Examining spatial proximity to health care facilities in an informal urban setting

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The United Nations Sustainable Development Goal (SDG) 3 seeks to ensure universal health coverage for everyone irrespective of geographical location by 2030. Anecdotal evidence exists on the possibility of attainment of the goal at household level in slum areas most especially in Africa. Recent studies suggest that further work is needed on the advancement of empirical evidence on slum health [1, 2], especially in Africa where slum population growth is reported to be at the same level with urban population growth [3]. There is the need to understand the dimensions of spatial proximity to healthcare facilities in Nigeria towards achieving SDG 3 [4], especially in slum areas where little evidence exists. Spatial access to appropriate healthcare is even more relevant given the rapid rise in Covid-19 cases globally. The lack of detailed quality spatial data is a concern to both researchers and development agencies [5]. In an attempt to contribute to the knowledge gap in slum health studies, this study draws on two data sets (field validated OpenStreetMap data and healthcare facility survey data) from an ongoing research project to examine spatial proximity to healthcare facilities (HCFs) in Sasa, an informal urban "slum" area in Nigeria. The decision to focus on spatial proximity is based on findings from a household survey, in an ongoing project, which suggest that one of the main reasons given by respondents for choosing HCFs is proximity. Conceptually, there are two main schools of thought about spatial proximity [6]; this study considers proximity as a distance measure defined quantitatively. The ongoing research project is a National Institute for Health Research (NIHR) Global Health Unit on Improving Health in Slums at University of Warwick [7]. This Unit focuses on health services in slums through the study of seven slum sites in Africa and Asia and aims at finding optimal ways to enhance health services. We thus present initial results from one of the study sites in Africa. The following research questions are explored. What are the differentials of spatial proximity to health care providers in informal settlements like slum? What are some of the lessons learnt from using OpenStreetMap-based mapping approach for slum health research?

An OpenStreetMap-based data collection methodological approach was developed and implemented [8]. A spatially-referenced sampling frame was generated through a combination of: remote participatory mapping from satellite imagery; local participatory mapping and ground-truthing; and the identification of dwellings of each validated structure.

Additionally, a healthcare facility survey was conducted to capture types of facilities etc. The following categories of HCFs are drawn from survey data and used for analyses: four Clinics and Maternity Centres (CMC); twenty-two Patent Medicine Stores (PMS); five Traditional and Faith Healers (TFH); and one Eye Health Centre (EHC). Two-fold analyses are conducted. First, two measures of spatial proximity (spatial network and Euclidean distances) to different types of HCFs within the site are computed using field validated OpenStreetMap (OSM) network data. Bivariate analysis is performed to test sinuosity (ratio of network and Euclidean distance). Additionally, comparative analyses of combined means and medians (using k-independent samples median tests) for categories of HCFs are performed. Second, a reflective exercise is undertaken to outline some of the lessons learnt during the research process related to the OSM-based approach.

This study presents the outcome of the two-fold inquiry outlined. Preliminary results show strong positive correlation (r=0.97; 99% CI) between the two spatial proximity measures suggesting that Euclidean and network spaces are quite similar in terms of accessibility to health care services within Sasa slum. Overall sinuosity index is 1.16 suggesting that the non-linear nature of network routes to HCFs contributes to 16% more than the Euclidean metric. The combined network distance grand mean (with standard deviations) and grand medians for each of the categories are as follows: 727m (±299) and 766m for CMC; 579m (±256) and 563m for PMS; 589m (±240) and 589m for TFH; and 503m (±204) and 490m for EHC. Residents can access these facilities within a walking distance (under 1km) where Clinics and Maternity Centres appear to be the farthest from most residents. This study advances the evidence base on slum health towards achieving SDG 3 and promotes the use of OSM-based mapping approach and data for slum health research.

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