

Housing and Health Outcomes of HIV Positive Persons in the Lower Manya Krobo District, Ghana

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Abstract

Although emerging in Western industrialized societies, research on the links between housing and health outcomes of vulnerable populations, such as those living with HIV/AIDS, has received less attention from scholars and policy makers in sub-Saharan Africa (SSA). This is problematic, especially when the majority of people living with HIV/AIDS (PLWHAs) reside in SSA, and governments in these parts of the world are the worst violators of housing rights. With very weak and unstable economies in several parts of SSA, including Ghana, persons living with HIV/AIDS are particularly financially vulnerable, may sometimes feel too sick to work and cannot afford decent housing as a result. Notwithstanding, the intellectual discourse on the housing and health nexus has been lacking in several parts of SSA including Ghana. Using survey data collected from 605 HIV+ persons aged 18-50+ from two major hospitals located in the Lower Manya Krobo District of Ghana, this paper examined the effects of housing structure, type and arrangements, housing accessibility and conditions on the physical and psychological health of PLWHAs. Results indicate that, housing has an independent effect on health outcomes, controlling for socio-economic and demographic variables. Respondents living in poor housing structures and deplorable housing conditions had poorer physical and psychological health scores. The findings suggest that it is relevant to think about houses occupied by HIV+ persons as an important source of health inequality—one that increases their morbidity risks. It is recommended that policy makers consider housing as an important element of HIV prevention and care.

Keywords: Ghana; HIV; Housing; Physical health; Psychological health; Lower Manya Krobo

INTRODUCTION

There is abundant scientific evidence on the links between housing and health (see Krieger & Higgins 2002; Breyse et al. 2004; Bonnefoy 2007; Oswald et al. 2007; Hwang et al. 2003; Bond et al. 2012). Housing conditions affect health in several ways, as inadequate and deficient housing has been found to be highly correlated with respiratory, nervous system, and cardiovascular diseases (Yarnell & Leger 1977; Kilpelainen et al. 2001; WHO 2010). Based on such compelling evidence, the World Health Organization asked that housing be considered an important determinant of health, as addressing housing needs could help prevent a wide range of diseases among populations (WHO 2010). Although emerging in most advanced countries such as the U.S and Canada, research on the links between housing and health of vulnerable populations, including persons living with HIV/AIDS has received little attention in SSA. This is problematic given that more than 60% of people living with HIV reside in this part of the world, and that the majority of countries in SSA (including Ghana) have housing deficits (see Boamah 2010). Some evidence, mostly from more advanced countries, indicates that persons living with HIV not only face acute housing problems, but also live in houses that do not meet the proper safety and sanitary features required of standard homes (Aidala et al 2005; Aidala et al. 2007; Bonuck 2008; Smith et al. 2000; Kidder 2007; Scott et al. 2007). With very weak and unstable economies in several parts of SSA, including Ghana, persons living with HIV/AIDS are particularly financially vulnerable. This vulnerability is heightened given that HIV and AIDS infected persons sometimes feel too sick to work and cannot afford decent housing. There are also high levels of stigma and discrimination associated with the disease, increasing the likelihood of evictions among HIV positive patients (Elford et al. 2008; Wolitski et al. 2009). We know however that homelessness among HIV positive persons could potentially expose them to behaviors that may lead to re-infection or onward transmission of the virus to others (see Leaver

et al. 2007; Wolitski et al. 2009). Furthermore, with a lowered immune system, living in homes that fail to meet the required housing standards could expose patients to more opportunistic infections and other serious health complications.

Currently, Ghana does not have a housing policy for HIV positive persons, unlike the United States, UK and Canada. The lack of a housing policy for HIV positive persons in Ghana reflects the dearth of research in this area. Thus, this study fills an important gap as it is one of the foremost if not the first attempt at drawing linkages between housing and health outcomes of HIV positive persons in Ghana with implications for the rest of the sub-Saharan African region. Specifically, we seek to examine whether the physical, material and social conditions existing within the homes of persons living with HIV/AIDS affects their physical and psychological health.

Background and Context

Lower Manya Krobo, the site for this study, is predominantly a farming and fishing community located in the the Eastern region of Ghana and has continuously documented the highest levels of HIV prevalence in the history of the country (Anarfi, 1995). HIV prevalence was estimated at 13% in 1999, four times higher than the national average of 3% at the time. Although the recent national HIV sentinel survey indicates reductions in prevalence to 10.1%, these reductions have only been marginal as the district continues to lead in AIDS morbidity and mortality (see NACP, 2003; Ghanaweb, 2013). The high HIV prevalence in the district has often been traced to high levels of poverty in the area and migration of local women to neighboring countries such as Cote D'Ivoire (known to have one of the highest rates of infection in West Africa) who become infected as a result of commercial sexual activities and return to continue the sex trade in Ghana (Fobil and Soyiri, 2006). The average household size in the Manya Krobo

area is 7.5 and is higher than the regional and national averages of 4.6 and 5.1 persons, respectively (National Catholic Health Services, 2012). Typical of most households in Ghana, the majority of people in the Manya Krobo district reside in compound houses—where different families live in the same house and share housing facilities such as bathrooms, kitchens etc.—or live in other types of rented rooms that lack basic amenities such as toilets and bathrooms (Ghana Statistical Service, 2008). But these are considered the ‘fortunate’ ones, especially as they at least have a roof over their heads compared to others who make the cold cement or wooden floors in front of market stalls and people’s houses their permanent homes (Legislative Alert, 1993). It must be emphasized, however, that the dire housing situation in Lower Manya Krobo is not peculiar, as it reflects the general housing crisis faced by the Ghanaian society (Ghana Statistical Service (GSS), 2008). It is argued that the housing deficits and deplorable housing conditions in Lower Manya Krobo has obvious health implications for at-risk populations, in particular HIV-positive persons whose immune system may have been suppressed by the virus and are therefore susceptible to infections and other communicable diseases. Also, reports of high levels of HIV-related stigma and discrimination in the district could mean that on knowing their sero-status, HIV positive persons may be more likely to be dismissed from their employment, thus compromising their ability to earn income and afford decent housing. The risk of tenure insecurity and possible eviction based on stigma threatens the health outcomes of HIV/AIDS positive persons, especially those who are in critical stages and need home-based care. In this paper, we examine whether the physical and psychological/emotional health outcomes of HIV+ persons differ by their housing conditions and characteristics. We hypothesize that respondents with poorer housing conditions (regarding

access, structure, conditions existing in the home, type and tenure of house) will have worse physical and psychological health outcomes.

Theoretical perspectives

We employ the population health perspective largely situated in the social determinants of health framework to explore linkages between housing and health outcomes among HIV positive persons in the Lower Manya Krobo district in the Eastern region of Ghana. Like other socio-economic and cultural determinants, the population health and social determinants frameworks identify housing as crucial to achieving optimum health among individuals within populations. Similar to income and education, housing has also been cited as an important correlate of health inequities within and across populations. The population health framework identifies three conceptual dimensions of housing linked to the health of individuals: the *material*, the *location and spatial* dimension, and the *psychological* dimension (Dunn 2004).

The *material* dimension, which forms part of the built environment, has mostly referred to the physical and structural components of housing. For example, it is established that the presence of lead and mold, inadequate ventilation, indoor air pollution, and overcrowding in any housing arrangement could have negative health consequences (Krieger & Higgins 2002). For HIV positive persons in particular, living in houses with such physical and structural defects could increase the risks of opportunistic infections, given that their immune system is suppressed and their ability to fight off such infections is reduced (National AIDS Trust, 2009). It is worth noting that tuberculosis and pneumonia, which are often cited as the two most common respiratory illnesses associated with HIV positive persons, could easily be transmitted through overcrowding and other poor physical housing conditions.

Similar to the *material* or *physical* dimensions, the *location* or *spatial* dimensions of a house are equally important. Several studies show location or neighborhood effects on health status (Roux, 2001; Roux, 2004; Cubbin et al. 2008). Location factors could point to the quality of relationships and resources capable of affecting the living standards of residents. Cubbin et al. (2008) outline several theoretical pathways through which location/neighborhood could affect the health of individuals within populations. First, the physical conditions of the neighborhood often captured by the presence and quality of social amenities such as water and air quality could either have positive or negative impacts on health. Second, the prevailing social environment reflected in the nature and quality of social relationships in the neighborhood may also affect the health of individuals. In this regard, HIV positive patients may be disadvantaged given the high levels of stigma which often leads to their isolation, and in extreme situations, eviction. Third, that the availability of services including health service posts, access to transportation and to employment opportunities within the neighborhood could affect health outcomes.

Finally, the population health framework identifies houses not only as physical dwellings but also as important financial investments that brings some *psychological* satisfaction and benefits to the health of owners. It is important to note that home ownership is often highly correlated with other relevant socio-economic variables such as income and education, which positively affect health outcomes. Drawing on the population health framework this study seeks to examine the effects of housing on the health outcomes of HIV positive persons in the Manya Krobo district of the Eastern region of Ghana. It is expected that respondents with poor housing conditions, limited access to housing and inadequate housing will experience poor physical and emotional health outcomes.

METHODS

Data collection protocols

Data for this study were collected from a cross-section of 605 HIV+ persons aged 18-50 years and above in the Lower Manya Krobo district in the Eastern region of Ghana. Recruitment of participants for the surveys began in June to August 2015 after ethics clearance was received from the Interdisciplinary Committee on Ethics in Human Research (ICEHR) at Memorial University of Newfoundland (where the first author is affiliated), the Ethics Committee for Humanities (ECH) at the University of Ghana (where the second author is affiliated), and the Ghana Health Service (GHS) operating under the Ministry of Health (MOH). As part of the community entry processes, the research team sought permission from the regional Directorate for Health Services in Koforidua—the Eastern regional capital that oversees the activities of the study sites. Similar permissions were sought from the District Directorate of Health Services, and the Administrations of the two hospitals from where the data were collected. Consistent with the customs and traditions of Ghanaians and specifically the Krobo people, the research team upon recommendation from the head nurses of the two hospitals employed for this study, sought permission from the ‘Konor’—the paramount chief and the overlord of the Manya-Krobo traditional area. Data were collected from two health facilities (Atua Government Hospital and St. Martins de Porres Catholic Hospital) all located in the Manya Krobo district. Both hospitals provide treatment for almost all HIV+ persons in the district, and the research team had established rapport with some health professionals and HIV+ persons attending the hospital. The first two authors together with nine research assistants participated in the data collection process. Prior to data collection, several training sessions were held for all research assistants (RAs) at the Institute of Statistical, Social and Economic Research (ISSER) where the second author is a Senior Research Fellow. The majority of research assistants were native Krobos and could speak

and comprehend the language fluently, even those who did not hail from the region had working knowledge of the Krobo language and other Ghanaian languages. Also, all RAs had participated in similar work in the past, and had the experience, cultural and language skills required for interacting with potential respondents. This we believe expedited the data collection process as such experiences helped in establishing rapport with patients quite easily.

Before data collection, questionnaires and interview guides were pretested with respondents constituting about 10% of the sample and further modified. Respondents used at the pre-testing phase did not participate in the original study. Respondents were selected from those who had shown up for check-up at the Voluntary Counseling and Testing (VCT) centres of the Atua government hospital and St. Martin's de Porres hospital, respectively. An average of about 30 HIV+ persons showed up for VCT services daily at each hospital. Thus, on a daily basis they were handed unique code numbers that ensured the random selection of 32 respondents (16 each for both hospitals). The assignment of unique code numbers meant we were able to track all respondents who were used as part of the random selection process so they are not included in the same process the next day or not used twice in the study. Data were collected using face-to-face interviews. Although costly and time-consuming, we found this appropriate and suitable given the sensitive nature of the topic and the fact that the majority of respondents were not very literate to fill out a questionnaire. For the purposes of this study, the sample size was limited 550 respondents who gave complete information on their housing situation and health outcomes.

Measures

Given our interests, the outcome variables employed for this study captured the *physical/bodily* and *psychological/emotional* health of the respondents. Physical health was measured with two latent variables: *Physical body weakness* and *Fatigue* all derived using 6-point Likert scale items

(see Table 1 for description and operationalization of the items). Thus, the latent variables are a summative index weighted by factors loadings derived from the Likert scale items. Factor loadings for both latent variables ranged from 0.5 to 0.8 and reliability coefficients (Cronbach's Alpha) estimated as 0.875 and 0.831 respectively. *Psychological/emotional* health was also derived using 5-point Likert scale items (see Table 1 for description and operationalization of the items). This is a summative index weighted by the factor loadings with the factor scores extracted. Factor loadings for this scale ranged from 0.5 to 0.9 and reliability coefficient (Cronbach's Alpha) estimated as 0.940. Coding suggests that higher (positive) values on the scale indicate poorer physical and psychological health scores while lower (negative) values indicate better physical and psychological health scores.

Several variables were used as measuring the housing situation of respondents. These include *housing structure* and *housing environment*; two latent variables derived from 5 point Likert scale items that asked respondents about the quality of their houses/homes (see Table 1 for description and operationalization of the items). The factor score (summative indices weighted by the factor loadings from the various observed items) are extracted as latent variables. Factor loadings ranged from 0.6 to 0.8 and reliability coefficients (Cronbach's Alpha) estimated as 0.912 and 0.827 for both latent variables respectively. Coding suggests that higher (positive) values on the scale indicate quality housing structure and environment, while lower values (negative) indicate poorer housing structure and environment. *Housing conditions* are measured with five dummy-coded variables asking respondents about ventilation, overcrowding, lighting, damp and mold, and noise. *Housing access* was measured with three dummy-coded variables asking if anything prevented respondents from accessing housing, if they have been ever harassed by their landlords/family due to their HIV status and if they have ever been evicted.

Housing type and arrangement was also measured with two polytomous variables that asked respondents the type of house/dwelling they lived in and housing arrangement (see Table 1 for description and operationalization of the items). We control for the socio-economic (education, income and occupation) and demographic (age of respondents, residence, ethnicity, gender, and marital status) characteristics including the two hospitals from where data were collected.

Analytical strategies

First, factor analytical techniques were used to create outcome and some predictor variables on housing. Factor Analysis, according to Hanushek and Jackson (1977) is a theory-generating and in other cases theory-testing model that postulates the existence of a relationship between unobserved (latent) variables and some observed (measured) variables through a set of structural coefficients. Specifically Exploratory Factor Analysis (EFA) was used to determine and explore the underlying factor structure for the observed indicators tapping the latent constructs used as outcome and predictor variables. Principal Component Analysis (PCA) was employed as the data reduction and extraction procedure. The varimax rotation technique was also used to simplify the factor structures making interpretation of the data easier and reliable. The Anderson Rubin factor scores, which basically are composite measures for each respondent on each factor, were extracted. These are standardized scores and continuous in nature requiring that we employ the Ordinary Least Squares (OLS) in examining the health outcomes of respondents. Analyses were preceded by diagnostic tests to establish whether variables met the assumptions of the planned regression model. We interpret the unstandardized beta coefficients, such that a positive coefficient for health outcomes will mean worse/poorer health outcomes and negative beta coefficients, better health outcomes.

RESULTS

Descriptive results in Table 2 shows that on the average respondents were aged 45.7 years, and the majority representing (74.5%) were females. Approximately, 29% of the samples were married, although quite a significant proportion of women identified as separated or divorced (26.3%) and widowed (25.6%). The Lower Manya Krobo area from where the data were collected is predominantly occupied by the Krobos who are broadly categorized as ‘Adangbes’ in Ghana. It is thus not very surprising that the majority of respondents identified as ‘Ga-Adangbes’ followed by ‘Ewes’ and ‘Akans’. Regarding their socio-economic characteristics, very few had senior high school or higher education, while the majority had junior high school education and below. The majority of respondents were employed and reported income less than 250 Ghana Cedis (about 63 USD at current exchange rates during the data collection) per month. Negative median scores for health outcomes indicate that respondents reported better physical and emotional health outcomes. Also, with positive scores on housing structure and environment, it is evident that respondents thought of the quality of the material and environmental dimensions within their homes as good or excellent. Similarly, respondents had good housing conditions and the majority had not faced problems accessing housing. Regarding their housing arrangements, the majority lived in ‘compound houses’ and ‘traditional/hut’ houses. Approximately 20.6% owned their houses, 27.9% rented their houses and about 49% lived in extended ‘family houses’.

Bivariate results are presented in Table 3. These results show the gross effects of housing variables on the physical and psychological health of respondents. For instance, it is clear that higher scores on housing structure and environment (quality housing) are associated with better physical and psychological health outcomes. Similarly, compared to those with poor housing conditions, respondents with good housing conditions as in good ventilation, less overcrowding,

less noise, less damp and mold and good lighting in their homes had better health outcomes. Housing access variables are not significantly associated with health outcomes, but for respondents who had been evicted and had counterintuitively reported better outcomes, compared to those who had not been evicted. For housing type, we find that those living in compound houses had better emotional health outcomes, than respondents in hut/traditional houses. The bivariate results also show that respondents' socio-economic characteristics are significantly associated with their physical and psychological health outcomes. Specifically, respondents with employment, higher education, and some income, had better physical and psychological health outcomes than those unemployed, those with no education and respondents with no income.

Multivariate results are presented in table 4. Two separate models are run for the outcome variables. Model 1 examines only housing variables and model 2 controls for socio-economic and demographic predictors. Housing structure and environment are significantly associated with physical and psychological health outcomes. Respondents with good/excellent housing structure and environment had better physical and psychological health outcomes even after controlling for their socio-economic and demographic characteristics. We find however, that the statistical significance of variables tapping housing conditions is significantly attenuated in the multivariate context. Regarding access to housing, it is interesting to find that respondents who indicated they had been harassed by their landlords/family due to their HIV serostatus experienced poorer physical health outcomes (fatigue) compared to those who had not been harassed. It was counterintuitive however to find that those who had indicated something prevented them from accessing housing had better physical health outcomes than those who reported nothing prevented them. Further analyses showed that it was until the variable on 'hospital data were

collected from' was controlled that the effects of 'anything prevented from accessing housing?' emerged, meaning the latter suppressed the effects of the former. A cross-classification analysis of the two variables showed that the majority of respondents from Atua Government Hospital indicated that they had been prevented from accessing housing, meanwhile it is these same group of respondents who had worse physical health outcomes (bodily weakness), compared to those in St. Martin's de Porress (a mission) Hospital. Both income and education are significantly associated with health outcomes, but it is those with secondary/higher education who had better physical health outcomes. Similarly, respondents who some income had better psychological and physical health outcomes compared to those without any income. It is also worth noting that the never married had poorer psychological health outcomes, compared to the married.

DISCUSSIONS

The literature on health inequalities has traditionally emphasized income, education and occupation as important socio-economic correlates of health outcomes (Subramanian & Kawachi 2004; Marmot & Wilkinson 2006; Marmot et al. 1997; Lynch et al. 2004; Adler & Newman 2002). More recently, housing has emerged as an important pathway through which social inequalities translates into and explains health inequalities. Specifically, several studies, mostly from Western advanced countries have shown that inadequate housing, poor housing quality and housing-related exposure have adverse effects on health outcomes (Thompson et al 2001; Matte & Jacobs 2000; Barton et al. 2007; Dales et al. 2008; Vasconcelos et al. 2010; Jacobs 2011). In the majority of these studies, however, the focus has been on the general population with less emphasis on vulnerable populations, in particular, persons living with HIV and AIDS. Meanwhile, emerging evidence, also from western advanced countries show that housing plays a crucial role in the lives of HIV positive persons. For instance, stable housing enables persons

living with HIV/AIDS (PLWHAs) access comprehensive healthcare, including adherence to HIV treatment regimens and additional health promoting behaviors (Leaver et al. 2007; Aidala et al. 2005; Riley et al. 2007; Milloy et al. 2012; North American Housing and HIV/AIDS Research Summit IV 2011). Housing quality and the social conditions existing within the homes of PLWHAs have been found to increase their morbidity risks (PHAC 2007; Milloy et al. 2012). This is compounded by the fact that PLWHAs are sometimes too sick to work, are discriminated from employment opportunities due to their serostatus, and as a result are unable to access affordable and adequate housing (see NCH 2007).

Although growing in the West, studies are yet to be conducted on the linkages between housing and health for PLWHAs in sub-Saharan Africa and Ghana specifically. This omission in the literature is extremely problematic given that the majority of HIV positive persons live in SSA, and the sub-region is noted for the worst housing violations. Using data collected from two hospitals in Ghana and applying the population health perspective, this study examined the effects of housing on the physical and psychological health outcomes of PLWHAs in the Lower Manya Krobo district. The study is one of the first, if not the foremost, to consider housing variables on the morbidity outcomes of PLWHAs in Ghana. Results are generally consistent with our theoretical expectations. For instance, the finding that poor housing structures, including the material dimensions of a house, and the environmental conditions existing within the home have negative health consequences is consistent with the population health perspective and the social determinants of health framework that consider housing as one of the major determinants of health inequities (Krieger & Higgins 2002; Roux, 2004; Cubbin et al. 2008). The finding corroborates others that argue that unsuitable housing and lack of access to housing could further deteriorate the health outcomes of a demographic group with a suppressed immune system

(Aidala et al. 2005; Elise et al. 2007; Milloy et al. 2012). Bonnefoy (2007) established theoretical links between housing and health, and argued that there is always a health relevance to the various dimensions of housing, especially given that dwelling conditions may trigger direct health effects. While difficult to draw causal connections between housing and some specific health conditions, Bonnefoy (2007) established that in some cases odours, smells, thermal discomfort, chemical emissions etc could trigger physical health problems or what he referred to as the 'Sick Building Syndrome' (SBS) including irritation of eyes, fatigue, headaches, sore throat and decreased concentration as observed in this study.

The impact of housing on the psychological/emotional health of respondents was noted in this study. Distinctions are often made between a 'house' and a 'home'—while the former refers to the physical and structural components of the house (for e.g space, warmth, humidity etc.), the latter which taps the psychosocial dimensions of the house concerns issues about security, permanence, and sense of attachment and belonging (Moloughney 2004). It is thus not surprising that these had significant effects on the psychosocial outcomes of respondents given that the 'home' is where social interactions take place and could represent significant financial and personal investments as espoused by the population/social determinants of health framework.

Discrimination of HIV/AIDS patients due to their serostatus has been identified as a common barrier to accessing adequate and affordable housing (Elford et al. 2008). Although the majority of respondents indicated that they had not been discriminated against by their landlords, those who did reported adverse physical health outcomes. Pascoe and Richman (2009) theorized that discrimination can often result in physical health challenges through several pathways including stress responses to the discriminatory event, psychological responses that decrease positive emotions and increase negative emotions, heightened physiological stress responses and

engaging in other health risk behaviors. The significance of established socio-economic predictors, especially income on the physical and emotional health is not surprising and consistent with the extant literature that shows that low income is strongly associated with negative emotional and physical health outcomes (Marmot et al. 1997; Lynch et al. 2004; Adler & Newman 2002).

Several policy questions emerge from this study. At the moment there is no specific housing policy for PLWHAs in Ghana, despite the role quality and affordable housing plays in the lives of this important and vulnerable group. This research has however demonstrated that quality and accessible housing is an important health need, especially for PLWHAs. Previous and successive governments in Ghana continue to realize housing as a social good, one that brings stability and economic improvement in the lives of its people. It is in this regard that the Ministry of Works and Housing launched an ambitious program of making both housing accessible and affordable to economically vulnerable sections of the population, including low and middle income earners (CHF International 2004; The Africa Report 2013). While laudable, there is no specific reference to PLWHAs in this policy, in spite of the higher levels of vulnerability among the group. It is recommended based on our research findings that policy makers consider affordable and decent housing a top priority for PLWHAs. We also recommend that housing be made a critical element of HIV prevention and care in Ghana.

Although findings are useful, several limitations are also noted. First, we are unable to draw 'causal' connections between housing variables and health outcomes, especially given that the data used are cross-sectional. Also, based on the cross-sectional nature of the data, establishing temporal order between housing variables and health outcomes may be difficult, especially as we are unable to tell whether poor housing preceded poor health outcomes and vice-versa. Data used

were collected mainly from hospitals while patients came for check-up and to receive anti-retroviral therapy (ART) and does not capture PLWHAs who do not receive care and may not have visited the hospital within the study period. It is also important to acknowledge that the data are self-reported and may be subject to report bias as mostly occurs with self-report data elsewhere. Notwithstanding, this study is seminal as it is the first to draw empirical links between housing variables and health outcomes among HIV positive persons in Ghana. The study has important research and policy implications. For instance, it leads academic debates for thinking about housing as an important determinant of health for PLWHAs in the sub-Saharan African region as our search shows an extreme paucity of data and studies in this area. The study also seeks to bring to the attention of policy makers a basic but important need for persons living with HIV, which for a very long time has been relegated to the background, yet can be corrected with public policy. Such policy, when enacted, will enable persons living with HIV/AIDS live comfortably and independently in their respective communities. Solving the housing problems of HIV positive persons also means meeting their health needs, and cutting back on their health costs.

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Table 1: Description and operationalization of selected dependent and independent variables

Variables	Description and operationalization
Health outcomes	
Physical health (body weakness)	A summative index weighted by factor loadings derived from these variables: if in the past 30 days respondents experienced general bodily pains; physical weakness; heavy, rapid or irregular heart-throbbing; excessive need for sleep; pains in joints or limbs; dizziness; backache; pains in the neck or shoulders. A 6 point likert scale ranging from 'none=1' to 'very severe=6'. Factor loadings ranged from 0.6 to 0.8; Cronbach's Alpha=0.875
Physical health (fatigue)	A summative index weighted by factor scores derived from these variables: if in the past 30 days respondents feeling numbed and benumbed; headaches; tiredness; heaviness or tiredness in the legs; weariness. A 6 point Likert scale ranging from 'none=1' to 'very severe=6'. Factor loadings ranged from 0.5 to 0.8. Cronbach's Alpha=0.831.
Emotional/psychological health	A summative index weighted by factor loadings derived from these variables: if in the past 30 days respondents found life exciting and wanted to enjoy every moment of it; were curious and interested in all sorts of things; were clearly able to sort out things when faced with complicated situations; your life was well balanced between your family, personal and professional activities; were able to easily find answers to your problems; got along well with everyone around you; had a good sense of humor easily making your friends; felt good and at peace with yourself; felt healthy and in good shape; were able to face difficult situations in a positive way; morale was good. A 5 point Likert scale ranging from 'Almost always'=1 to 'never=5'. Factor loadings ranged from 0.5 to 0.9. Cronbach's Alpha=0.940.
Housing variables	
Housing structure	A summative index weighted by factor loadings derived from these variables: in general the quality of your current housing/dwelling; in general the satisfaction level of your current house/dwelling; thermal comfort (indoor temperatures); natural lighting and view; indoor air quality (ventilation system); amount of space in room/house; safety and security of building. A 5 point likert scale ranging from Very poor=1' to 'excellent=5'. Factor loadings ranged from 0.6 to 0.8. Cronbach's Alpha=0.912
Housing environment	A summative index weighted by factor scores derived from these variables: noise exposure and sleep; sanitary installations (bathrooms and toilets); exposure to infestations such as mice, flies etc.; level of privacy in your current house/dwelling; cleanliness and tidiness of the surroundings; traffic intensity (vehicular/human). A 5 point likert scale ranging from 'very poor=1' to 'excellent=5'. Factor loadings ranged from 0.6 to 0.8.

	Cronbach's Alpha=0.827.
Housing conditions	Respondents asked to indicate whether the following conditions exist in their current homes/dwellings; Ventilation coded (Poor=0, Good=1); Overcrowding (Poor=0, Good=1); lighting (Poor=0, Good=1) Damp and Mold (Poor=0, Good=1); Noise (Poor=0, Good=1).
Housing access	Respondents asked if anything had prevented you from accessing housing (no=0, yes=1); ever been harassed by your landlord/family due to HIV serostatus (no=0, yes=1); ever been evicted (no=0, yes=1).
Housing type/arrangements	Type of dwelling/house respondents live in, coded (no=hut/traditional house, 1=compound, 2=Detached/Semi-detached, 3=other); housing arrangement (own house=0; rented=1; family house=2; 3=other).
Socio-economic/demographic	
Age	Age of respondent at time of interview measured as a continuous variable
Ethnicity	Ethnic background of respondents categorized as Ga Adangbe (reference); Akan; Ewe
Gender	Gender of respondent categorized as Male (reference); Female
Education	Educational background of respondents categorized as No education (reference); Junior Secondary School; Senior Secondary School/Higher.
Marital status	Marital status of respondents categorized as Married (reference); Never married; Separated/divorced; Widowed; Cohabiting.
Income	Monthly income of respondents categorized as No income (reference); less than 250 Ghana Cedis; more than 250 Ghana Cedis.
Employment	Whether respondents are employed or not categorized as No (reference); Yes
Residence	Where respondents are located categorized as Rural (reference); Urban
Hospital	Hospital data were collected categorized as Atua Government Hospital (reference); St. Martins de Porres Hospital

Table 2: A univariate distribution of selected dependent and independent variables

Health outcomes	%/median scores (N=550)
Median score for physical health (body weakness)	-.007
Median score for physical health (fatigue)	-.320
Median score for emotional health	-.061
Housing variables	
<i>Housing structure</i>	.022
<i>Housing environment</i>	.034
Housing Conditions	
<i>Ventilation</i>	
Poor	30.2
Good	69.8
<i>Overcrowding</i>	
Poor	23.6
Good	76.4
<i>Lighting</i>	
Poor	24.5
Good	74.5
<i>Damp and Mold</i>	
Poor	8.4
Good	91.6
<i>Noise</i>	
Poor	29.9
Good	70.1
Housing access	
<i>Anything prevented from accessing housing?</i>	
No	85
Yes	15
<i>Ever been harassed by landlord due to HIV?</i>	
No	98.2

Table 2continued

Socio-economic/demographic	
Mean age of respondents	45.7
<i>Gender</i>	
Male	24.5
Female	74.5
<i>Marital status</i>	
Married	28.8
Never married/single	10.1
Separated/Divorced	26.3
Widowed	25.6
Cohabiting	9.3
<i>Ethnicity</i>	
Ga Adangbe	78.5
Akan	10.1
Ewe	11.4
<i>Hospital data collected from</i>	
Atua	52.2
St. Martins	47.8
<i>Education of respondents</i>	
No education	32.3
Primary education	18.5
Junior high school	35.6
Senior high school/higher	13.7
<i>Income of respondents</i>	
No income	30.0
Less than 250 Ghana Cedis	52.3
More than 250 Ghana Cedis	17.7
<i>Employment</i>	
No	23.4
Yes	76.6

Yes	1.8
<i>Ever been evicted?</i>	
No	85.1
Yes	14.9

Type of Housing/arrangements

Type of House

Hut/Traditional house	34.3
Compound house	48.2
Detached/Semi-detached house	12.1
Other	5.5

Housing arrangement

Own house	20.6
Rented house	27.9
Family house	48.5
Other	3.0

Residence

Rural	54.6
Urban	45.4

Table 3: Bivariate models of Physical and emotional health among HIV+ persons in the LMKD, Ghana, 2015

Housing variables	Model 1-BW	Model 2-F	Model 4-EH
<i>Housing structure</i>	-.173 (.042)***	-.081 (.042)**	-.259 (.040)***
<i>Housing environment</i>	-.066 (.042)	-.147 (.042)***	-.268 (.040)***
Housing Conditions			
<i>Ventilation</i>			
Poor ventilation	0	0	0
Good ventilation	-.462 (.089)***	-.105 (.091)	-.387 (.088)***
<i>Overcrowding</i>			
Overcrowded	0	0	0
Not overcrowded	-.539 (.095)***	-.116 (.098)	-.563 (.094)***
<i>Lighting</i>			
Poor lighting	0	0	0
Good lighting	-.546 (.094)***	-.001 (.097)	-.347 (.094)***
<i>Damp and Mold</i>			
Has Damp and Mold	0	0	0
No Damp and Mold	-.519 (.149)***	.069 (.151)	-.621 (.144)***
<i>Noise</i>			
Noisy	0	0	0
No Noise	.275 (.090)***	-.218 (.091)***	-.326 (.089)***
Housing access			
<i>Anything prevented from accessing housing?</i>			
No	0	0	0
Yes	-.203 (.117)*	-.019 (.118)	.079 (.115)
<i>Ever been harassed by landlord due to HIV?</i>			
No	0	0	0
Yes	-.051 (.336)	.663 (.335)	.387 (.304)
<i>Ever been evicted?</i>			

No	0	0	0
Yes	-.291 (.118)***	.058 (.118)	-.146 (.115)
Type of Housing/arrangements			
<i>Type of House</i>			
Hut/Traditional house	0	0	0
Compound house	.103 (.093)	-.099 (.093)	.192 (.091)
Detached/Semi-detached house	-.178 (.139)	-.092 (.139)	-.290 (.135)**
Other	-.055 (.198)	-.340 (.199)*	.115 (.186)
<i>Housing arrangement</i>			
Own house	0	0	0
Rented house	.060 (.120)	-.021 (.119)	.116 (.119)
Family house	.078 (.109)	.144 (.109)	.141 (.107)
Other	-.141 (.253)	.355 (.252)	.316 (.252)
Socio-economic/demographic			
Age of respondents	.012 (.004)***	.003 (.004)	-.002 (.004)
<i>Gender</i>			
Male	0	0	0
Female	.113 (.098)	.166 (.098)*	.126 (.095)
<i>Marital status</i>			
Married	0	0	0
Never married/single	.123 (.152)	.224 (.151)	.451 (.149)***
Separated/Divorced	-.021 (.113)	.258 (.113)**	.278 (.110)**
Widowed	.182 (.114)	-.046 (.113)	.115 (.111)
Cohabiting	.157 (.155)	.195 (.154)	.292 (.154)*
<i>Ethnicity</i>			
Ga Adangbe	0	0	0
Akan	-.148 (.143)	-.190 (.143)	.254 (.138)
Ewe	.041 (.130)	.084 (.130)	-.006 (.129)
<i>Residence</i>			
Rural	0	0	0
Urban	-.012 (.084)	-.148 (.083)	-.021 (.056)

Hospital data collected from

Atua	0	0	0
St. Martins	-.371 (.082)***	.366 (.082)***	-.538 (.079)***
<i>Education of respondents</i>			
No education	0	0	0
Primary education	-.089 (.121)	-.061 (.121)	-.141 (.119)
Junior high school	-.252 (.100)***	-.133 (.100)	-.314 (.099)***
Senior high school/higher	-.230 (.136)*	-.465 (.136)***	-.326 (.131)***
<i>Income of respondents</i>			
No income	0	0	0
Less than 250 Ghana Cedis	-.176 (.093)*	-.138 (.094)	-.410 (.088)***
More than 250 Ghana Cedis	-.506 (.123)***	-.352 (.124)***	-.823 (.118)***
<i>Employment</i>			
No	0	0	0
Yes	.286 (.099)***	-.213 (.099)**	-.398 (.096)***

Note; *p<.1; **p<.05; ***p<.01

Table 4: Multivariate models of Physical and emotional health among HIV+ persons in the Lower Manya Krobo District, Ghana, 2015

Housing variables	Physical Health-Weakness		Physical Health-Fatigue		Emotional Health	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
<i>Housing structure</i>	-.114(.045)***	-.093 (.046)**	-.103 (.046)**	-.080 (.046)	-.253(.042)***	-.233(.042)***
<i>Housing environment</i>	-.006(.044)	.013 (.045)	-.142(.045)***	-.123(.045)***	-.236(.041)***	-.230(.041)***
Housing Conditions						
<i>Ventilation</i>						
Poor ventilation	0	0	0	0	0	0
Good ventilation	-.055(.114)	-.164 (.116)	.162 (.117)	.209 (.117)	.067 (.108)	-.007 (.107)
<i>Overcrowding</i>						
Overcrowded	0	0	0	0	0	0
Not overcrowded	-.154 (.121)	-.002 (.126)	-.090 (.124)	-.175 (.127)	-.225 (.113)**	-.075 (.115)
<i>Lighting</i>						
Poor lighting	0	0	0	0	0	0
Good lighting	-.350(.112)***	-.376(.113)***	.124 (.115)	.159 (.114)	-.023 (.106)	-.063 (.104)
<i>Damp and Mold</i>						
Has Damp and Mold	0	0	0	0	0	0
No Damp and Mold	-.371 (.159)**	-.261 (.161)	.064 (.163)	-.005 (.163)	-.346 (.148)**	-.227 (.147)
<i>Noise</i>						
Noisy	0	0	0	0	0	0
No noise	-.081 (.097)	-.046 (.099)	-.156 (.099)	-.138 (.101)	-.045 (.091)	-.037 (.091)
Housing access						
<i>Anything prevented from accessing housing?</i>						
No	0	0	0	0	0	0
Yes	-.158 (.120)	-.283 (.126)**	-.027 (.123)	.070 (.128)	.102 (.111)	.008 (.115)
<i>Ever been harassed by landlord due to HIV?</i>						
No	0	0	0	0	0	0
Yes	.263 (.357)	.277 (.356)	.726 (.366)**	.796 (.361)**	.478 (.318)	.396 (.309)
<i>Ever been evicted?</i>						

No	0	0	0	0	0	0
Yes	-.320(.126)***	-.250 (.130)	-.063 (.130)	-.085 (.132)	-.327(.117)***	-.225 (.117)
Type of Housing/arrangements						
<i>Type of House</i>						
Hut/Traditional house	0	0	0	0	0	0
Compound house	.095 (.094)	.096 (.102)	-.074 (.097)	.035 (.104)	.277 (.089)***	.139 (.094)
Detached/Semi -detached house	.003 (.143)	.093 (.102)	.042 (.147)	.004 (.148)	.032 (.134)	.067 (.134)
Other	.119 (.203)	.161 (.211)	-.201 (.208)	-.074 (.214)	.396 (.182)**	.159 (.188)
<i>Housing arrangement</i>						
Own house	0	0	0	0	0	0
Rented house	-.022 (.123)	.142 (.129)	-.068 (.126)	-.153 (.130)	-.142 (.115)	-.083 (.118)
Family house	-.015 (.111)	.093 (.119)	.097 (.113)	-.092 (.121)	-.047 (.104)	-.034 (.109)
Other	-.188 (.245)	.018 (.246)	.326 (.251)	.179 (.250)	.143 (.233)	.191 (.229)
Socio-economic/demographic						
Age of respondents		.016 (.004)***		.003 (.004)		-.003 (.004)
<i>Gender</i>						
Male		0		0		0
Female		.049 (.108)		-.002 (.110)		.061 (.099)
<i>Marital status</i>						
Married		0		0		0
Never married/single		.209 (.155)		.168 (.157)		.399 (.143)***
Separated/Divorced		-.029 (.120)		.110 (.121)		.114 (.109)
Widowed		.016 (.123)		-.122 (.125)		.070 (.113)
Cohabiting		.158 (.159)		.147 (.161)		.060 (.147)
<i>Ethnicity</i>						
Ga Adangbe		0		0		0
Akan		-.073 (.143)		-.055 (.145)		-.130 (.129)
Ewe		.073 (.131)		.118 (.132)		-.003 (.120)
<i>Residence</i>						
Rural		0		0		0
Urban		-.106 (.089)		-.002 (.091)		.009 (.082)

<i>Hospital data collected from</i>							
Atua		0		0		0	
St. Martins		-0.309(.099)***		.469 (.100)***		-0.393(.090)***	
<i>Education of respondents</i>							
No education		0		0		0	
Primary education		-0.026 (.123)		.032 (.125)		-0.086 (.113)	
Junior high school		-.143 (.106)		-.099 (.107)		-.105 (.097)	
Senior high school/higher		-.058 (.148)		-.294 (.149)**		-.063 (.133)	
<i>Income of respondents</i>							
No income		0		0		0	
Less than 250 Ghana Cedis		-.025 (.159)		-.305 (.161)		-.367(.143)***	
More than 250 Ghana Cedis		-.158 (.183)		-.454(.185)***		-.516(.164)***	
<i>Employment</i>							
No		0		0		0	
Yes		-.084 (.172)		.172 (.174)		.109 (.154)	
N	550	550	550	550	550	550	550
R-square	.117	.187	.059	.135	.199	.296	

Note; *p<.1; **p<.05; ***p<.01