Defining Electronic Health Technologies and Their Benefits for Global Health Program Managers

DEFINITION

Geospatial analysis: the use of geographic data (such as GPS coordinates, street names, or other geographic identifiers) **to identify spatial relationships, patterns, and trends in data"** (WhatIs.com, available at: http://whatis.techtarget.com/definition/geospatial-analysis)

Geospatial Analysis

Geospatial analysis (also referred to as "spatial analysis") can be described as the use of geographic data (such as GPS coordinates, street names, or other geographic identifiers) to identify spatial relationships, patterns, and trends in data (1). This can include statistical methods, spatial statistics techniques (such as interpolation or network analysis), or the layering of different geographically coded data sets in order to discover geographic patterns in data using a geographic information system, or GIS (2).

Often used to conduct geospatial analysis, a GIS is basically "a database linked to a map" (3). In other words, a GIS is a "computer-based system used to collect, store, manage, analyze, display, and distribute geographic data (points, lines, and polygons referenced to the surface of the Earth) and their attributes (e.g., unique identifier, name, type, date collected, etc.)" (3). In practice, the term GIS applies most often to software that is used to create maps and conduct spatial analysis, using well known software packages such as ArcGIS, Google Earth, or QGIS (among many others).

Geographic information systems enable the linking of data sets with geographic data to spatially assess relationships and trends. In health, geospatial analysis software is used to discover patterns of disease outbreaks and their response to interventions; identify catchment areas for health facilities; and identify areas of high priority for investment and interventions.

Spatial analysis and metrics can also be calculated to go beyond simply displaying data on a map. For instance, network analysis allows you to estimate time for travel based on the road network, rather than just straight-line estimates of distance. All of these analyses can be pivotal for better health program management and program targeting.

> Voice, text, transactional, geospatial, and positional data can be overlaid with other data—for example, income, health, and education—to produce new insights into complex issues

MEASURE Evaluation, funded by the U.S. Agency for International Development (USAID), has a mission to safeguard public health and

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improve lives, by strengthening countries' capacity to generate and use high-quality health information to make strategic decisions that are responsive to specific contexts. We have been using geospatial analysis to support health programs for many years.

What Can Geospatial Analysis Do for Global Health Program Managers?

Geospatial analysis has been applied in low- and middle-income countries to look at the prevalence of a specific disease, the number of providers trained to treat that disease, and the number of patients treated for the disease, all at a specific location. It has also been used to look at distances between facilities, in order to estimate travel time and barriers to service access. In these cases, the findings from geospatial analyses have enabled decision makers to target their health programs to precise needs at discrete locations.

In the Democratic Republic of the Congo, maps informed by data on new polio cases focused immunization efforts where they were needed most

One example of how geospatial analysis has been used for better global health program management comes from Tanzania. MEASURE Evaluation worked with local authorities in the Iringa and Njombe regions to implement a method that produced computer-generated, district-level maps of HIV transmission dynamics and catchment and coverage patterns for the care and treatment of clients of facility-based and outreach HIV services. Given the evidence of these maps, decision makers ultimately increased the coverage and quality of these regions' care and treatment services (4).

Another example comes from research done on polio eradication activities in the Democratic Republic of the Congo (DRC). In 2006 and 2007, a polio outbreak occurred in the DRC—an area that had been free from the virus since 2004. In order to understand the geospatial pattern of the reported polio cases, implementers used Google Earth—a free, accessible means of accessing satellite imagery—to map the points of each reported polio case. From this plotting, they saw a spatial distribution of polio cases that appeared to follow the Congo River. Given this finding, implementers sought to use maps of specific sections of the river in order to direct their immunization efforts to the populations living along the river or on islands in it. Detailed maps of the Congo River were not accessible or known; once again, implementers were able to use Google Earth in order to accurately plan and deploy vaccination teams to specific sections of the river (5).

According to Raoul Kamadjeu, of the National Center for Immunization and Respiratory Diseases, U.S. Centers for Disease Control and Prevention, using Google Earth:

> improved field operations and resulted in better dispatch of vaccination teams and allocation of resources. It also allowed the creation of maps of high quality for advocacy, training and to help understand the spatiotemporal relationship between all the entities involved in the polio outbreak and response (5).

Google Earth View of a Vaccination Campaign in the DRC

Kamadjeu, 2009

For more information on this example go to:
http://link.springer.com/article/10.1186%2F1476-072X-8-4/fulltext.html

For more information on MEASURE Evaluation, visit:
www.measureevaluation.org

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Geospatial Analysis

ALL ABOUT eHEALTH

Electronic health (eHealth) refers to the health sector's use of information and communication technologies (ICT) such as mobile phones, portable and handheld computers, Internet and cloud-based applications, open source software, and data warehouses. Advances in ICT have increased exponentially the amount of data that health information systems can collect, synthesize, and report. Expansion of these technologies in low- and middle-income countries (LMICs) promises to revolutionize the global health sector's response to these countries' most pressing health issues.

MEASURE Evaluation—funded by the U.S. Agency for International Development—seeks new ways to exploit such eHealth solutions as data dashboards and geospatial data analysis, as part of its mandate to strengthen health systems in low-resource settings. Even though health program managers in LMICs—as everywhere—are increasingly expected to use and invest in such strategies, many lack information about how the strategies work and how they can benefit the management of health programs.

To address this problem, we developed this glossary of eHealth strategies most likely to enhance data access, synthesis, and communication for health program managers at all levels of a health system who are eHealth novices. The list has been vetted and revised by an advisory group representing the World Health Organization, the Free University of Free Brussels/European Agency for Development and Health, the University of Oslo, the Public Health Foundation of India, and the National Institute of Public Health Mexico.

The complete set consists of fact sheets on the following eHealth strategies, in addition to this one:

- **Dashboards**
- **Crowdsourcing**
- **Hackathons**
- **Open data**
- **Big data and data science**
- **Integration and interoperability**
- **App competitions**

In each fact sheet, you'll find the following information:

- eHealth strategies that have been used in health information system strengthening efforts to improve access to and synthesis, presentation, and communication of health data for program management
- How the strategies have been adapted (or not) from their application in resource-rich country settings to health programs in LMICs
- An example of the strategy for global health program management
- Links to additional resources for more in-depth details on the strategies

BIBLIOGRAPHY

1. Whatls.com. 2014. "Geospatial Analysis." Whatls.com, January 2014. Available at: http://whatis.techtarget.com/definition/geospatial-analysis.

2. MEASURE Evaluation. 2012. "Geographic Approaches to Global Health: A Self-directed Mini-course." Chapel Hill, NC: MEASURE Evaluation. Available at: http://www.cpc.unc.edu/measure/resources/publications/ms-12-56?searchterm=Geographic+Approaches+to+Global+Health.

3. Spencer, J., Stewart, J., and Wilkes, B. 2014. "GIS Techniques for M&E of HIV/AIDS and Related Programs." Chapel Hill, NC: MEASURE Evaluation. Available at: https://training.measureevaluation.org/node/90.

4. Cunningham M., Mapala Y., and Patrick J. 2014. "Using Geospatial Analysis to Improve Resource Allocation for HIV Programs in Iringa Region, Tanzania." Chapel Hill, NC: MEASURE Evaluation. Available at: http://www.cpc.unc.edu/measure/resources/publications/sr-14-107.

5. Kamadjeu, R. 2009. "Tracking the Polio Virus down the Congo River: A Case Study on the Use of Google Earth™ in Public Health Planning and Mapping." *International Journal of Health Geographics* 8(1): 4. Available at: http://link.springer.com/article/10.1186%2F1476-072X-8-4/fulltext.html.

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MEASURE Evaluation is funded by the U.S. Agency for International Development (USAID) under terms of Cooperative Agreement AID-OAA-L-14-00004 and implemented by the Carolina Population Center, University of North Carolina at Chapel Hill in partnership with ICF International, John Snow, Inc., Management Sciences for Health, Palladium, and Tulane University. The views expressed in this presentation do not necessarily reflect the views of USAID or the United States government. FS-15-165d