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Socioeconomic determinants of mortality in HIV: evidence from a clinical cohort in Uganda

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Abstract

Objective—To delineate the association between baseline socioeconomic status (SES) indicators and mortality and lost to follow-up (LTFU) in a cohort of HIV-infected individuals enrolled in antiretroviral treatment (ART) in urban Uganda.

Design—Retrospective cohort study nested in an antiretroviral clinic-based cohort.

Methods—SES indicators including education, employment status, and a standardized wealth index, and other demographic and clinical variables were assessed at baseline among ART-treated patients in a clinic-based cohort in Kampala, Uganda. Confirmed mortality (primary outcome) and LTFU (secondary outcome) were actively ascertained over a 4-year follow-up period from 2005–2009.

Results—Among 1763 adults (70.5% female; mean age 36.2 years (SD=8.4)) enrolled in ART, 14.4% (n=253) were confirmed dead and 19.7% (n=346) were LTFU at 4-year follow-up. No formal education (Adjusted Odds Ratio (AOR) 1.76; 95% Confidence Interval (CI): 1.19 to 2.59),

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Conflicts of Interest

For the remaining authors none were declared.

having fewer than 6 dependents (AOR 1.39; 95% CI: 1.04 to 1.86), unemployment (AOR 1.98; 95% CI: 1.48 to 2.66) and housing tenure index score (a component of the wealth index) (AOR 1.11; 95% CI: 1.00 to 1.23) were significantly associated with confirmed mortality at 4 years. SES indicators were not associated with LTFU at 4 years.

Conclusions—Baseline SES indicators, including education, number of dependents, employment status, and components of a standard wealth index, may indicate long-term vulnerability to mortality in patients with HIV/AIDS, despite uniform access to ART. Future studies delineating the pathways through which poverty and limited assets affect clinical outcomes may lead to more effective HIV interventions in low-resource settings.

Keywords

HIV; Socioeconomic status; Lost to follow-up; Mortality

INTRODUCTION

Socioeconomic status (SES) has been widely demonstrated to predict disease outcomes across a number of conditions and populations, with most of the relevant evidence deriving from studies of non-communicable diseases in high-income countries.^{1,2} In contrast, little is known about the relationship between SES and mortality in low-income countries, and there are surprisingly little data on associations between SES and mortality in the context of HIV/AIDS, the largest contributor to adult mortality in Africa.³

The relationship between SES and HIV is complex and context-dependent. Studies in high-income countries have demonstrated increased risk of mortality among HIV-infected persons living below the poverty line⁴ and in neighborhoods with lower average annual income,⁵ though the latter relationship was largely accounted for by differential access to antiretroviral therapy (ART). In addition to mortality, LTFU has emerged as a key outcome in HIV treatment given the high rates of LTFU across stages⁶ of clinic enrollment, pre-ART evaluation, and ART adherence observed in SSA⁷⁻⁹. To the best of our knowledge, studies evaluating the relationship between SES and long-term mortality or LTFU have not been replicated in Sub-Saharan Africa (SSA).

Most studies set in SSA have focused on the relationship between SES and risk for contracting HIV¹⁰⁻¹⁵ or short-term clinical outcomes. For example, studies have demonstrated an association between low SES and loss-to-program (i.e. died, lost to follow-up (LTFU), transferred out) between diagnosis and initiating ART.^{16,17} Among individuals enrolled in ART programs, there is evidence from SSA that having a regular source of income¹⁸ and having a greater number of assets¹⁹ were protective of mortality and LTFU at up to one year follow-up. However, previous studies have been limited by short periods of follow-up (i.e. 1 year or less) and by the use of SES measurements calibrated for use in high-income countries that may not be accurate or sensitive reflections of local variation in degrees of hardship, or access to resources.²⁰

Several conceptual and practical barriers stand in the way of validly and reliably evaluating SES in the context of HIV in low-income settings, such as SSA. A major concern is the validity of existing indicators and indices in representing access to resources. For example, income, land ownership, and house value are currently in widespread use but their scales and significance vary substantially by country and, unadjusted, they are often not predictive of health outcomes.²⁰ To address these challenges, Filmer and Pritchett²¹ introduced and validated an asset-based wealth index derived from principle components analysis as a proxy for a household's long-run economic status. Based on local patterns of covariance in asset ownership, the wealth index has the advantage of being contextually adaptable and has

been validated against other important health-related outcomes.²¹ However, the standard wealth index has not yet been applied to the study of mortality and LTFU in HIV in African settings, and little is known about the association between other core SES domains—such as education and employment status—and longer-term mortality and LTFU in ART programs in SSA.

In HIV interventions in low-income countries, locally adaptable and valid SES measurements could aid in the identification of vulnerable patients in need of more intensive services. To address this need, the present study delineates the relationship between baseline wealth index components, other SES variables, and 4-year confirmed mortality and LTFU in a retrospective cohort study of HIV-infected adults living in Kampala, Uganda. By utilizing an adaptable and validated approach to the measurement of SES, the wealth index, and other easily measured SES indicators, we demonstrate the feasibility and utility of stratifying risk within populations of HIV-infected adults in Africa using metrics sensitive to within-population variability in SES.

METHODS

Study Design

We conducted a retrospective cohort study of all patients 18 years of age and older on ART through the Reach Out Mbuya Parish HIV/AIDS Initiative (ROM) who were screened for food assistance between April and May 2005 using a tool that collected SES indicators. At the end of the study period, December 1, 2009, patients were classified as active, died, transferred, or LTFU using data from active surveillance mechanisms. This study was approved by the institutional review boards of Johns Hopkins School of Medicine, the Uganda Virus Research Institute Science and Ethics Committee, and the Uganda National Council for Science and Technology, and was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2000.²²

Setting

ROM began in an urban slum of Kampala, Uganda, in May 2001, and has grown to currently serve more than 4,500 persons living with HIV/AIDS, approximately 80% of whom are on ART. ROM serves patients from the Mbuya parish catchment area (population: approximately 100,000); and patients must have residency confirmed before initiating ART. The population in this parish is of relatively low SES compared with the rest of the country, and many residents are displaced persons from the civil war in northern Uganda.

Most ROM staff are peer community health workers, and the ART clinic is primarily staffed by nurses. All ROM services, including ART, are free to patients with funding provided through church funds, private and institutional donations, the Uganda Ministry of Health, and PEPFAR. Additional details about the ART program and protocols have been published in previous reports.^{23,24}

In 2002, ROM began offering food assistance to its clients through the World Food Programme (WFP) HIV nutritional program.²⁵ Patients were referred for food assistance screening by clinicians or community health workers based on suspected food insecurity as indicated by observed nutritional, clinical, and SES indicators. Nearly all (>95%) patients screened for food aid screening at ROM obtained high screening scores and were offered food aid. Food assistance was provided to the patient and his or her family members, typically for 12 months, and assistance was then phased out over 6 months.

Measurements, Definition of Outcomes, and Outcome Ascertainment

The primary outcome of this study was confirmed all-cause mortality. Deaths were identified by ROM staff through active surveillance using home visits, regular hospital visits, and verbal autopsies. The secondary outcome was LTFU status (defined as no clinic visits over a final 90-day period in patients previously on ART without reported death or known transfer of care). Event-free subjects were censored in December 2009. Additional details on vital status classification methods have been published in an earlier report.²⁴

Socioeconomic Status Indicators—SES indicators were assessed using the World Food Programme (WFP) food assistance screening tool developed by the WFP for use in HIV nutritional programs in the region. The instrument collects information on key domains of SES and food availability using items drawn from the Uganda Demographic and Health Survey.²⁶ Items were selected for inclusion on the instrument based on perceived importance in reflecting overall economic and social position in relation to others in the local community.

The SES indicators included education level, employment status, living/sanitation conditions (e.g. water source), expenditures (e.g. number of dependents), and proxies for wealth (e.g. housing characteristics and access to productive assets), consistent with commonly cited domains of SES.^{20,21,27} Education, a fundamental aspect of SES, was included given the important associations between education level and economic outcomes, social and psychological resources, and health behaviors.²⁸ In this analysis, education level was divided into no formal education (i.e. never been to school) and at least some primary school education. Employment status was included as a dichotomous variable (i.e. employed vs. unemployed). Number of dependents is included as a proxy for household expenditures. Living/sanitation conditions and asset ownership are included in a composite wealth index²¹ (see description below) as an alternative to income and expenditure data,^{21,27} which were not available. Scoring proceeded based on in-home interviews and observations of the household by clinicians and program staff.

Construction of a Wealth Index—Household wealth was estimated using a wealth index based on ownership of common household assets. We included all items available from the food assistance screening tool that were also included in the standard wealth index described by Filmer and Pritchett.²¹ One item on the screening form (“access to productive assets”—defined as assets that could be used to generate income, such as land or motorcycles) represented a composite of several items in Filmer and Pritchett’s index.²¹ One additional item from the screening form—home ownership status (vs. renting or being accommodated for no fee)—was also included in the index because it represents a major form of asset ownership. To address the assumptions of logistic regression, items occurring infrequently (<2% of observations) were excluded from the index.²⁹ The items included in the final wealth index for principal component analysis were: house ownership status, ownership of household assets (i.e. mobile phone, sewing machine, bicycle), and living/sanitation conditions (i.e. water source²⁶, house structure type, and cooking fuel source).

Principal component analysis was then applied to the remaining items to determine weights for the included variables, according to the methods described by Filmer and Pritchett.²¹ Filmer and Pritchett’s method was selected as it represents a standard approach to estimating a proxy variable for wealth and long-run economic status in the absence of information on income or household consumption expenditures.²¹ Furthermore, principal component analysis accounts for the collinearity expected to occur among indicators of the same latent factor (i.e. wealth or SES).²¹ According to common practice in principal component analysis, all principal components with eigenvalues (i.e. a measurement of the amount of

covariance explained by a component) greater than 1 were retained as covariates in the initial logistic regression models of mortality and LTFU.³⁰

Covariates—Covariates for the study included age, marital status, and sex. Age was included as a covariate given its universal association with illness and mortality, and as a potential confounder in the relationship between exposures and outcomes.²⁷ Marital status and sex were included as likely modifiers of the relationship between SES and the outcomes of interest, as previously demonstrated in Uganda.²⁴

Statistical Analysis

We tested two hypotheses: baseline SES indicators—including employment status, education level, number of dependents, and wealth index—are associated with (i) confirmed mortality and (ii) LTFU in an HIV clinic population in urban Uganda.

To test the primary and secondary hypotheses, we first performed bivariate analyses of the association between predictors and the outcomes of interest using logistic regression. Age and wealth index were treated as continuous variables; all other variables were categorical (dichotomous). For the multivariate logistic regression models with confirmed mortality and LTFU as outcomes (respectively), we first fitted full models including age, sex, and all available SES indicators (including wealth index components) that reached the $p < 0.10$ level of significance in bivariate analysis. Subsequently, reduced models were evaluated and compared using the Bayesian Information Criterion (BIC), a likelihood-based criterion for model selection that imposes a penalty on additional items to prevent overfitting.³¹ The model with the smallest BIC was considered the most likely and parsimonious model, and therefore was selected as the final model. Analyses were conducted using STATA, version 12.³²

RESULTS

Patient Characteristics and Vital Status at Four-Year Follow-up

Between October 1, 2003 and July 31, 2004, 1763 patients enrolled in the ART program at ROM were evaluated for food aid using the WFP food assistance screening tool. The cohort was predominantly female (70.5%), middle-aged (mean 36.2 years (SD=8.4)), and reported some form of employment (61.4%). Baseline characteristics, including SES indicators, are presented in Table 1. By December 2009, 14.4% (n=253) had died, 19.7% (n=346) were LTFU, 56.5% (n=995) patients remained enrolled on ART, and 8.2% (n=144) had transferred care. Vital status could not be ascertained for 1.4% of patients (n=25).

Wealth Index Principal Components Analysis

Four principal components had eigenvalues greater than 1 and explained 81% of the variability among the included items. Factors 1 and 2 were characterized as covariance relating to 'Housing Structure' and 'Housing Tenure' (i.e. housing arrangements, including own, rent, or accommodated without a rental fee), respectively, and combined to explain 48% of the total covariance among SES indicators. Higher scores on Housing Structure (i.e. Factor 1) were primarily related to use of temporary housing materials. Higher scores on Housing Tenure (i.e. Factor 2) were explained by differences in housing arrangements under which one lives, with higher scores on the Housing Tenure index largely driven by being accommodated without a rental fee. Table 2 presents the scoring factors (i.e. the relative weight) for each variable composing factors 1 and 2, as well as the factor means for subjects (i.e. proportion scoring positive for identified variable) according to their vital status.

Socioeconomic Status Indicators and Mortality

In unadjusted analysis, male sex, no formal education, unemployment, and having less than 6 dependents were associated with increased odds of confirmed mortality. In unadjusted analysis of the wealth index principal components, Housing Tenure (i.e. Factor 2), but not Housing Structure (i.e. Factor 1), was significantly associated with mortality ($p=0.003$ vs. $p=0.11$, respectively) and was retained for multivariate modeling. In the final adjusted analysis, male sex (Adjusted Odds Ratio (AOR) 1.63; 95% confidence interval (CI): 1.19 to 2.24) and having less than 6 dependents (AOR 1.39; 95% CI: 1.04 to 1.86), no formal education (AOR 1.76; 95% CI: 1.19 to 2.59), unemployment (AOR 1.98; 95% CI: 1.48 to 2.66), and Housing Tenure index score (AOR 1.11; 95% CI: 1.00 to 1.23) were associated with increased odds of confirmed mortality (see Table 3).

Socioeconomic Status Indicators and Lost to Follow-up

In unadjusted analysis, male sex and younger age were associated with LTFU. In unadjusted analysis of the wealth index principal components, Housing Tenure (Factor 2) was marginally significantly associated with LTFU ($p=0.06$) and was retained for initial multivariate modeling (Table 4). Only sex and age were included in the final multivariate model, according to pre-specified model selection criteria (see Methods). In the final adjusted analysis, male sex (AOR 1.44; 95% CI: 1.12 to 1.87) was associated with increased odds of LTFU and years of age (AOR 0.97; 95% CI: 0.96 to 0.99) was associated with decreased odds of LTFU at 4 years.

DISCUSSION

By evaluating SES indicators at baseline and assessing vital status over 4 years in a Ugandan HIV cohort enrolled in ART, we found that baseline SES factors—including lack of formal education, unemployment, and housing tenure index score (i.e. a component of the wealth index)—were associated with increased confirmed all-cause mortality. To the best of our knowledge, this is the first study to demonstrate the association between wealth index components and confirmed mortality in an HIV-infected cohort in a low- or middle-income country and among the first to assess the relationship between other important SES domains, such as education level and employment status, and mortality. Our findings accord well with studies from high-income countries^{4,5} and demonstrate that, in the urban Ugandan context, SES remained a significant predictor of mortality even though all subjects were enrolled in ART. The results of our study also demonstrate that, even in very poor populations, within-population heterogeneity in wealth, education, and employment status is sufficiently important to be associated with mortality, even after accounting for other important baseline characteristics.

This study, therefore, adds to the existing literature on SES and health outcomes by extending previous findings to the HIV pandemic. The finding of increased odds of confirmed mortality among unemployed subjects builds on the results from a study in South Africa which demonstrated that having a source of monthly income was protective of death at 1 year.¹⁸ The finding of increased odds of confirmed mortality with lower wealth index corroborates the findings of increased short-term (mean follow-up: 275 days) mortality among HIV patients in rural Zambia,¹⁹ and extends them to 4 years of follow-up, an urban population in Uganda, and use of a standard wealth index. There is little evidence from previous studies addressing the association between education level and mortality in individuals with HIV. In other settings, education has been seen to represent a fundamental aspect of SES, with important associations between education level and economic outcomes, social and psychological resources, and health behaviors.²⁸ While housing tenure has not

been extensively studied in HIV/AIDS, home ownership has been shown to predict survival in other conditions, including cancer.³³

Our findings are consistent with Link and Phelan's theory of SES as a "fundamental cause" of health outcomes.³⁴ The fundamental cause theory posits that SES factors such as education, employment, and wealth affect health largely by providing access to resources required to maintain a "health advantage" over time.² While there is substantial empirical support for the theory from other health conditions,² we believe that the findings from this study fill a significant gap in highlighting the important role of social conditions as fundamental causes of inequalities in HIV outcomes in SSA.

While the finding of increased odds of confirmed mortality with lower wealth index was hypothesized in advance, several key findings were unanticipated. We expected that the first principal component (defined as the axis accounting for the greatest proportion of covariance in wealth indicators) of the wealth index (i.e. in this study, Housing Structure) would be the most strongly associated with the outcomes of interest. However, in our analyses the second principle-component (i.e. Housing Tenure) was more strongly associated with confirmed mortality and LTFU. This unanticipated finding can largely be explained by similar proportions of covariance explained by the first and second principal components (i.e. 25 vs. 23%), suggesting that both components are nearly equally important in describing the wealth variation patterns between subjects. In light of the variable weights assigned to each component, the wealth index findings suggest that housing arrangements may be a more relevant marker of vulnerability vis-à-vis mortality in HIV-infected persons than physical housing structure.

Another unexpected finding was the small proportion of persons reporting ownership of household assets, such as mobile phones, bicycles, and sewing machines. The lack of variability (i.e. infrequency) limited the number of indicators included in our principal components estimation. The rates of asset ownership reported in this study were consistently lower than those reported in the Uganda Demographic and Health Survey for persons living in the same region (i.e. Kampala).²⁶ While this discrepancy may suggest reporting bias (e.g. consistent underreporting of assets potentially based on the desire to obtain aid), the reports are directionally consistent with those obtained on observation-based items, such as water source and housing structure. Together, these observations diminish the likelihood of reporting bias and instead suggest that the study cohort represents a population with relatively lower SES compared with the surrounding population in Kampala. This discrepancy appears to strengthen our conclusion that wealth heterogeneity is an important determinant of health outcomes even among the poorest segments of the population in low-income countries.

Finally, we expected that lower SES would be associated with increased LTFU, as in previous studies evaluating LTFU between diagnosis and initiating ART.¹⁷ However, there were no significant associations between SES factors and LTFU in our analysis. Sex and age were found to be strongly associated with odds of LTFU. While other studies have documented a high frequency of LTFU in ART,³⁵ to the best of our knowledge SES-related correlates of LTFU in ART have not been previously evaluated beyond 1 year in SSA¹⁸ and thus our findings serve as an initial observation to be tested against future findings.

The findings of this study represent those of patients drawn from a single clinic site in urban Uganda and may not be generalizable to other populations. While the study's cohort design using prospectively collected data reduces important sources of bias (such as recall or selection bias), the non-experimental approach introduces the possibility of confounding and barriers to concluding causality. However, the main objective of this study was not to detail

exact causal pathways for mortality in HIV/AIDS patients, but rather to identify potential socioeconomic markers of vulnerability to mortality during the course of treatment that are recognizable early in the course of illness. Thus, questions of causal pathways and modifiability of risks remain for future investigations. Specifically, our findings raise the question of whether interventions addressing housing tenure and asset ownership, such as conditional and unconditional cash transfers,³⁶ could result in improved outcomes in patients with HIV as preliminary data from retrospective observational studies has already begun to suggest.²⁴

Another potential limitation of this study is that clinical measures known to predict mortality in HIV/AIDS, such as viral load and CD4 count, were not included in our analyses. While we acknowledge the central role of these factors in determining HIV outcomes, the current study instead sought to identify higher order contextual factors that may ultimately be found to be important determinants of access to care, barriers to adherence, nutrition, and stress-mediated immune competence, among other factors.³⁷ Finally, while active ascertainment of vital status partially accounts for potential biases introduced by differential losses by both determinants of interest and outcomes, tracking of all LTFU patients was beyond the scope of this study and may therefore introduce a form of selection bias affecting the relationship between baseline factors and overall mortality.³⁸ Therefore, we have limited our conclusions to the relationship between baseline SES factors and confirmed cases of mortality.

Conclusions

We conclude that baseline SES indicators, including a standard wealth index, may indicate long-term vulnerability to mortality in HIV/AIDS, even in apparently uniformly low-income populations enrolled in ART. If replicated, these findings would further the argument for economic and educational interventions to improve HIV outcomes in low- and middle-income countries. Our findings begin to illuminate which elements of SES may be more strongly associated with ultimate outcomes of interest and suggest priority targets for future interventions. We eagerly anticipate future studies that elucidate the mechanisms by which SES affects mortality in HIV/AIDS, as well as interventions that address the socioeconomic needs of patients as part of HIV treatment.

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Table 1

Patient Demographic and SES Characteristics at Enrollment by Final Outcome Classification

Variable	All Patients n (%)	Died n (%)	LTFU n (%)
Total	1763	253 (14.4%)	346 (19.7%)
Male	520 (29.5)	93 (36.8)	119 (34.4)
Age (years)			
18–30	490 (28.3)	74 (29.8)	115 (33.3)
31–35	409 (23.6)	41 (16.5)	91 (26.4)
36–41	424 (24.5)	60 (24.2)	77 (22.3)
42+	408 (23.6)	73 (29.4)	62 (18.0)
Married	612 (36.3)	81 (34.5)	128 (39.1)
No Formal Education	223 (12.7)	47 (18.6)	36 (10.4)
<6 Dependents	783 (45.4)	124 (51.5)	161 (47.1)
Unemployed*	649 (38.6)	126 (53.4)	134 (40.4)

* Data missing for 5% of subjects for employment status; <3% missing data in remainder of covariates.

SES, Socioeconomic status. LTFU, lost to follow-up.

Table 2

Scoring Factors for Principle Components and their Mean Values

Variable	Scoring Factor			Item Frequency		
	Factor 1: 'Housing Structure'	Factor 2: 'Housing Tenure'	All Subjects (n=1761)	Died (n=253)	LTFU (n=346)	
No assets	0.29	-0.23	0.91	0.92	0.92	
Productive asset	-0.27	-0.28	0.04	0.03	0.04	
Accommodated	0.04	0.59	0.20	0.27	0.17	
Rent	0.08	-0.67	0.69	0.61	0.74	
Temporary Housing Structure	0.65	0.09	0.72	0.76	0.73	
Semi-temporary Housing Structure	-0.64	-0.13	0.25	0.21	0.25	
Unprotected water source	0.06	0.09	0.03	0.03	0.03	
Fuel is firewood	0.07	0.21	0.09	0.10	0.07	

Notes: "Scoring Factor" is the standardized weight (-1 to 1) assigned to each variable by component.

"Mean Values" represent the frequency with which each item was endorsed among (1) all subjects, (2) subjects who died, and (3) subjects who were LTFU, respectively. LTFU, lost to follow-up.

Table 3

Unadjusted and Adjusted Odds of Mortality

Variable	Mortality OR (Unadjusted) (95% CI)	p-value	Mortality AOR (95% CI)	p-value
Male Sex	1.47 (1.11–1.94)	0.007	1.63 (1.19–2.24)	0.002
Age	1.01 (1.00–1.03)	0.09	1.01 (0.99–1.03)	0.27
Married	0.91 (0.68–1.21)	0.51	--	
No Education	1.73 (1.21–2.46)	0.003	1.76 (1.19–2.59)	0.004
<6 Dependents	1.32 (1.01–1.74)	0.04	1.39 (1.04–1.86)	0.02
Unemployed	2.02 (1.53–2.67)	<0.001	1.98 (1.19–2.59)	0.004
<i>Wealth Index Components</i>				
Factor 1 (Housing Structure)	1.09 (0.98–1.20)	0.11	--	
Factor 2 (Housing Tenure)	1.16 (1.05–1.27)	0.003	1.11 (1.00–1.23)	0.04
Factor 3 (Household/Productive Assets)	1.07 (0.96–1.21)	0.22	--	
Factor 4 (Water/Fuel Source)	0.97 (0.85–1.11)	0.67	--	

“—” Indicates variables dropped for the final adjusted models. OR, odds ratio. AOR, adjusted odds ratio.

CI, confidence interval.

Table 4

Unadjusted and Adjusted Odds of LTFU

Variable	LTFU OR (Unadjusted) (95% CI)	p-value	LTFU AOR (95% CI)	p-value
Male Sex	1.32 (1.03–1.70)	0.03	1.44 (1.12–1.87)	0.005
Age	0.98 (0.96–0.99)	0.002	0.97 (0.96–0.99)	<0.001
Married	1.16 (0.90–1.48)	0.25	--	
No Education	0.76 (0.52–1.11)	0.16	--	
<6 Dependents	1.09 (0.86–1.38)	0.50	--	
Unemployed	1.10 (0.86–1.40)	0.46	--	
<i>Wealth Index Components</i>				
Factor 1 (Housing Structure)	1.03 (0.94–1.12)	0.53	--	
Factor 2 (Housing Tenure)	0.92 (0.84–1.01)	0.06	--	
Factor 3 (Household/Productive Assets)	0.95 (0.87–1.05)	0.31	--	
Factor 4 (Water/Fuel Source)	0.98 (0.87–1.10)	0.69	--	

“--” Indicates variables dropped for the final adjusted models. OR, odds ratio. AOR, adjusted odds ratio.

CI, confidence interval.