

# **SPATIAL DESIGN NETWORK ANALYSIS FOR URBAN HEALTH (SDNA-UH) - DECIPHERING THE ASSOCIATIONS BETWEEN BUILT ENVIRONMENT MORPHOMETRICS AND HEALTH OUTCOMES**

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## **ABSTRACT:**

The relationship between structure of configured urban space in a city and human behaviour and health has long been established. However, few studies have empirically examined the impacts of detailed built environment (BE) configuration upon health outcomes. The study hypothesizes that the configuration of the city, especially the distribution of land uses and design of street networks defines physical connectivity and accessibility to health-promoting-community-resources, influences individual's activity patterns, mental and behavioural responses as well as social interactions and hence determines the socio-spatial distribution of health<sup>1,2</sup>. With the objective of operationalizing the multiple multilevel spatial determinants of health in a city system, spatial Design Network Analysis for Urban Health (sDNAUH), a high resolution GIS database comprising sophisticated BE morphological metrics (morphometrics) has been developed for the assembly constituency of Caerphilly, Wales (Figure 1). The UK Ordnance Survey MasterMap data layers were employed to construct more than 100 land use and street network accessibility indices. A network model of street-level physical accessibility was developed using spatial Design Network Analysis (sDNA) as shown in Figure 2. Dwelling locations of respondents of the Caerphilly Prospective Study (CaPS), a community sample of older men of Caerphilly, Wales were geocoded so as to form the individual-level health and socio-demographic component of sDNA-UH. The sDNA-UH indices were parameterized within multiple street-network catchments around respondent's dwelling. The analytical strategy employed involved assessment of health effects of differential accessibility of an individual's dwelling with respect to multiple service and facility catchments at multiple spatial scales of 0.5 mile and 1 mile street-network catchments. The effects upon general health (expressed in terms of perceived health and disability) and psychological health (measured by hospital anxiety and depression scale; HADS) in older adults of Caerphilly were examined. The presence of hierarchically clustered data with individuals nested within census defined lower super output area (LSOA) neighbourhoods enabled the examination of impact of BE configuration upon general and psychological health through a series of multi-level logistic regression models. Two-level logistic mixed effects models with LSOA-level random effects were fitted on the health indicators of perceived general health, long standing disability, anxiety and depression. Statistical analyses were performed with the user-written `runmlwin` command within Stata 11.2. Specific attributes of BE, especially the

dwelling-level density, dwelling type, density of community services, street network movement potential expressed in terms of betweenness index and neighbourhood-level deprivation (measured by Welsh Index of Multiple Deprivation) were reported to be significantly associated with health