Prevalence and Social Risk Factors of Functional Limitations Among Slum-Dwelling Older Adults: Findings From the Nairobi Urban Health and Demographic Surveillance System

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Abstract

Objective: In this study, we investigate the patterns and the risk factors of functional limitations in a sample of 1323 slum-dwelling older adults in Kenya who participated in the Nairobi Urban Health and Demographic Surveillance Systems. **Methods**: We conducted crude and adjusted logistic regression analyses to evaluate the associations. **Results**: The prevalence of activities of daily living (ADL) and instrumental ADL (IADL) limitations were approximately 5% and 8%, respectively; some 4.5% reported both limitations. Estimates varied significantly between sexes and age ($p < .001$). After adjustments, age, female, and Garre ethnic group were associated with ADL and IADL limitations. ADL decline was determined by co-residence (aOR = 0.93, 95% CI = 0.34–0.95), household size (aOR = 1.19, 95% CI = 1.04–1.37) and educational level (aOR = 0.45, 95% CI = 0.05–0.72). **Conclusions**: Older slum-dwellers in Nairobi experience functional impairments with marked age and sex differences. These findings may encourage salient policy planning and public health interventions to promote healthy aging in informal settlements.

Keywords

functional impairments, informal settlements, intergenerational care, long-term care

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Introduction

The pace of demographic aging and its local variations is currently remarkable in sub-Saharan Africa. Many older adults in SSA increasingly face age-related incidence of chronic diseases with serious implications for their functional status and independence (Gyasi & Phillips, 2018; Payne et al., 2013). Functional limitations among older adults are common globally with an estimated prevalence of 40% and associated with substantial morbidity and mortality (United Nations DESA, 2017). Evidence indicates a higher rate of functional decline in SSA and the prevalence is two times higher than in developed countries and other low- and middle-income countries (Phaswana-Mafuya et al., 2013; WHO, 2011). Difficulty in carrying out activities of daily living (ADL, such as feeding, toileting, bathing, dressing, walking, and transfer oneself) and instrumental ADL (IADL, including the ability to use the telephone, medication, and shopping) may increase dependence in old age with significant adverse impact on well-being and

increased demand for support and social care (Diehr et al., 2013; Harling et al., 2019). Identification of modifiable risk factors for functional limitations would inform policy and public health strategies for prevention and quality of life in old age (Chatterji et al., 2015).

Several studies have shown that slum-dwelling older adults may have a greater risk of experiencing functional limitations and other health-related challenges (Aboderin et al., 2017; Wilunda et al., 2015). Older adults in informal settlements in Kenya live in poor social and environmental conditions such as inadequate water and sanitation,

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pollution, overcrowding, and social deprivation (Wamukoya et al., 2020). Whilst older adults in these settings are vulnerable to prolong and higher levels of poverty, policy debates and interventions for better functional health least consider their plights (Dianati et al., 2019). Research on functional health has, therefore, become a public health issue in slum settings (Payne et al., 2017) and is essential for the aging in place and age-friendly agendas (WHO, 2007; 2015). However, data on the risk factors for the functional decline of older adults in slum areas in SSA are limited.

Previous studies suggest that ADL and IADL limitations are a function of age and over time (Christensen et al., 2013; Falk et al., 2014). Compared to men, women exhibit a higher risk of developing functional disabilities despite that women seem to live longer than men (Chatterji et al., 2015; Sjolund et al., 2015). A rural South African study found worse physical performance in terms of walk speed and grip strength as independent predictors of ADL impairment (Harling et al., 2019). In China, Liu et al. (2009) found that lower education, unemployment, and rural residence remain important risk factors for functional decline in old age. Systematic reviews and meta-analyses have identified physical inactivity and self-rated health to predict functional limitations (Tak et al., 2013; van der Vorst et al., 2016). Low social participation and living arrangement (i.e., household composition) have also been reported to influence functional limitations in Western and Asian societies (d'Orsi et al., 2014; Tomioka et al., 2017).

An investigation into functional limitations and associated factors in slum-dwelling older people may be crucial for public health and policy discourse. This paper provides a pioneering and timely analysis of the patterns and risk factors of ADL and IADL limitations using data from the Nairobi Urban Health and Demographic Surveillance System (NUHDSS). Research on this topic is currently limited but important for future aging research in a slum setting in SSA.

Methods

Study Design and Setting

Data for this study were drawn from the NUHDSS established in two informal settlements in Nairobi, namely, Viwandani and Korogocho with a total population of approximately 90,000 people in 2019 (van de Vijver et al., 2013). The two settlements are characterized by poor housing, lack of basic infrastructure, violence, insecurity, high unemployment rates, and poor health indicators (African Population and Health Research Center, 2002). The NUHDSS has maintained regular individual and household demographic and socio-economic surveillance in these urban poor settings through a quarterly census since 2002. The NUHDSS was set up to provide a unique platform and has been systematically generating data on vital demographic, socio-economic, socio-epidemiological

studies among Nairobi's urban poor and for evaluating intervention programs. This study focuses on the subset of data on older adults 60 years or over. The final analytic sample thus, numbered 1323 respondents who participated in the study and answered all relevant questions.

Study Variables and Measures

We assessed ADL with a six-item scale indicating performance in the past 30 days on a dichotomous option: yes (1) and no (2) (Katz et al., 1963). The items in the NUHDSS included: "In the last 30 days, did you require supervision, direction or assistance in. . . (a) eating, (b) getting into bed or out of bed, (c) moving around inside your house (mobility), (d) dressing or putting on your clothes, (e) taking a bath, (f) going to the pit latrine or toilet or outside to ease yourself"? The total score ranged from 1 to 6 with a higher score indicating a greater functional decline. The overall score was dichotomized into 0 = no ADL and 1 = at least one ADL for analytical purposes.

IADL was measured based on three items relevant to local circumstances. These items were captured using the following: "In the last 30 days, did you require supervision, direction or assistance in . . . a) doing light housework such as washing dishes or preparing meals, b) going around outside the house in the neighborhood and compound, c) going to shop for groceries from mama-mboga, duka, kiosk, vibanda, etc."? These items were assessed on a four-point Likert scale ranging from: no difficulty (1), mild difficulty (2), moderate difficulty (3), and severe difficulty (4). The overall score ranged from 3 to 12 with the higher score suggesting higher levels of functional limitation. For this analysis, a dichotomous variable was generated, with the value of 1 if the respondent reported a moderate or severe difficulty and 0 if otherwise.

We examined socio-demographic variables including *age* (in years), *gender* (male = 0; female = 1), *slum residential area* (Korogocho = 0; Viwandani = 1), ethnicity (Kikuyu = 0; Luhya = 1; Luo = 3; Kamba = 4; Garre = 5; Others = 6), household size and living arrangements (Lives alone = 0; Lives with children only (<18) = 1; Lives with working age (18–59) and children (<18) = 2; Lives with working age (18–59) only = 3; Lives with older person only (60+) = 4; Lives with working age (18–59) and older person (60+) = 5; Lives with working age (18–59), children (<18) and older person (60+) = 6). *Marital status* was categorized into married/partnered = 0; never married = 1; divorced/separated/widowed = 2. *Education level* was originally assessed with four levels (never attended school = 0; primary-level = 1; secondary-level = 2; higher = 3). Secondary and higher educational levels were later collapsed to avoid over-fitting of the regression models given that the "higher educational level" category recorded only 4 (0.1%) of the overall sample. *Wealth status* was recorded as quintiles (lowest = 0; second = 1; middle = 2; fourth = 3; highest = 4).

Statistical Analysis

The analysis proceeded in three stages. First, descriptive statistics were performed to describe the sample, including mean ± standard deviations for continuous variables, and frequencies and percentages for categorical variables. This was followed by bivariate analysis exploring the associations between ADL and IADL impairments and socio-demographic measures by both age and gender using Pearson's χ^2 test and Fisher's exact test. In addition, a cross-sectional correlation matrix with Bonferroni correction for multiple comparisons was calculated to describe the sample. At the final stage, logistic regression models were separately fitted for independent variables given the level of measurement of ADL and IADL limitations.

We first calculated the unadjusted/crude odds ratio (OR) by regressing the outcome variable on each independent socio-demographic and economic variables. Finally, we built generalized multivariate logistic regression models constituting the independent variables which were statistically significant at p-value < 0.05 during the crude regression analyses. We, therefore, estimated the adjusted OR, evaluating the independent predictors associated with ADL and IADL limitations in the overall sample. Data analyses were performed using IBM SPSS Statistics for Windows application (version 21; Chicago, IL, USA) with p < 0.05 as the level of significance (two-tailed).

Results

Sample Characteristics and Bivariate Associations

The socio-demographic characteristics of the respondents are shown in Table 1. The total sample of 1323 older people 60 years and older was included in the study. The mean age was approximately 68 years (*SD* = 12) and the majority (69%) were in the 60–69 age group. There were three persons to a household on average (*SD* = 2.5). The majority of the sample were males (62%), resided in Korogocho slum area (66%), and about of the participants 40% lived alone. About 4% lived in skipped generation households (households with older adults and children less than 18 years only). Educational levels were generally low with 86% of the sample having no or just basic education. Wealth was fairly distributed: 24% and 22% reported lower and highest quintiles respectively. Correlational analyses (Table 2) revealed that age, gender, living arrangement, household size, and education were significantly associated with both ADL and IADL limitations. Wealth quintile and ethnic background did not correlate with any of the functional limitation measures.

Prevalence and Patterns of Functional Limitations

Overall, 111 (8.4%) of the sample reported any functional limitation whilst about 5% and 8% experienced difficulty in at least one ADL and IADL respectively. A further 4.5% of respondents reported comorbidity of ADL and IADL (Table 3). Having difficulty in toileting (3.9%) and bathing (3.6%) were the most frequently cited ADL impairments. In terms of IADL, 7.4% and 4.5% of the sample reported difficulty in undertaking light housework and going shopping respectively. The results showed that ADL and IADL limitations increased with age (with respect to bathing, eating, getting in/out of bed, going around the house, and shopping) and were more prevalent among older women than men across all constructs with statistically significant differences (p < .05) (Figures 1 and 2).

The crude OR for each explanatory variable based on bivariate estimations is shown in Table 4. Explanatory variables with a p-value < .05 in the crude regression analyses were included in the subsequent multivariate analysis. Age, sex, ethnicity, living arrangements, household size, and educational status were included in multivariate models for both ADL and IADL whilst slum community was added to the IADL model only (Table 4).

Risk Factors for Activities of Daily Living Limitations

After adjusting for potential confounders in the multivariate logistic model (Model 2), we found evidence for a strong association between age and ADL limitation with an increasing rate of ADL difficulty with increasing age. The 70–79 age group (aOR = 2.02, 95% CI: 1.96–4.12) and 80+ age group (aOR = 4.51, 95% CI: 1.05–19.24), had an increased risk of ADL. Females were 3.5 more likely to report ADL than males (aOR = 3.40, 95% CI: 1.78–6.50). Belonging to Garre (aOR = 2.93, 95% CI: 1.21–8.75) and other ethnic groups (aOR = 2.99, 95% CI: 0.98–3.87) was associated with increased risk of ADL. Those with secondary education or above were found to have about 55% lower rates of ADL decline compared to those with no formal education (aOR = 0.45, 95% CI = 0.05–0.72). Household size was associated with an increasing rate of ADL (aOR =1.19, 95% CI: 1.04–1.37). Older adults who lived with both working-class individuals and children had just approximately 7% lower odds of ADL limitation compared to those in solitary households (aOR = 0.93, 95% CI = 0.34–0.95).

Risk Factors for Instrumental Activities of Daily Living Limitations

Following the adjustment for possible covariates (Model 4), we found that IADL decline increased with age (70–79: aOR = 2.12, 95% CI: 1.43–3.14; 80 and above: aOR = 6.78, 95% CI: 4.00–11.47). Also, female sex (aOR = 2.04, 95% CI: 1.41–2.96), and belonging to the Garre ethnic group (aOR = 2.66, 95% CI: 1.33–5.34) were the significant risk factors associated with IADL

Table 1. Descriptive Statistics and Profile of the Sample (*N* = 1323).

Variable	*N* = 1323	(%)	Mean	(±*SD*)
Mean age (in years)			68.2	(11.8)
Age groups				
60–69	917	(69.3)		
70–79	301	(22.8)		
80+	105	(7.9)		
Gender				
Male	825	(62.4)		
Female	498	(37.6)		
Marital status				
Married/partnered	65	(63.7)		
Never married	21	(20.6)		
Divorced/separated/widowed	16	(15.7)		
Slum area				
Korogocho	872	(65.9)		
Viwandani	451	(34.1)		
Ethnicity				
Kikuyu	580	(43.8)		
Luhya	163	(12.3)		
Luo	108	(8.2)		
Kamba	219	(16.6)		
Garre	65	(4.9)		
Others (e.g., Meru, Kisii, Somali, Borana, Embu, Taita, Masai, Kalenjin, Gabra, Kuria, Pokomo, etc.)	188	(14.2)		
Level of education				
Never attended school	441	(33.3)		
Primary	702	(53.1)		
Secondary or higher	180	(13.6)		
Wealth quintile				
Lowest	273	(23.6)		
Second	218	(18.9)		
Middle	214	(18.5)		
Fourth	200	(17.3)		
Highest	250	(21.6)		
Household size			3.0	(2.5)
Living arrangement				
Lives alone	517	(39.6)		
Lives with children only (<18)	58	(4.4)		
Lives with working age (18–59)+children(<18)	414	(31.7)		
Lives with working age (18–59) only	257	(19.7)		
Lives with older person only (60+)[a]	61	(4.7)		

[a]Only 4 (0.3%) households had adults (18–59 year), older people (60 + years) and children (<18 years).

limitations among older people in slum areas of Kenya. There was no evidence for an association between household size and IADL after controlling for the other sociodemographic determinants (aOR = 1.07, 95% CI: 0.97–1.18). After full adjustment, the association between living arrangements and IADL decline did not reach significance.

Discussion

Previous research from various global regions, including rural and urban settings has provided considerable evidence of functional impairments among older populations (Harling et al., 2019; Knodel et al., 2018; Payne et al., 2017; Schatz et al., 2017). However, data from challenging and resource-poor settings such as urban informal settlements are almost lacking, particularly in SSA. To our knowledge, this is the first study to analyze the prevalence of functional limitations, and the associated risk factors among slum-dwelling older adults using data from the NUHDSS cohort, Kenya. This study added to the limited but growing literature on functional limitations in informal settlements, particularly in SSA.

Our findings indicated that 5% and 8% of urban informal-dwelling older Kenyans were respectively living

Table 2. Correlations Between the Study Variables of Interest.

	1	2	3	4	5	6	7	8	9
1. Activities of daily living	1								
2. Instrumental activities of daily living	.465***	1							
3. Age	.201***	.263***	1						
4. Gender	.134***	.161***	.155***	1					
5. Slum area	.216**	.026	−.120	−.009	1				
6. Ethnicity	.033	.006	−.152***	−.184***	.061	1			
7. Household composition	.058**	.088***	.001	.185***	−.071	.063**	1		
8. Household size	.157***	.141***	.033	.162***	−.014	.103***	.643***	1	
9. Education level	−.092**	−.162***	−.321***	−.336***	.068	−.089***	−.084***	−.164***	1
10. Wealth quintile	.003	.027	−.074**	.001	−.307***	−.025	.280***	.291***	.069**

Pearson product-moment correlations were used to calculate the association between continuous variables, point-biserial correlations were used to assess the relationship between continuous and dichotomous variables, and phi-correlations were used to assess the relationship between dichotomous variables.
***$p < .001$; **$p < .005$

Table 3. Distribution of Activities of Daily Living and Activities of Daily Instrumental Living Limitations by Gender and Age ($N = 1323$).

Variable	Number (%) of ADL and IADL	
	n	(%)
At least one ADL	62	(4.7)
Taking bath	47	(3.6)
Eating	15	(1.1)
Dressing	34	(2.6)
In/out of bed	35	(2.6)
Siting/standing	35	(2.6)
Toileting	51	(3.9)
At least one IADL	104	(7.9)
Light house work	98	(7.4)
Walking around	60	(4.5)
Shopping	59	(4.5)
Any functional limitation	111	(8.4)
Both ADL and IADL	60	(4.5)

Note. ADL = Activities of daily living; IADL = Instrumental activities of daily living.

with at least one ADL and IADL limitation. Moreover, some 4.5% of the overall sample reported suffering from both ADL and IADL and, this prevalence increased with age and showed gender differences. Whilst women were significantly more likely to report any ADL and IADL limitations and across indicators, much of these impairments were observed among the oldest old cohort. The most affected ADL and IADL were difficulty in attending toilet and undertaking household chores respectively. Although research on functional limitations among older people living in low-resource or slums settings is limited, this subject, especially measured with ADL, has been somewhat investigated in both rural and urban communities, including those in high-income countries (Brown et al., 2017; Harling et al., 2019).

The low rates of ADL and IADL limitations in the older NUHDSS population are striking and are not directly comparable with the estimates reported in South Africa, Nigeria, Poland, and Pakistan. For example, Harling et al. (2019) found a much higher prevalence of ADL impairment (12%) among rural South Africans. Ćwirlej-Sozańska et al. (2019) analyzed a sample of 2207 community-dwelling older Polish and found that 17% and 36% of the sample respectively lived with at least one ADL and IADL limitations. In rural Nigerian settings, Abdulraheem et al. (2011) reported a 15.7% rate of ADL limitations. Moreover, a 9% prevalence of ADL was observed in a cohort study among older people in the USA using data from the Health and Retirement Study (Brown et al., 2017). There are several plausible hypotheses that may explain these differences in the prevalence of functional limitations. This may potentially relate to a *preferential return migration thesis* where older adults in urban slum areas return to their native rural communities, particularly after retirement (Falkingham et al., 2012). The observation may possibly be explained by the well-known *selectivity in mortality perspective*, particularly among the very old and severely impaired older adults who continuously stayed in urban slum environments (Bergland et al., 2017) as a result of the heightened hitches in the provision of the needed long-term and social care in these disadvantaged settings.

In addition, the discrepancy could, at least, in part relate to the differences in operationalization, definition, and tools used in assessing functional limitations. Finally, the threshold for conceptualizing older adults across settings is worth noting. For example, some studies were conducted in rural settings and included middle-aged adults (see Harling et al., 2019). Those in the US (Brown et al., 2017) and Chinese societies (Liu et al., 2020) conceptualized old age as those 65 years or over. The absence of standardized indicators may force the use of *adapted* tools that are culturally modifiable. This may ascribe to the low prevalence of functional limitations in this study. It is, therefore, important to note that direct comparisons of our results and those of
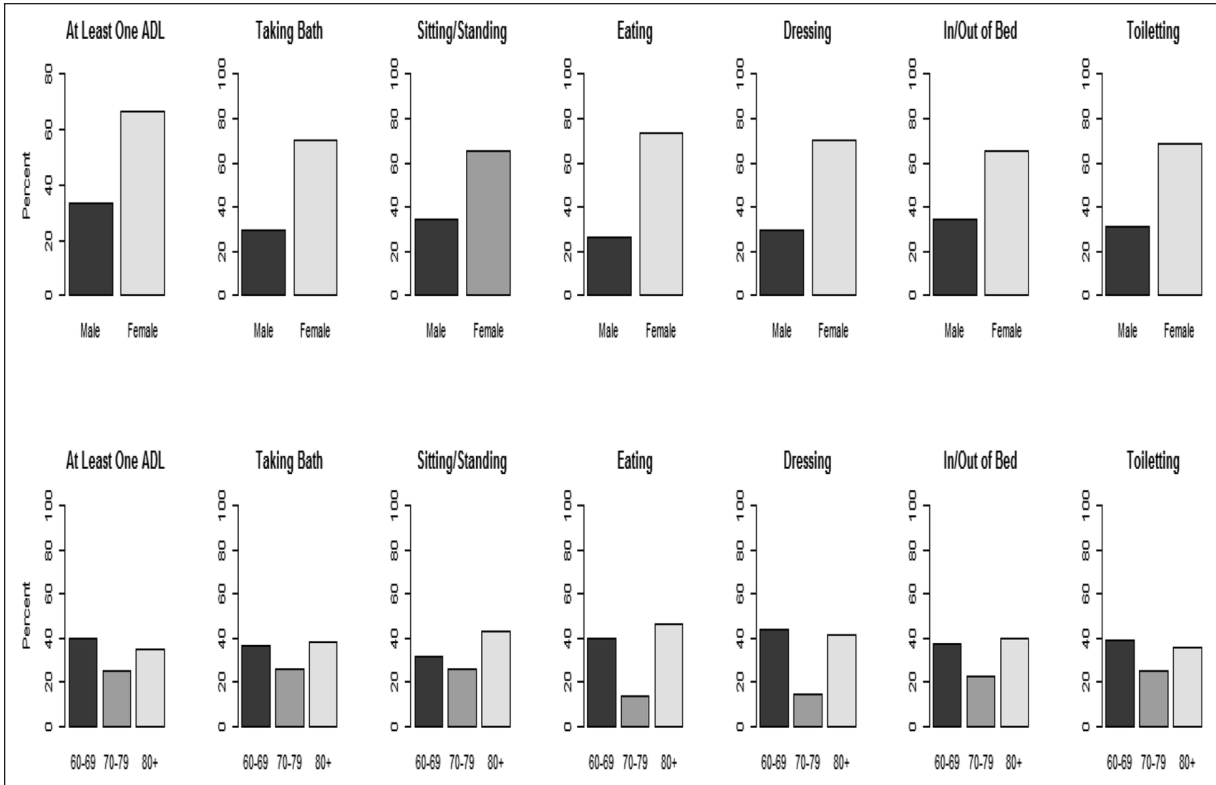
Figure 1. Distribution of activities of daily living limitations and indicators by age and gender.
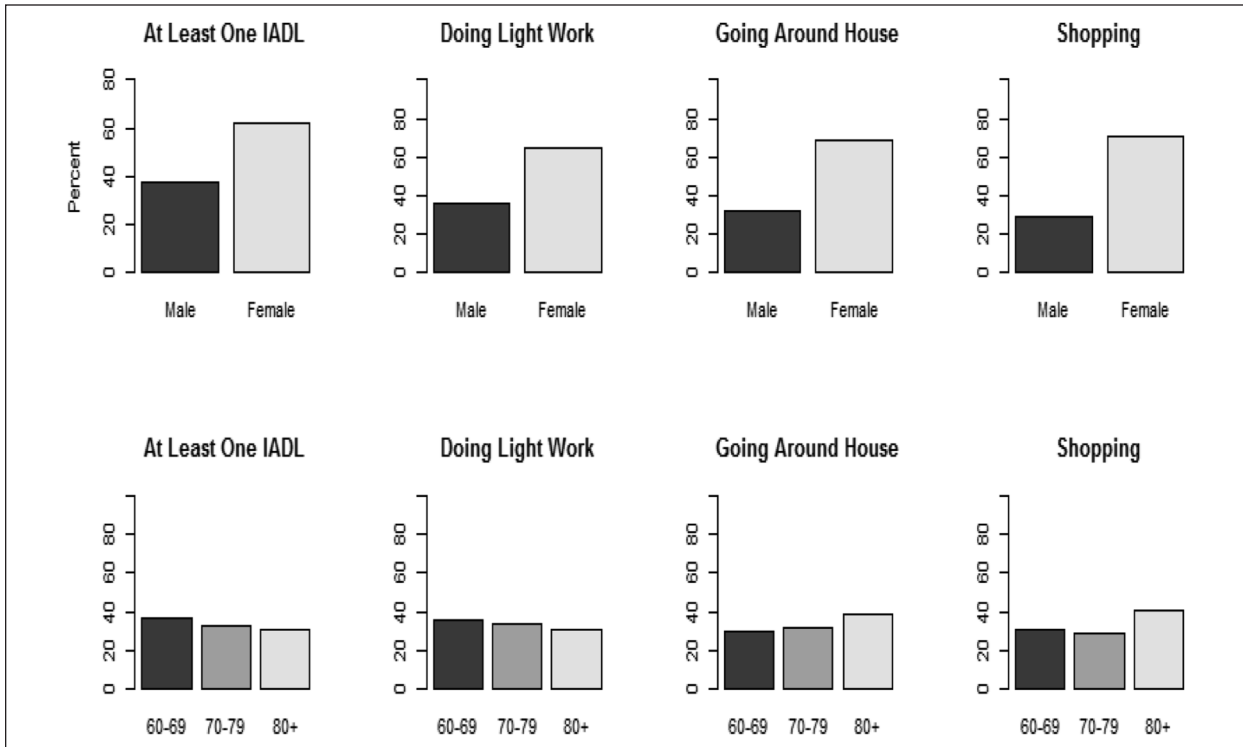

Figure 2. Distribution of instrumental activities of daily living limitations and indicators by age and gender.

previous studies are difficult largely due to contextual and socio-economic differences.

We examined the factors associated with ADL and IADL limitations. Age, gender, and ethnicity were independently associated with both ADL and IADL limitations after full adjustment for potential confounders. Moreover, living arrangements, household size, and level of education significantly predicted declines

Table 4. Results of the Binary Logistic Regression Models Predicting Long-Term Care Needs Among Older Slum Residents in Kenya. The Point Estimates are Adjusted Odds Ratio with 95% Confidence Intervals.

	ADL Limitations				IADL Limitations			
	Model 1: Crude		Model 2: Adjusted		Model 3: Crude		Model 4: Adjusted	
Variables	OR	(95% CI)	aOR	(95% CI)	OR	(95% CI)	aOR	(95% CI)
Age (in years) (ref: 60–69)	1.00		1.00					
70–79	2.00	(1.06–3.81)**	2.02	(1.96–4.12)*	2.29	(1.60–3.27)***	2.12	(1.43–3.14)***
80+	4.46	(5.11–17.50)***	4.51	(1.05–19.24)***	7.45	(4.79–11.58)***	6.78	(4.00–11.47)***
Gender (ref: Male)		1.00	1.00					
Female	3.53	(2.06–6.03)***	3.50	(1.78–6.50)***	2.47	(1.81–3.35)***	2.04	(1.41–2.96)***
Slum area (ref: Korogocho)	1.00							
Viwandani	0.89	(0.52–1.54)			1.63	(1.15–2.29)***	0.94	(0.63–1.42)
Marital status (ref: Married/partnered)	1.00							
Never married	0.69	(0.26–1.85)			1.28	(0.372–4.37)		
Divorced/ separated/ widowed	2.27	(0.66–7.79)			4.50	(0.55–36.93)		
Ethnicity (ref: Kikuyu)	1.00							
Luhya	0.93	(0.37–2.31)	2.20	(0.79–6.09)	0.55	(0.30–.99)*	0.88	(0.46–1.66)
Luo	0.23	(0.03–1.69)	0.28	(0.03–2.56)	0.87	(0.47–1.59)	1.27	(0.65–2.49)
Kamba	1.28	(0.61–2.67)	2.18	(0.95–4.99)	0.82	(0.52–1.30)	1.21	(0.72–2.03)
Garre	3.40	(1.45–7.95)*	2.93	(1.21–8.75)*	2.98	(1.69–5.23)***	2.66	(1.33–5.34)**
Others	1.95	(0.98–3.87)*	2.99	(1.19–7.47)	1.33	(0.86–2.06)	1.60	(0.94–2.74)
Living arrangement (ref: Living alone)	1.00							
With children only	1.60	(0.46–5.65)	0.92	(0.23–3.67)	1.48	(0.69–3.18)	0.94	(0.41–2.18)
With working age and children	0.96	(1.45–4.78)***	0.93	(0.34–0.95)**	2.05	(1.43–2.96)***	1.29	(0.67–2.47)
With working age only	0.82	(0.34–2.01)	0.49	(0.18–1.38)	1.44	(0.93–2.24)	1.25	(0.76–2.08)
Others	0.99	(0.23–4.42)	0.35	(0.04–2.80)	0.88	(0.36–2.14)	0.56	(0.21–1.52)
Household size	1.24	(1.14–1.33)***	1.19	(1.04–1.37)**	1.14	(1.09–1.21)***	1.07	(0.97–1.18)
Education (ref: Never)	1.00							
Primary	0.52	(0.30–0.89)*	2.11	(0.98–4.50)	0.43	(0.31–0.60)***	1.11	(0.71–1.73)
Secondary/higher	0.47	(0.01–0.51)**	0.45	(0.05–0.72)**	0.29	(0.16–0.52)***	1.05	(0.52–2.11)
Wealth quintile (ref: Lowest)	1.00							
Second	1.76	(0.79–3.91)			1.02	(0.62–1.66)		
Middle	0.81	(0.31–2.11)			0.66	(0.39–1.14)		
Fourth	1.12	(0.46–2.76)			1.09	(0.66–1.79)		
Highest	1.31	(0.57–2.97)			1.24	(0.78–1.96)		
-2 Likelihood ratio			369.679				926.243	
Hosmer–Lemeshow χ^2			16.007(0.42)***				14.713 (0.65)***	
Adjusted Pseudo R^2			0.34				0.42	

Note. OR = Crude odds ratio; aOR = Adjusted odds ratio; CI = Confidence intervals (presented in parentheses); ADL = Activities of daily living; IADL = Instrumental activities of daily living. 1.00 = Reference category
***$p < 0.001$; **$p < 0.005$; *$p < 0.05$

in ADL. However, there was no evidence to suggest that slum locality and wealth status were associated with functional limitations in this sample. Our finding that the risk of functional limitations increases with age is not entirely surprising and supports recent findings in a Chinese multicenter cross-sectional study in which the aging process was ascribed to ADL and IADL declines (Liu et al., 2020). Studies from other

global contexts have suggested that each subsequent year in life remains the most important factor for the increased occurrence of functional limitations and the need for long-term care assistance for such aging adults (Bleijenberg et al., 2017; Connolly et al., 2017; Koster et al., 2006). Life-course and age-related events such as retirement, social isolation, and mental and chronic physical health challenges including non-communicable diseases (which are major risk factors for functional impairments) are shown to accumulate and intensify with increasing age (McCracken & Phillips, 2017). This suggests that efforts to guard against ADL and IADL impairments should target age-related social and health problems.

Females were 3.5 times and 2.0 times more likely to report ADL and IADL difficulties respectively than their male counterparts. This finding supports many previous studies. For example, Abdulraheem et al. (2011) note that the female gender is four-folds more likely to suffer functional disability among rural older Nigerians. Our observation could be explained by the male-female health-survival paradox which suggests that although women live longer than men on average, the former report higher age-specific morbidity burden, including activities of daily tasks, physical health, and health-related quality of life (Gyasi et al., 2019; Oksuzyan et al., 2014). Our finding suggests a critical consideration for gender-specific health policy lenses in an attempt to deal with age-related functional limitations.

Studies mainly from advanced countries have shown substantial ethnic group differences in functional limitations and this is well documented in the UK (Williams et al., 2012, 2020) and the US populations (Barnes et al., 2011). These pieces of evidence have strongly and consistently demonstrated ethnic inequalities in functional limitations among older adults with higher declines among African Americans compared with White Americans (Thorpe et al., 2011). Our study extended these findings in urban informal settings in SSA and found that older adults who belonged to the Garre ethnic group were approximately three times more likely to report functional limitation in both ADL and IADL declines compared to those in the Kikuyu ethnic group. This observation may be explained by well-known risk factors related to the genetic difference as well as the social determinates of health including socio-economic deprivation among different population groups. Taking into account ethnic diversities in policies and public health practices in slum settings may be crucial in improving functional status and independence in old age.

Our study found that slum-dwelling older adults who lived in three-generation households (co-residing with children and working-age group) had lower odds of reporting ADL limitation compared to those who lived alone. This finding is in line with Chinese (Bai et al., 2020), Ghanaian (Gyasi & Phillips, 2018), and Polish studies (Ćwirlej-Sozańska et al., 2019) demonstrating that higher levels of meaningful social connections and

associated support could potentially decrease the risk of functional disability. Although studies have argued that living alone may mean greater independence and autonomy for older adults to perform daily activities (Nunes et al., 2017), the oldest olds living in poor urban environments may not have the requisite physical and cognitive abilities to live independently. Therefore, living with others who are prepared to provide the needed support and care may lessen the severity of functional limitation. Ensuring resourceful co-residence in slum settings may be essential for active aging among older adults in such communities. However, our analysis found that a unit increase in household size predicted a decline in ADL. While this finding appears rather difficult to interpret, it is an interesting contribution to the literature. It is possible that increases in the number of household members were ascribed to the severity and the extent of health problems faced by older adults.

In our study, we found that older adults who had secondary or higher levels of education had about 55% lower odds of reporting ADL limitation compared to those who never attended formal education. This finding is consistent with previous observations from rural populations in Nigeria (Abdulraheem et al., 2011), urban populations in Bagé-RS, Brazil (Nunes et al., 2017), and among Americans (Brown et al., 2017). Education has been identified as an important socio-economic indicator that may contribute meaningfully toward a better functional health outcome mainly through its positive link with health literacy, and health services use (Gyasi & Phillips, 2018). Again, the well-educated could maintain healthy lifestyle behavior including dieting and physical activity which may, in part, improve the functional status of older people (Liu et al., 2020; Snowdon et al., 1989).

We note several limitations of this study. First, the cross-sectional data and analysis may limit our findings to correlational inferences and associations between various predictor variables and the long-term care needs as opposed to cause-and-effect statements. This has the potential to limit our ability to generalize our findings. A longitudinal study design for these important relationships is warranted for future study. Our data source undoubtedly is affected by response errors as is the case for any survey, particularly among older people. The measures of functional limitations; ADL and IADL difficulties are self-reported and, therefore, not only remain subjective but may also present challenges of statistical endogeneity. Also, as the current study assessed older persons aged 60 years or over in two poor informal urban communities, it may not provide an estimate of the full burden of functional impairment, since many older adults with severe impairments may live outside the slum settings in Kenya and elsewhere. Caution should be taken when generalizing our results to other settings. Despite these limitations, our study makes an important contribution to the published literature and health policy on patterns, and the risk factors of ADL

and IADL among older adults in poor urban slum contexts where data on this subject are limited.

Conclusions

This paper improves understanding of the patterns and the social determinants of functional limitations among older adults using data from the NUHDSS study, Kenya. Findings indicate that older adults in slum settings suffer from various levels of ADL and IADL limitations. Nevertheless, the rates of ADL and IADL limitations in this NUHDSS older population appeared lower compared to the rates recorded from other contexts, including rural and urban areas of SSA. The rates of functional limitations vary by salient social characteristics of the participants. For example, females reported higher rates of functional limitations than males and the severity also increased with advancing age. Most importantly, age, gender, and ethnicity showed greater risks of ADL and IADL limitations whilst living arrangements, household size, and education attainment predicted ADL decline. Our findings may present critical implications for policy and public health efforts for this older cohort and could encourage the development of strategies to promote healthy aging in these communities. Also, the role of the local and national authorities to improve functional status of slum-dwelling older adults is important. A greater understanding of both the patterns and determinants of physical functioning at older ages in African-wide urban slum settings is required. Future research needs to consider the dynamics of functional limitations among middle-aged adults in sub-Saharan Africa.

Ethical Approval

The NUHDSS study protocol and consent procedures, including surveillance and VA, were approved by the Kenya Medical Research Institute/National Ethical Review Committee (NON-SSC Protocol No.339). Additionally, written informed consent for all household-level data collection was provided by household heads, while for individual interviews, adults consented to their own interviews and other measurements. Named data are securely stored in an MS-SQL database and only authorized data personnel have access rights. Participants identified with medical conditions during surveys were offered to counsel and referred for care to health facilities supported by the research program in the NUHDSS.

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