Mapping Environmental Health

Anne Johnson: Welcome to Environmental Health Chat, a podcast about how the environment affects our health, from the National Institute of Environmental Health Sciences Division of Extramural Research and Training. I'm your host Anne Johnson.

[music] The year was 1854. A doctor named John Snow discovered that cholera, which was then ravaging his London neighborhood, is spread by contaminated water. It's a notable scientific achievement and today Snow is regarded as one of the founding fathers of modern epidemiology.

A crucial piece of evidence leading to Snow's discovery was a simple map. It revealed how cholera cases were clustered around a single water pump, which he pinpointed as the source of the outbreak.

In today's podcast, we're taking a look at the incredible power of geospatial analysis in environmental health. We've come a long way since Snow's hand-drawn map, but the lesson endures: connecting the dots between location, exposures, and health can save lives.

Our guest is Dr. Michael Jerrett. He's department chair and professor of environmental health sciences at the Fielding School of Public Health at the University of California, Los Angeles.

Michael Jerrett: There are certainly many advances that have occurred, say, in about the past 15 years, that have really helped us to better understand the spatial and temporal dimensions of exposures that are either harmful or beneficial for people's health. The importance of Google Maps and other programs is that they are awakening the sort of geographic imagination in many environmental health researchers, who may not have thought of things spatially before, but now, because they have this constant access to an online mapping system, they're starting to pose questions about how they can use that information to better characterize exposures and outcomes.

Anne Johnson: Having detailed place-based information transforms something like air pollution from a national or global problem into an extremely local one. And a good map is a powerful tool for communicating risks and spurring change.

Michael Jerrett: Geographic information systems have been absolutely fundamental in revealing patterns of inequalities in environmental exposures and mapping them. With the evolution of the technologies, particularly cell phone technology, people can capture large amounts of information and potentially offer this up to better characterize the environmental risks that are being faced. And this is also going to, I think, in many ways level the playing field, because the community groups begin to have their own resources and their own characterizations of the environment that are in many instances more highly resolved than what they would get out of conventional government and public health agencies. So, we can have communities become data providers for better environmental decision making that protects public health.

Anne Johnson: Michael points to three main components that have vastly expanded our geospatial analysis capability. First, there's the proliferation of geolocation technologies, like the GPS tracker in your cell phone. There's also been a huge growth in remote sensing technologies. These are the

satellites and airplanes that allow scientists to collect vast amounts of information about a place without ever setting foot there. To bring together and interpret all this geospatial information, you need the third component—a Geographic Information System, or GIS. GIS is a computer system that models spatial data.

Michael has tons of examples of how these technologies can be used in environmental health. In one recent study, he and his colleagues published air pollution levels for the entire continental U.S. at a resolution of 50 meters. In another, he's looking at how living near green space or bodies of water might help to improve people's health.

Geospatial technology is not only proliferating in the United States. It also opens new opportunities in some of the places hardest hit by pollution—places like China and India.

Michael Jerrett: It used to be very difficult to operate in those locations because of a lack of infrastructure and lack of equipment. But what's happening in a lot of these poor and rapidly industrializing countries is that the cell phone has sort of leapfrogged over conventional communication systems so that it's widely penetrated into the population. And that offers a potential for us to begin to get a lot more detailed information in these places that have huge human populations, unprecedentedly bad environmental problems, and lack the traditional infrastructure that we might rely upon to gather information about environmental conditions. So I think this is another very promising area where the new technologies and the geographic information science can come together to give us a better look at how to protect public health in these countries that are experiencing such tremendous environmental health challenges.

Anne Johnson: But working with geospatial data is no easy feat. It's crucial to have adequate protections for personal privacy and data security, for example. Another issue is the sheer volume of data involved. Michael told me about a recent project that involved recording the locations and physical activity levels of just over 200 children for a couple weeks. That seemingly simple exercise generated more than 230,000 observations. Crunching the numbers was a major challenge, even for powerful university computers.

Michael says researchers are going to need specialized training in order to take advantage of the geospatial capabilities we have now—and build new opportunities in the future.

Michael Jerrett: We need to think about better ways of integrating geographic information science into the training of our undergraduate and graduate students so that we're better able to have the trained personnel because it's not just the computers and the data—probably the most important component of any geographic information system is the people who can actually run the software and do the analysis and understand the results. And unless we're able to train more people in these areas, it will continue to be, I think, an underutilized resource.

Anne Johnson: Check out two of our recent podcasts for more on this. The episode titled Air Quality Monitoring for Citizen Science discusses some of the challenges of using large amounts of data at the

community level. Our episode on [Careers in Environmental Health](#) offers tips on finding training opportunities to build new skills.

Thanks again to today's guest, Dr. Michael Jerrett of UCLA.

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