Geospatial analysis: a new frontier in humanitarian health research?

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The complexity and brutality of modern conflicts, with Yemen as a prime example, pose threats to humanitarian providers and reduce access to affected communities. Humanitarians and researchers alike have increasingly used remote methods to study health challenges, monitor health violations, and deliver interventions. Remote methods can be as simple as Skyping local providers or more sophisticated such as machine learning-based monitoring of social media reports. In *The Lancet Global Health*, Kent Garber and colleagues[1] explore a grossly underused remote method in humanitarian health research, that is, geospatial analysis.

The use of geospatial analysis has been exploded in every field of scholarship and practice since it first emerged in the 1960s. In humanitarian practice, geospatial methods have been applied in diverse situations, for example to track population displacement, conduct forensic analysis of attacks on health facilities, develop early warning systems for epidemics, or estimate conflict-related environmental damage.[2,3] Such applications have been narrow in scope, largely focused on generating maps; more sophisticated applications, such as complex patterning and predictive modelling, are not used.[2] Geospatial analysis is gaining traction in global health research. Two journals, *International Journal of Health Geographics*, launched in 2002, and *Geospatial Health*, launched in 2006, are dedicated to its application. As of Aug 27, 2020, searching PubMed yields 777 articles with geospatial in the title. Surprisingly, only a few studies come from humanitarian settings, focusing on estimating mortality[4–6] or assessing vulnerability.[7] Cowan proposed a Humanitarian Data Model and validated it with experts; however, the model has not been used in humanitarian health research.[8]

In this context, the novel contributions of the study by Garber and colleagues become clear: integrating multiple georeferenced data sources, for health facilities, population distribution, and road grids in a geospatial network model, to generate estimates for a difficult-to-estimate parameter of health-care access, travel time to health-care facilities. In doing so, the study provides important data about the Yemeni public health infrastructure, addressing a gap previously identified in the National Health Strategy (2010–25).[9] Given the conflict situation, access times do not seem particularly striking on first look: 69% of the population live within 30 min of a functioning public primary health-care facility and 37% live within 30 min of functioning public hospitals. Access times become problematic, however, when considering services that are crucial in conflict settings: emergency surgical care is beyond 30 min reach for 84% of the population and 70% of pregnant women endure long travel times to obtain a caesarean section.[1] The findings of disparities between urban and rural areas are consistent with the pre-conflict situation. In this underfunded crisis,[10] the findings of this study invite an evaluation of the current humanitarian response. They should help humanitarian planners think about ways to bridge the current health service gaps and prioritise the most affected districts. The study analysed data for 2018. The use of geospatial analysis is arguably more needed today under the COVID-19 epidemic that has further strained the health system in Yemen.

Although Garber and colleagues' proof-of-concept analysis is most promising, the study raises issues for consideration in future geospatial applications in humanitarian health research. First, as in all analyses, outputs are as good as the inputs and assumptions. Research datasets should be made publicly available for scrutiny and use. In their study, estimated travel times assume access to motorised transport but this assumption might not hold considering active hostilities, seasonality, and fuel shortages. The Health Resources Availability Monitoring System health facility data exclude the private health sector and there are questions on data quality. Additional layers of data, for example from the electronic Disease Early Warning System on the number and location of cholera cases, or poverty levels from the Household Budget Survey, can further enrich the analysis. Second, assessing the validity is challenging. Considering lack of access to affected communities, findings of geospatial analyses are difficult to verify. True partnerships between global and local researchers and providers on research design, data collection, and model refinement can help improve such verification. Third, translating the findings to practice will be the test for the use of geospatial analysis. We need collaborations to incorporate the perspectives of local and international humanitarian organisations about how geospatial analysis should be developed and employed. Funding initiatives, such as Research for Health in Humanitarian Crises, can play a part in promoting such collaborations. Finally, for geospatial analysis to be adapted widely, future research should show that geospatial analysis affects humanitarian decisions and, ultimately, impacts humanitarian outcomes.

Perspective is important as we applaud geospatial methods. Our need to pursue such methods in humanitarian settings, largely driven by conflicts with reduced humanitarian access to affected populations, reflects the unsettling state of our world today. Ensuring unhindered humanitarian access to affected populations remains, therefore, a priority. Where this access is not possible, geospatial methods are helpful to provide answers to humanitarian questions. We now need more studies to expand the use of these methods in humanitarian health research. International and local academic–humanitarian collaboration on such methods is fundamental to advancing this nascent field of scholarship.

We declare no competing interests.

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