 2016) and South Africa (Govender et al. 2011; Narsai et al. 2013; Turok and Borel-Saladin 2015). In this study, the poor quality of housing was reflected in the low amounts of monthly rent. Further analysis indicated that tenants from Nyalenda B paid a higher monthly rent, compared to those from other settlements. These results are corroborated by Smith (2017) whose study also highlights that residents of Nyalenda spent a higher portion of their household income on rent. The higher amount of rent paid is an indication that the housing in Nyalenda B was of better quality than that in the other settlements. This finding is also related to the high number of live-in landlords in Nyalenda B, indicating that these landlords paid attention to conditions within their premises, including the quality of housing that they put up. These results further strengthen the premise that landlords play a crucial role in improving living conditions in informal settlements. These results further highlight that there are other economic factors that influence living conditions in Kisumu city's informal settlements: due to population growth in the city and low incomes among the urban poor tenants, there is demand for cheap/affordable housing. Landlords take advantage of this rising demand to put up (cheap, poor quality) housing structures, which would be a source of income for them (the landlords). These structures would meet the immediate housing demand of the urban poor tenants, but in the long run, this type of housing is unsustainable, as reflected in the complaints about housing units that leaked during the rainy season.

These results therefore show that whereas landlords have to play a role in basic service provision, tenants equally have a role to play in ensuring that they improve their living conditions. However, other factors determine the conditions that residents of informal settlements live in. As mentioned earlier, population growth, low-income levels and demand for cheaper accommodation push some landlords to construct low-quality housing without providing basic services. Some of these landlords may also be financially constrained/living in poverty, and yet some may be negligent, reluctant or they concentrate on other investments that fetch income (e.g. construction of rental housing). Tenants opt to live in compounds with poor housing and without basic services due to financial limitations/low incomes so that they can meet other basic needs. It is also possible that the relationship between landlords and tenants is interdependent, where both parties can exercise power over each other. The (usually small scale) landlords depend on the rent from the houses as their income, while the tenants can delay rent payment or refuse to pay due to low or irregular income, or due to non-

provision of services. Such a relationship where both landlords depend on one another has similarly been mentioned by Cadstedt (2010) and Smith (2017). How the two parties resolve these differences depends on the relationship they have.

Having described living conditions in Kisumu's informal settlements, it is imperative to identify areas that need improvement. A number of approaches have been proposed for improvement of informal settlements, such as tenure security, upgrading of housing and provision of infrastructure. The results of the present study have revealed deprivation that manifests as the lack of basic services (Gulyani et al. 2014; Satterthwaite 2014). Such lack points to the need for improvement in service delivery especially at the compound level where these services are shared. What has emerged from the results is that even with tenure security, there is still a lack of basic services. Development approaches should be geared towards providing services that are lacking or effective management strategies of services that are shared. Such services and infrastructure include sanitation and solid waste management. Other studies have also alluded to the critical importance of service provision/improvement. In South Africa, Narsai et al. (2013) have highlighted the importance of water and sanitation provision, especially in overall health and development, while in India, Jain et al. (2015) suggested the delivery of 'essential services' for the urban poor, and Parikh et al. (2015) showed the importance of water, sanitation and electricity as avenues for improvement of living conditions. Speer (2016) draws attention to the need for and importance of sanitation service provision among homeless people in California; and in Brazil, residents of East District ranked sanitation and sewers as an area requiring improvement (Pimentel Walker 2016). Investing in infrastructure also leads to development in other sectors. It is for instance shown that investing in water and sanitation also leads to an improvement in the health and education sectors (Estache and Wodon 2014, pp. 13–14, 21). Improvement in infrastructure provision in Kisumu's informal settlements, therefore, may also benefit other areas, thus leading to overall development.

Alongside service delivery, results point to the need to improve housing, especially those that are in poor condition. Since Kisumu city has a large portion of its residents living in informal settlements, incremental upgrading of housing may be explored by working together with landlords. Such kind of upgrading is favoured as residents maintain their social and economic networks (Andersen 2014; Gilbert 2014; Patel et al. 2011). An upgrading of housing may result in slightly higher rent, hence requiring the involvement of financing mechanisms to support landlords who are financially challenged. Such challenges of high rent were experienced in the upgrading project in Kibera in Nairobi where residents moved back to their former housing because of the resultant change in their way of life (Otsuki 2016).

It is also important to consider the stakeholders who should be involved in this improvement. Developmental efforts in Kisumu are undertaken by various stakeholders including governmental departments, non-governmental organisations, the private sector and the community itself. At the highest level, the governmental departments are involved in policy formulation; for instance, the Ministry of Land, Housing and Urban Development which is in charge of physical planning and developing housing policies; the Ministry of Environment and Natural Resources, which is responsible for policy formulation and developing guidelines on solid waste management; the Ministry of Health which is in charge of sanitation matters; and the Ministry of Water and Natural Resources which is in charge of policies related to water resources. These ministries are

represented at the county government level within Kisumu County. Other governmental bodies are also actively involved in the city, such as the National Environment Management Authority (NEMA) that is responsible for developing guidelines and implementation of policies related to the environment such as solid waste management, and the Kisumu Water and Sewerage Company (KIWASCO) that is responsible for water and sewerage service provision. Within the informal settlements, apart from the involvement of these governmental bodies, non-governmental organisations are also actively involved in assisting the government in delivery of services such as water and sanitation, supporting demonstration projects, providing technical assistance and working with the urban poor households. Community-based organisations act as lobby agents and link persons between the community and the government.

With this array of stakeholders, involvement should first begin by defining the responsibilities of each stakeholder, their level of jurisdiction and avenues of collaboration. The landlords, for instance, should be required to construct quality housing and provide basic services. Where they are unable to, financing mechanisms can be devised through partnership with relevant organisations. Tenants on the other hand need to be enlightened about their rights to basic services, while also taking part in improvement efforts. At the neighbourhood level, the county government could collaborate with institutions such as the Water and Sewerage Company, and community groups and associations to increase service delivery and devise mechanisms of ensuring safety within the settlements. Through the involvement of all these stakeholders from planning, decision-making and to implementation of interventions, improvement efforts will extend beyond compound-level services to the improvement of general living conditions.

Conclusion

Informal settlements have unique socio-economic characteristics, which call for development efforts that are tailored to the specific needs of each settlement. These characteristics should be identified in order to inform improvement efforts. Through an analysis of the housing, compound, neighbourhood conditions and individual level factors, this paper provides a description of living conditions and deprivation in Kisumu's informal settlements using the living conditions framework as well as the multi-dimensional poverty index. The settlements show that residents are deprived in a number of dimensions including lack of adequate services at the compound level. Since landlords have tenure security, they can use the land ownership as an avenue for development and improvement of living conditions. Nonetheless, residents, mostly tenants, present high levels of deprivation in terms of access to infrastructural services, low levels of education and low quality of housing. Most of the absentee landlords have constructed poor-quality housing and have not provided basic services. This study highlights the importance of basic service provision and upgrading of housing in the settlements. Landlords can be instrumental in basic service provision and the relevant ministries through the local government should collaborate with all stakeholders in policy formulation and implementation of these policies. What is also critical is the relationship between landlords and tenants, as it has implications on sustainability of services. This study reveals three levels of improvement in Kisumu's informal

settlements; first at the neighbourhood level within the settlements through which resources can flow in and out of the settlements, secondly at the compound level through the provision of basic services and finally at the household level through proper management of basic services and infrastructure. The three levels reflect the stakeholders involved, and the complementary roles that each of the levels play towards holistic improvement and development of informal settlements in Kisumu city.

Policy Recommendations

Drawing from these results, a few policy recommendations emerge. At the county level, there is need to formulate and/or reinforce policies on housing and service provision. This needs to be done by the county officials for those policies that are non-existent. Housing policies for instance should stipulate the requirements for any housing structures that are put up in the settlements, including the requirements for basic services such as sanitation.

Where policies are in place and they are not being reinforced, the county government should work closely with the community-level administration such as chiefs to ensure that landlords put up structures that meet the minimum standards.

It is also possible that community members may be ignorant about local policies on housing. Therefore, local-level leaders such as chiefs, community health workers and village elders should enlighten the residents about the existence of the policies and what these policies recommend.

These leaders should then collaborate with the county government and the community members to ensure that the policies are being enforced.

Apart from enforcement, the local-level leaders should also work closely with young people and local youth groups in improving service provision at the compound level. In the informal settlements, the non-governmental organisations working in the settlements are engaging the youth groups in some activities such as waste disposal; however, these groups should be economically empowered and trained on waste as a resource so that they can be involved in waste management while at the same time generating revenue. Finally, the current local government is engaging the young people in local activities. These young people should be encouraged to form groups through which they can access funds from the national youth development funds.

Limitations and Recommendations for Further Studies

This study assessed living conditions in four dimensions: the neighbourhood, compound level, housing conditions and individual level. Nonetheless, living conditions can also be assessed using other measures. As such, both frameworks did not include other indicators such as higher education, energy sources, health insurance, disability, nutrition, child mortality and social/economic networks. Other indicators used by the demographic and health surveys to assess wealth such as asset ownership were also not included. Further quantitative and qualitative studies can be carried out including these indicators and adopting a systems approach. These further studies can also assess the 'soft' indicators such as choices, powerlessness and voice, beliefs, practices,

relationships and their influence on development in the settlements. The different facets of poverty in the settlements and avenues through which they can be opportunities for improvement can also be examined further.

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