

# **Land tenure (in)formality and disease prevalence in cities: an exploratory spatial analysis of urban neighborhoods in Accra.**

**Walter DACHAGA, Germany, Walter Timo DE VRIES, Germany, Elias Danyi KUUSAANA, Ghana**

**Key words:** land tenure, informality, urban, health, Ghana

## **SUMMARY**

In urban areas, increased disease burdens and the simultaneous manifestation of informal land tenure and poor health outcomes in informal settlements beg the question of whether the (in)formality of tenure and health have a link. This relational puzzle is but a real societal phenomenon rooted in current understandings of informal settlements or neighborhoods as areas with ‘inadequate access to safe water, inadequate access to sanitation and other infrastructure, poor structural quality of housing, overcrowding, and insecure residential status, which portrays informal settlements as areas of not only deprivation and tenure insecurity, but as locations of poor health outcomes and health inequities.

Informal settlements, which are manifestations of informal tenure, have been identified as hotspots for diseases – they carry a high disease burden and promote rapid local spread of communicable diseases. However, despite the seeming interaction between land tenure dynamics and health, health outcomes or patterns are hardly measured in relation to land tenure variables. Whereas a theoretical and conceptual relationship is often speculated between land tenure and health, such a relationship is hardly tested empirically in literature. Using cluster analysis and bivariate choropleth maps, this paper investigates spatial association between land tenure (in)formality and the prevalence of disease in urban neighborhoods in Ghana by identifying possible patterns and clusters of reported diseases. The findings are inconclusive on the existence of spatial association between disease clusters and slum presence which are manifestations of informal tenure. This is because patterns of low disease prevalence and high slum presence were observed while on the other hand high disease prevalence with low slum presence were also observed. Seeking explanations for the spatial divide in health offers insights for improving health outcomes particularly among disadvantaged groups and reducing health inequalities in cities. This study is therefore a first step towards gathering empirical evidence on land tenure and health links for advancing health-in-all policy approaches in cities. In addition, the study lends relevance to key Sustainable Development Goals including good health and well-being, clean water and sanitation, reduced inequalities and sustainable cities and communities.

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## **1. INTRODUCTION**

Current discourse on urban dimensions of health often begs the question of what urban conditions contribute to rapid and infectious disease spread. In response, scholars have consistently attributed the disease burden of cities to population density and lack of access to WASH facilities especially in informal settlements (Greenwell et al. 2013; Ross et al. 2020). This has led to a scholarly prescription of housing and infrastructure upgrade, often put forward as remedy for health vulnerabilities in informal settlements (Chaudhuri 2017; Corburn and Sverdluk 2017). While housing and infrastructure upgrade in informal settlements are health promotion interventions, a lack of focus on strengthening land tenure could lead to gentrification and associated health outcomes.

The scholarly response to urban dimensions of health tend to neglect the reality that urban density, low socio-economic status, lack of infrastructure and services, and spatial variability of health outcomes in informal neighborhoods are place-based emergent phenomena which are predicated on land tenure – people-land-relations (Ali et al. 2023). People living in informal areas worldwide are exposed to increased health risk due to their spatial environment (Friesen et al. 2020). The adverse health conditions among urban populations due to their spatial environment have been documented using health and household living indicators from survey data such as the Demographic and Health Surveys (Montgomery and Hewett 2005). Therefore, understanding persistent and increasing spatial inequalities in health remains an important field of academic enquiry for geographers, epidemiologists and public health researchers. Seeking explanations for the spatial divide in health offers insights for improving health outcomes particularly among disadvantaged groups.

In urban areas, increased health and disease burdens and the simultaneous manifestation of informal land tenure and poor health outcomes in informal settlements beg the question of whether the (in)formality of land tenure and health have a link. This relational puzzle is but a real societal phenomenon rooted in current understandings of informal settlements or neighborhoods as areas with ‘inadequate access to safe water, inadequate access to sanitation and other infrastructure, poor structural quality of housing, overcrowding, and insecure residential status, which portrays informal settlements as areas of not only deprivation and tenure insecurity, but as locations of poor health outcomes and health inequities (Wilkinson 2020). In the context of this study, we use informal settlements and slums interchangeably to mean the same thing.

Findings from existing studies on land tenure (in)formality and health do not lend themselves easily to generalization in other parts of the world, particularly in Ghana which is

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experiencing massive urbanization and sprouting of informal settlements. Although previous studies show connections between forms of housing tenure, neighborhood status and the prevalence of diseases in developed countries, these relationships have not been examined in Ghana.

In Ghana, informal settlements are a common scene in cities notably in Accra, Kumasi and Takoradi. The search for better livelihood has led to the congregation of more than half of country's population in cities with about 60% of the urban population concentrated in the Greater Accra, Ashanti and the Western Regions (Ghana Statistical Service 2014). According to the World Bank (2024), 33% of urban population in Ghana live in slums . Slums are manifestations of informal tenure, and have been identified as hotspots for diseases – they carry a high disease burden and promote rapid local spread of communicable diseases (Oppong et al. 2015). However, despite the seeming interaction between land tenure dynamics and health, health outcomes or patterns are hardly measured in relation to land tenure variables. Framed as an exploratory study for further investigation, the objective of the current study is to explore spatial association between land tenure (in)formality and health outcomes in Accra, Ghana, using slum locations as proxies of informal land tenure.

The study distinguishes itself from previous studies that looked at informal settlements and health because it puts focus on land tenure rather than the living conditions which are manifestations of the nature of land tenure in these areas. Previous studies have put emphasis on the characteristics of space and how these characteristics make informal settlements vulnerable to diseases (Ali et al. 2023). Focusing on land tenure means dealing with the cause of causes of disease prevalence in informal settlements.

## **2. THEORIZING THE QUADRIPARTITE HEALTH CHARACTERISTIC OF LAND TENURE**

To understand the quadripartite health characteristic of land tenure, it is important to grasp the concept of land tenure – the people-to-land-to-society relationships comprising a compendium of rights, restrictions and responsibilities that define practices and behaviors related to how people use, own, exercise rights and access interests in land and land-related resources (Chigbu 2023; Chigbu et al. 2022). The form and security of land tenure could breed either health-compromising or health-promoting land use, behaviors and practices. In this context we focus on the form by looking at (in)formality of the land tenure rather than (in)security of the land tenure which could arguably be independent of the form of land tenure.

Considerable progress have been made to link land tenure with livelihood (Tseng et al. 2020) and separately, housing and environmental risk with health (World Health Organisation 2018), land access with nutritional health, food security with child health (Ibrahim et al. 2022), housing quality with disease occurrence and health (Adjei and Kyei 2013; Baker et al. 2016), housing status with health (Aidala et al. 2016), housing condition and environmental health (Braubach et al. 2014) customary tenure with health (Tschirhart et al. 2015), and a dominant connection of housing tenure with health (Ziersch et al. 2017; Bond et al. 2012; Egan et al. 2015; Hernández and Swope 2019; Morris 2016; Baker et al. 2017). These studies have conceptually shorthanded housing tenure by assuming taxonomic collectives like

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'owner-occupation' or 'social housing' correspond with significant break-points in concrete real world categories like housing quality, social status, or financing mechanisms (Barlow and Duncan 1988). They also equate categories like housing class or consumption cleavages with specific tenures – a situation Barlow and Duncan (1988) describe as misuse and abuse of the word 'tenure'. Of course, housing needs land to be constructed, and it is the visible and valuable representation of land tenure. However, the non-explicit reference to land tenure and health connections in housing studies mixes the notions of land-as-property and housing-as-property. Consequently, these mixed notions mask the potential of land tenure interventions as health interventions and determinants of health.

Dachaga and Vries (2021) and Baumgartner et al. (2022) explicitly leverage and acknowledge conceptual links between land tenure and health by inferring pathways through which land tenure can influence health outcomes. In their views land tenure has a quadripartite health characteristic that makes it a social determinant of health. Thus, land tenure interventions are conceptualized as preventive health interventions that have the potential to deliver disease-resilient neighborhoods and healthy cities. Four key characteristics of land tenure that underpin the health relevance of land tenure are that it has a psychological variable comprising both the states of thinking and feeling, it is a distributive right of justice, it provides access to life enabling resources, and it is a social relation with people and land, whereby the strength of this relationship can be linked to stress-buffering benefits that affect health outcomes (Dachaga and Vries 2022). Therefore, formal and secure forms of urban land tenure tend to support stability of mind, access to basic health promotion infrastructure, clean environments and sense of belonging which together promote mental, physical, environmental and social health. On the contrary, informal and insecure forms of land tenure, through psychological instability, lack of access to health promoting infrastructure, exposure to environmental pollution and lack of social cohesion, tend to compromise mental, physical, environmental and social health.

These conceptual connections between land tenure and health, make land tenure a policy priority for addressing spatial variations in health equity in cities. What is needed is moving beyond existing theoretical evidence of land-tenure-health links to gathering empirical evidence of how land tenure underpins key psychological, environmental, infrastructure and social vulnerabilities of cities and their associated health outcomes.

### 3. METHODOLOGY

This study involves a mix of methods including using inbuilt ArcGIS Pro Cluster and Outlier Analysis (Local Moran I), ArcGIS Pro reclass function, ArcGIS Pro bivariate choropleth maps and GeoDa univariate Local Moran I cluster analysis. Informal settlements data (slums) of Accra were acquired from Maxwell Owusu et al (Owusu et al. 2021). Health data including cases of Cholera, Diarrhea, Malaria and Intestinal infections from 2017 to 2021 at Sub-district level were acquired from the Ghana Health Service. Administrative data included shapefiles of Sub-districts of the Greater Accra Region. The analysis involved performing cluster analysis with the health data to identify clusters and to explore spatial association between informal settlements and disease prevalence. The initial excel data received from Ghana Health Service were converted to a table in ArcGIS Pro and joined to the attribute table of the

Sub-districts' shapefile. Using GeoDa® software, a univariate Local Moran's I (LISA) analysis (Bone et al. 2013; Arcoverde et al. 2018; Anselin et al. 2006) was performed to identify clusters and how these relate spatially with informal settlements patterns. However, since GeoDa gives output maps in *.png* format and the informal settlements were in shapefile formats, it posed a challenge in overlaying the two datasets to study disease and informal settlements distribution patterns. Therefore, we explored ArcGIS Pro Cluster and Outlier Analysis which is the equivalent of the Local Moran I cluster analysis. This approach helped us identify patterns once the output cluster maps from ArcGIS Pro were overlaid with informal settlements (slums) data set. In addition, a spatial join was performed for the Sub-districts (and diseases) shapefile and the slums shapefile, and summed the geodesic areas covered by slums in each Sub-district. The output file from the spatial join was then symbolized using bivariate colors symbology and the disease and slum area of each Sub-district to visualize at which locations the two variables – land tenure (in)formality and disease prevalence agree spatially.

#### **4. SPATIAL ASSOCIATION OF (IN)FORMALITY OF LAND TENURE AND DISEASE PREVALENCE IN ACCRA**

The results from cluster and outlier analysis show that there are clusters of diseases which do not necessarily correspond to areas with concentration of slums. The analysis shows mixed results of spatial association between informality of tenure and disease prevalence. From figure 1, the results are dominated by a lot of outliers where low disease prevalence are surrounded by high disease prevalence and high disease prevalence are surrounded by low disease prevalence which defies the Tobler's first law of geography that everything is related to all else but those which are near to each other are more related when compared to those that are further away. From this perspective it is difficult to conclude an outright spatial relationship based on the cluster analysis. On the other hand, and from the cluster analysis, the high-high clusters are located away from slum areas while slum areas are surrounded by low-low clusters. This also makes it inconclusive of a significant relation between informality of tenure (slums) and that of disease prevalence. The results suggest that there may be a compendium factors beyond (in)formality of land tenure that account for spatial variability of disease prevalence in Accra. Based on local knowledge of some slum locations and interaction with public health information experts in Accra, possible reasons for these results could be due to reporting of disease cases especially where slums are located outside sub-districts with health facilities or where there are no existing health facilities within slum locations.

Regardless of the inconclusive results from the cluster analysis, a bivariate choropleth map of the output dataset of the spatial join of slums and diseases (by Sub-districts) shows that there is some spatial association between informal settlements and disease prevalence as shown in Figure 2, where subdistricts with high slum areas coincide high disease prevalence. From figure 2, we can observe that most of the slums are in sub-districts where disease prevalence is also high. This leaves room to conclude spatial association between slums and disease prevalence although we have high concentration of slums in areas that appears to have low

disease prevalence. We also observe high disease prevalence in some Sub-districts that are characterized by low slum areas. Again, lack of data on the availability of health facilities in these areas and actual hospital visiting behaviors in locations makes it difficult to conclude strong spatial association between informality of land tenure and disease prevalence.

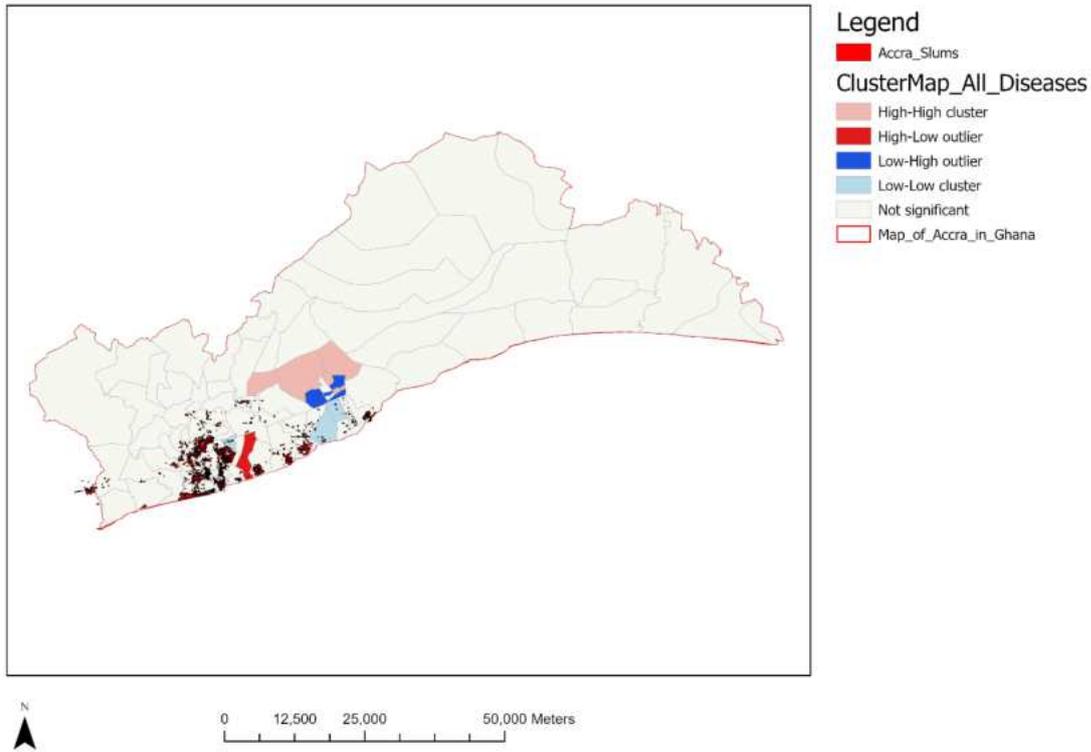
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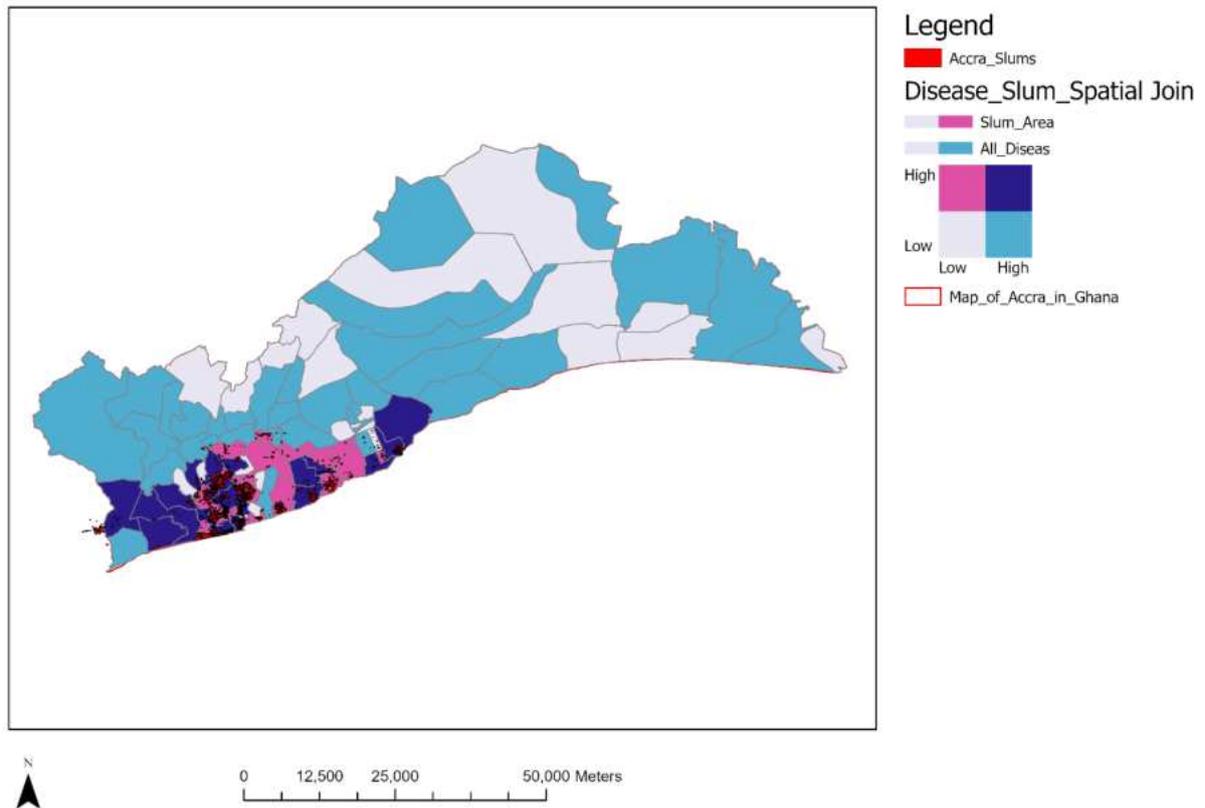


Figure 1. Cluster and outlier analysis of diseases overlaid with slums in Accra

Figure 2. Bivariate choropleth map of slums (informal tenure) and diseases in Accra

## 5. CONCLUSION

In this study we conducted exploratory analysis of neighborhoods in Accra in a bid to gain preliminary empirical insights into conceptual and speculative claims of spatial association between land tenure informality and disease prevalence as part of a larger study that explores the nuances of land tenure and its connection to health. The results from both cluster analysis and bivariate choropleth map are not conclusive on the existence of spatial association between disease clusters and slum presence which are manifestations of informal tenure. This is because patterns of low disease prevalence and high slum presence were observed while on the other hand high disease prevalence with low slum presence were also observed. The findings from the above analysis largely defy our expectation and existing literature on slum health and disease burden of cities which generally posit informal settlements as places of increased risk of disease and vulnerable populations (Weimann and Oni 2019; Sverdlik 2011; Zerbo et al. 2020; Ramlal et al. 2022; Osei and Stein 2017). However, significant patterns of high presence of slums in areas with high disease prevalence leaves some speculations of

spatial association that necessitates further investigation of differential land tenure dynamics including tenure security and how it influences health outcomes.

A key limitation of this study is in the use of data at different scales. Disease data were collected at sub-district level which may not reflect land tenure and health realities at the household level given the subjective nature of land tenure experiences. The limitations notwithstanding, the study forms a good start for further investigation of land tenure forms (security) and its connection to health outcomes in different neighborhoods in Accra. A learning point from this study is that while theoretically social phenomena and health and spatial events may seem to be connected, connecting social data with health using geospatial methods is not a straightforward process. Differential scales of data could mask social realities which require interacting with people. Therefore, research is needed at the household level and on methods to connect social data with health and geospatial data which together affect health outcomes.

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## **BIOGRAPHICAL NOTES**

Walter Dachaga is a Research Associate (PhD Candidate) and Graduate Program Coordinator at the Chair of Land Management at the School of Engineering and Design at the Technical University of Munich. He investigates land tenure and livelihood outcomes. He teaches land policy and land governance as well as property rights and land tenure systems in the MSc. Land Management and Geospatial Science program. His research span themes including urban health, land tenure security, urban land tenure, land policy and governance, women land rights and land use planning. Currently, his research focuses on land tenure security and health connections.

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