My research interests include the use of spatial analysis methods and geographic information systems to analyze health and social inequalities in cities and to evaluate geographical access to health care services and employment opportunities for women and minorities. I am currently exploring the impacts of socio-demographic changes such as immigration on geographical access to prenatal care services and geographical inequalities in reproductive health outcomes in New York City. This work attempts to 'decompose' changes in health status indicators for small geographic areas into components that represent: (1) the effects of demographic, compositional change and (2) improvement or deterioration in health status within a 'fixed' population. A second area of current and prospective research interest is the use of digital geographic information and GIS in community-based efforts to improve health. Through a series of case studies, I will examine how community groups make sense of geographic information about health and the environment; how geographic information and GIS contribute to community mobilization around health issues; and community groups' understanding of and need for spatial analysis tools.

Role of GIS/spatial analysis in health risk analysis and perception

Understanding health risks involves consideration of people, the environment (both built and natural), and the flows of people and environmental quality through space and time. Increasingly GIS and spatial analysis methods are being used to map and model environmental hazards and risks and to estimate population exposures to such hazards and risks. Detailed geographic data and rigorous spatial analysis methods exist for understanding the environmental component of health risk. For example, we can model fairly accurately the dispersal of air and water contaminants through space and time from point and non-point sources. Some public health researchers are using mobile devices to collect real-time environmental exposure information yielding rich spatio-temporal environmental data sets.

In comparison to the environmental component, the 'people' component of health risk is much less well-developed in GIS and spatial analysis research. Incorporating people in spatial analysis tools for health risk assessment involves several key issues. First, we need to grapple with population diversity in relation to age, gender, race/ethnicity, class and so on. Although two people live in the same place, their experiences of that place often differ markedly with concomitant effect on health and well-being. Furthermore, there are also important differences in immune response so that the effect on health of a given environmental exposure varies among people. Many spatial analysis tools to analyze, for example, disease clustering have been slow to incorporate population covariates that might influence the risk of ill-health.

Second, better tools are needed to model people's activity patterns and movements through space and time, at different geographical scales. For many people, the residence is not the primary source of exposure to environmental contaminants and to the human interactions that underpin many infectious health problems. Occupational risks have long been recognized, but there are also important exposures in recreational, social, educational, institutional and transportation settings. Thus, health risks are rooted in our activity and mobility patterns in space and time. Research shows that activity patterns are highly differentiated on the basis of age, gender, class and race/ethnicity. Social networks and interactions are also highly differentiated. Researchers are just beginning to develop spatial analysis tools for measuring, visualizing and modeling space-time activity patterns, and we know little about the implications for spatial analysis of health inequalities.

Finally, it's important to think broadly about the roles of geographic information and GIS in the context of public health policy and efforts by communities to improve health. Community groups have access to a wide array of geographic information on disease rates, demographic trends, environmental hazards, health care quality, etc and to rudimentary spatial analytic tools for exploring such information. How do communities perceive and use this information? How does it affect their interactions with state and local health departments and their use of health services? How are public health departments and health care providers using geographic information and what types of information and tools do they need? What are the long-term effects on spatial organization and quality of health services and mitigation of health risks?