

Publication

Assessing the population coverage of a health demographic surveillance system using satellite imagery and crowd-sourcing

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Remotely sensed data can serve as an independent source of information about the location of residential structures in areas under demographic and health surveillance. We report on results obtained combining satellite imagery, imported from Bing, with location data routinely collected using the built-in GPS sensors of tablet computers, to assess completeness of population coverage in a Health and Demographic Surveillance System in Malawi. The Majete Malaria Project Health and Demographic Surveillance System, in Malawi, started in 2014 to support a project with the aim of studying the reduction of malaria using an integrated control approach by rolling out insecticide treated nets and improved case management supplemented with house improvement and larval source management. In order to support the monitoring of the trial a Health and Demographic Surveillance System was established in the area that surrounds the Majete Wildlife Reserve (1600 km²), using the OpenHDS data system. We compared house locations obtained using GPS recordings on mobile devices during the demographic surveillance census round with those acquired from satellite imagery. Volunteers were recruited through the crowd-crafting.org platform to identify building structures on the images, which enabled the compilation of a database with coordinates of potential residences. For every building identified on these satellite images by the volunteers (11,046 buildings identified of which 3424 (ca. 30%) were part of the censused area), we calculated the distance to the nearest house enumerated on the ground by fieldworkers during the census round of the HDSS. A random sample of buildings (85 structures) identified on satellite images without a nearby location enrolled in the census were visited by a fieldworker to determine how many were missed during the baseline census survey, if any were missed. The findings from this ground-truthing effort suggest that a high population coverage was achieved in the census survey, however the crowd-sourcing did not locate many of the inhabited structures (52.3% of the 6543 recorded during the census round). We conclude that using auxiliary data can play a useful role in quality assurance in population based health surveillance, but improved algorithms would be needed if crowd-sourced house locations are to be used as the basis of population databases.

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