Published in final edited form as:

Science. 2014 October 24; 346(6208): 433. doi:10.1126/science.346.6208.433-a.

Ebola: Mobility data

M. Elizabeth Halloran^{1,2,*}, Alessandro Vespignani³, Nita Bharti⁴, Leora R. Feldstein^{1,5}, K. A. Alexander⁶, Matthew Ferrari⁴, Jeffrey Shaman⁷, John M. Drake⁸, Travis Porco⁹, Joseph N. S. Eisenberg¹⁰, Sara Y. Del Valle¹¹, Eric Lofgren¹², Samuel V. Scarpino¹³, Marisa C. Eisenberg¹⁰, Daozhou Gao⁹, James M. Hyman¹⁴, Stephen Eubank^{12,15}, and Ira M. Longini Jr.¹⁶

¹Fred Hutchinson Cancer Research Center, University of Washington, Seattle, WA 98109, USA

²Department of Biostatistics, University of Washington, Seattle, WA 98195, USA

³Department of Physics, Northeastern University, Boston, MA 02115, USA

⁴Department of Biology, Pennsylvania State University, University Park, PA 16802, USA

⁵Department of Epidemiology, University of Washington, Seattle, WA 98195, USA

⁶Department of Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, USA

⁷Department of Environmental Health Sciences, Mailman School of Public Health, Columbia University, New York, NY 10032, USA

⁸Odum School of Ecology, University of Georgia, Athens, GA 30602, USA

⁹Francis I. Proctor Foundation, University of California, San Francisco, CA 94143, USA

¹⁰Department of Epidemiology, University of Michigan, Ann Arbor, MI 48109, USA

¹¹Los Alamos National Laboratory, Los Alamos, NM 87545, USA

¹²Virginia Bioinformatics Institute, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, USA

¹³Santa Fe Institute, Santa Fe, NM 87501, USA

¹⁴Department of Mathematics, Tulane University, New Orleans, LA 70118, USA

¹⁵Department of Population Health Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, USA

¹⁶Department of Biostatistics, University of Florida, Gainesville, FL 32611, USA

Understanding human movement and mobility is important for characterizing, forecasting, and controlling the spatial and temporal spread of infectious diseases. Unfortunately, the current West African Ebola outbreak is taking place in a region where mobility has changed considerably in recent years. Efforts must be made to better understand these mobility patterns. For example, mobile phone call records provide insight into how people move

*Corresponding author. betz@u.washington.edu.

within countries, particularly if they move from hotspots of disease. Analyses of Orange Telecom data have produced initial maps of movement in Senegal and Ivory Coast (1, 2), and endeavors are under way to obtain similar data for Sierra Leone, Guinea, and Liberia.

Additional sources are needed to gain a more complete picture of mobility and infer patterns of disease spread. For example, information on land border crossings would elucidate regional movement. Genomic surveillance data can genetically link cases across time and space ("Genomic surveillance elucidates Ebola virus origin and transmission during the 2014 outbreak," S. K. Gire *et al.*, Reports, 12 September, p. 1369; published online 28 August). More complete data are needed on the routes taken by trucks and buses, which have been implicated in disease spread. Quantifying recurrent seasonal migration in response to climate, harvest cycles, or cultural events is important for anticipating fluctuations in transmission rates (3).

All these types of data can be used in dynamic transmission models to provide case projections, help focus resources and interventions, and assess the success of interventions. However, modeling efforts are limited in the absence of good mobility data. Existing data sources for West Africa include air transportation data, which have been used to model the local, regional, and global spread of Ebola (4) and newly updated world population data sets (5). However, newer census data are vital to underpin the mobility data. Keeping this information up to date while developing more comprehensive mobility data sets will greatly benefit intervention planning and resource allocation.

Such data should not necessarily lead to travel restrictions, such as flight route cancellations and border closures, which hamper relief efforts. Rather, the information should be used to create more valid models of transmission, which can then be used to plan and evaluate potential interventions. Better quantification of the impact of potential interventions will be critical in the coming weeks as the outbreak continues to grow.

Acknowledgments

The authors of this letter are all in the MIDAS Network supported by the National Institute of General Medical Sciences of the National Institutes of Health.

References

1. Flowminder.org. www.flowminder.org
2. Wesolowski A, et al. PLOS Curr Outbreaks. 201410.1371/currents.outbreaks.0177e7fc52217b8b634376e2f3efc5e
3. Bharti N, et al. Science. 2011; 334:1424. [PubMed: 22158822]
4. Gomes MFC, et al. PLOS Curr Outbreaks. 201410.1371/currents.outbreaks.cd818f63d40e24aef769dda7df9e0da5
5. WorldPop Ebola. www.worldpop.org.uk/ebola