How African homes impact health

July 25 2019, by Beth Amato

Credit: Wits University

Machine learning study finds housing have improved in sub-Saharan Africa but adequate water and sanitation remains biggest challenge.

The study, thought to be the first to use machine-learning to measure housing conditions in sub-Saharan Africa, has found housing quality transformed but the persistence of slum conditions compromise health.

Medical entomologist, science prodigy, and Associate Professor of Public Health at Wits University, Fredros Okumu, was 18 years old

when he was recruited as live mosquito bait as part of a Ph.D. research experiment. Inside that tent waiting for the insanity-invoking buzz near his ears, Okumu's fate was sealed: he'd work tirelessly during his academic career to find a solution to one of humankind's most vexing public health problems in Africa—the deaths caused by malaria.

His initial focus was inside the home: he simulated the attractive qualities of human beings to mosquitoes (such as blood, scent and other particular biological markers) in a "decoy site," which contained pathogenic fungi to kill the flying critters. This complemented other interventions like nets and insecticides. In 2009, his team developed location models to determine where best to place mosquito decoy devices using digital geographical information systems and participatory community mapping.

Okumu's specialisations are applied parasitology and the combined disciplines of geo-information science, earth observation and environmental modelling. He has recently looked at the quality of rural and urban housing in sub-Saharan Africa as an opportunity to accelerate the efforts against combatting malaria and other significant public health concerns in the region.

Okumu co-authored a ground-breaking paper entitled Mapping changes in housing in sub-Saharan Africa from 2000-2015 in the international science journal *Nature*, which is the first accurate approximation of urban and rural housing quality in the region.

Jigsaw housing analysis

The study is innovative in a number of ways, notably because it built a machine-learning model to fill in data gaps, much like a jigsaw puzzle. To Okumu's knowledge, this study is the first to apply a geostatistical modelling approach to measure housing conditions in sub-Saharan

Africa. The data also reveal the differences in each country's adoption of safe housing.

Said Okumu, "The quality of housing determines the risk of diseases such as malaria, respiratory infections and diarrhoeal disease. We knew anecdotally that African housing is changing, but until now this trend had not been captured on a wide scale."

The study was led by the London School of Hygiene and Tropical Medicine, the Imperial College London, and the Malaria Atlas Project at the University of Oxford. The study quantified changes in housing in the region using national survey (data was gleaned from 661 945 households in 31 countries) within a geostatistical framework.

A marked transformation in the quality of housing was observed, which bodes well for the attainment of Sustainable Development Goal (SDG) 11—the achievement of sustainable cities and communities. Adequate housing, said lead author of the study Dr. Lucy Tusting, is a human right and will become more urgent as Africa's population will double by 2050. By then, UNICEF predicts, one in four people on Earth will be African with the population likely to rise from 1.2-billion to 2.5-billion.

Prioritising roofs and taps

Housing was considered improved using the United Nations standards: safe water and sanitation, an adequate living area, and durable construction (no gaps in walls, eaves or doors). But, while the study shows that improved housing has doubled between the years 2000 and 2015 (from 11 percent to 23 percent), 53-million urban Africans continue to live in slum conditions. Adequate water and sanitation are by far the greatest challenges in the region.

The findings highlighted poor sanitation as commonplace, which is one

of the chief reasons that hold back progress to improve living conditions. Alongside SDG 11 is the need to prioritise SDG 6—clean water and sanitation. "The two are intrinsically linked," said Okumu.

The most improved housing was seen in Botswana, Gabon and Zimbabwe. The Democratic Republic of Congo, Eritrea, and South Sudan had the worst housing conditions.

Notably, Africans are self-financing home improvements. "In general, the housing improvements are driven by people's own household incomes, which means that the poorest households are left behind," said Okumu.

Because changes are linked to economic factors, the poorest communities need support for housing improvements. "Legal structures combined with subsidies on construction materials and training for local construction workers are potential options," he added.

Constructing healthier cities

For the goal of universal access to safe, adequate and affordable housing to be achieved, reliable baseline data, such as what the study provides, is critical. Measurements (prior to the release of the study) of housing conditions in Africa were limited to specific years and urban areas only.

"If we were to trace the trends beyond 2015, it is unlikely that the 2030 target will be achieved. However, these findings still provide a great demonstration that a deliberate effort could accelerate these trends," said Okumu.

The poorest households thus need government support, particularly around improved drinking water and sanitation.

Okumu said, "In addition, it is vital that building regulations and housing programmes are cognisant of the design features that can safeguard health. For example, screening and improving houses has been shown to be an effective means of reducing the transmission of mosquito-borne diseases such as malaria, while reducing standing water in urban environments can reduce the presence of mosquitoes that transmit dengue, chikungunya, yellow fever and the Zika virus. It is vital that health specialists work closely with urban planners, engineers and governments to help 'build out' these diseases across Africa."

Okumu's and Tusting's next step is to understand the implications of the changes in housing for health in sub-Saharan Africa. Their baseline data can be used by researchers working to establish housing trends and their study can provide the technical documentation needed for policy makers to improve housing. In addition, Okumu and the authors' seminal research is also important to prepare adequately for climate change in Africa. The UN posits that sub-Saharan Africa (which has already experienced more frequent climate change extremes) will have longer and more frequent heat waves. Climate change is already considered a threat multiplier, exacerbating existing problems.

Housing and climate change

The UN-Habitat notes that cities in particular are facing unprecedented demographic, environmental, economic, spatial and social challenges and that urbanisation has put these into relief. Six out of 10 people will live in cities by 2030, with 90 percent of this growth occurring in Africa, Latin America and the Caribbean.

Despite the Earth heating up, cities are ill-prepared to cope. Reasons for this include a lack of city policies and the existence of regulations on urban planning and the environment which haven't been adjusted to manage climate change.

Okumu and Tusting have suggested that a multi-sectoral approach is needed to improve health and wellbeing across the continent and to build resilience against threats such as climate change. "Government agencies in housing, financing, environment, education and health can join hands in tackling this challenge," said Okumu.

Provided by Wits University