Brief Report

The potential contributions of geographic information science to the study of social determinants of health in Iran

Hamidreza Rabiei-Dastjerdi, Stephen A. Matthews[1]

Abstract:
Recent interest in the social determinants of health (SDOH) and the effects of neighborhood contexts on individual health and well-being has grown exponentially. In this brief communication, we describe recent developments in both analytical perspectives and methods that have opened up new opportunities for researchers interested in exploring neighborhoods and health research within a SDOH framework. We focus specifically on recent advances in geographic information science, statistical methods, and spatial analytical tools. We close with a discussion of how these recent developments have the potential to enhance SDOH research in Iran.

Keywords:
Iran, Geographic information sciences, social determinants of health, spatial methods

Social Determinants of Health Research Center, Isfahan University of Medical Sciences, Isfahan, Iran, [1]Department of Sociology and Criminology, Department of Anthropology, Penn State University, Pennsylvania, USA

Address for correspondence:
Dr. Hamidreza Rabiei Dastjerdi, Social Determinants of Health Research Center, Isfahan University of Medical Sciences, Isfahan, Iran. E-mail: hamidreza.rabiei@ polimi.it

Social Determinants of Health

We take as a given that the study of health, and its social and spatial variation, is of critical importance to a society. While there is a recognized need for more comprehensive data collection on the individual, we are motivated by the opportunities that can emerge from the integration of individual data with higher-level contextual or place-based information. Indeed, measuring and monitoring place-based socioeconomic, demographic, and built environment characteristics may facilitate a better understanding of the multilevel and multifactorial processes related to health disparities.

Research and policy interest in a social determinants of health (SDOH) framework has been evident since Wilkinson and Marmot important report in 1998 to the World Health Organization.[1] Since then there has been a parallel growth of interest in the effects of place on individual attitudes, behaviors, health, and well-being. Advances and developments in geographic information science and multilevel modeling have opened up new opportunities for health research and policymakers. In this brief communication, we argue that the SDOH framework coupled with an emphasis on the role of neighborhood context presents new opportunities for Iranian research and policy related to health and well-being.

In developed countries, the SDOH framework has a strong foothold and has been used to address burgeoning health questions associated with health disparities and "epidemics" associated with lifestyle factors such as obesity, smoking, and drug use.[2] The emergence of geospatial data infrastructures designed to compile, share, and integrate multifactorial place-based data – on socioeconomic, demographic, built and physical environment, and

health – provides a research environment that can facilitate cutting edge SDOH research.[3] Here, we briefly describe the opportunities for leverage in SDOH research that are afforded by access to geospatial data and analytical tools. We cover topics that include descriptive, exploratory analysis, and spatial modeling as well as foundational issues associated with instruction and related strategies designed to raise awareness of analytical tools and resources. Specifically, we identify three areas in which geospatial data and analytical tools can be leveraged to better understand the SDOH and inform Iranian health policy. The use of jargon in this commentary is necessary but we hope minimal. We encourage interested readers to follow-up on any technical and topical issues we raise and to consult some of the references and accessible resources that we cite.[4-6]

Mapping outcomes and risk factors

Mapping health outcomes should be the first step to any neighborhood and health project. A geographic information system software package facilitates the design of maps based on, for example, aggregate birth and death rates, maternal, and child health outcomes (e.g. percent live births and percent low birth weight) and on health service screening and treatment use. A well-designed map may reveal the spatial patterning of the outcome of interest and may generate among researchers and policymakers new hypotheses around the social and environmental mechanisms, processes, and risk factors behind the map. Here too, mapping risk factors related to exposure to risk (e.g. industry, pollution, and natural hazard prone areas) and access to resources (e.g. health facilities, transportation, green space, and other amenities) may highlight important dimensions of spatial health inequality by revealing those areas and populations most vulnerable. Maps of predictors such as those listed above may be, especially valuable to intervention researchers, planners, and policymakers. Moreover, the maps of outcomes and risk factors may lead to discussions of additional data needs, research designs, interventions, and best courses of action in future research and policy.

Exploratory spatial data analysis

Exploratory spatial data analysis (ESDA) takes the mapping of data a step further. Specifically, ESDA tools[7,8] may be used to test for spatial dependence and clustering of outcomes and potential risk factors. These tools are necessary as "spatial data are special"[9], and their use in statistical analytic framework requires consideration of issues such as spatial dependence (where the value of an attribute in a neighborhoods – i.e. observations – is not independent of the value of the attribute measured in adjacent or nearby neighborhoods). Another complicating factor in spatial data analysis is the concept of spatial stationarity. The majority of empirical analyses of spatial data are focused on calibrating a "global" model, where the term "global" implies that all of the data are used to compute a single statistic or model and that the relationships between variables in the model are stationary across the study area. However, the global approach is undermined if the relationships between variables vary over space resulting in "local" variation from the single, one model fits all. Geographically weighted regression is an exploratory regression technique that allows for variations in relationships over space.[10-12] ESDA and mapping tools can also be used to examine the robustness of findings associated with changes in the scale or units of analysis used (i.e. the robustness of results from an analysis based on districts vs. an analysis based on neighborhoods).[13] Finally, more sophisticated methods that harness both spatial and temporal risk using point pattern analysis are available.[14]

Advanced spatial and statistical methods

Researchers interested in confirmatory spatial models use spatial econometric approaches. These techniques led themselves to ecological models to examine the multivariate associations between health outcomes and sets of plausible contextual factors where all measures are at the ecological unit level.[15,16] In recent years, the array of analytical techniques that fall under the umbrella of spatial econometric methods has expanded to incorporate, among others, spatial regime models, and spatial panel models.[17] An explosion of research using multilevel (or hierarchical linear) models has been observed across the social and health sciences.[18,19] Thousands of publications in social epidemiology have examined individual health and well-being outcomes using multilevel models that explicitly combine data on the individual with contextual or neighborhood-level factors. Bayesian approaches to health outcomes research also have become increasingly popular over the past decade. Bayesian hierarchical modeling in particular appears to offer great promise in the study of patterns of disease[20] and is already widely used by spatial epidemiologists. Developments in spatial analytic fields continue at a fast pace, and while we cannot cover all topics here, emergent tools and techniques such as dynamic models and agent-based modeling may warrant the close attention of health researchers and policymakers.

This array of methods – from the basic to the more advanced – can all be used to leverage the value of geospatial and contextual data as well as demonstrate the ability to incorporate spatial and hierarchical analytical constructs and data structures into the study of health and well-being.

The Context of Iran

If health researchers and policymakers in Iran are to take better advantage of these sets of methods, concomitant developments in training and data availability may be needed. Iran has the capacity to both build new types of health informing geospatial databases and advance instructional programs in handling geospatial data and spatial analytic methods. Today, researchers can leverage relatively crude district-level data to demonstrate the role of contextual factors, thereby transforming how researchers and policymakers think about the role of place and social determinants on health. In some countries and at the international level, we see examples of aggregate health-related data infrastructures that include data on outcomes but also diverse sets of potential risk factors.[21,22] These databases allow the researchers and policymakers to develop effective policies and programs and evaluate previous plans and policies overtime. In Iran, a similar approach can be taken. The ability to analyze theoretically and substantively relevant contextual factors could pave the way for new knowledge creation around the SDOH and help generate new research questions regarding many dimensions of health among Iranians including, but not limited to, understanding variation in health status across the life course, role of SDOH in noncommunicable disease, and the role of antecedent area characteristics on individual health outcomes. We believe Iran is well positioned to make big strides in SDOH research.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1. Wilkinson R, Marmot M. Social Determinants of Health. The Solid Facts. Copenhagen: World Health Organization, Regional Office for Europe; 1998.
2. Schroeder SA. We can do better – improving the health of the American people. New England Journal of Medicine. 2007; 357 (12):1221-8.
3. Healthy People 2020. Healthy People 2020. Available from: https://www.healthypeople.gov/. [Last accessed 2017 Feb 04].
4. De Smith M, Goodchild MF, Longley P. Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools. Leicester, UK: Matador; 2007.
5. Center for Spatially Integrated Social Science (CSISS). Csiss.org. 2017. Available from: http://www.csiss.org/. [Last accessed on 2017 May 10].
6. TeachSpatial. Teachspatial.org. 2017. Available from: http://www.teachspatial.org/. [Last accessed on 2017 May 10].
7. Anselin L. Local indicators of spatial association. Geographical Analysis 1995; 27(2):93-115.
8. Lloyd C. Local Methods for Spatial Analysis. 1st ed. Boca Raton, FL: CRC; 2010.
9. O'Sullivan D, Unwin D. Geographic Information Analysis. 1st. Hoboken, NJ: John Wiley and Sons; 2010.
10. Fotheringham AS, Rogerson P. The SAGE Handbook of Spatial Analysis. 1st ed. Los Angeles: SAGE Publications; 2009.
11. Fotheringham AS, Brunsdon C, Charlton M. Geographically Weighted Regression. 1st ed. Chichester, West Sussex: Wiley; 2002.
12. Wheeler DC. Geographically weighted regression. In: Fischer M, Nijkamp P, editors. Handbook of Regional Science. Berlin, Heidelberg: Springer; 2014. p. 1435-59.
13. Wong DW. The modifiable areal unit problem (MAUP). In: Fotheringham AS, Rogerson P, editors. The SAGE Handbook of Spatial Analysis. Los Angeles: Sage; 2009. p. 105-24.
14. Gatrell A, Bailey T, Diggle P, Rowlingson B. Spatial point pattern analysis and its application in geographical epidemiology. Transactions of the Institute of British Geographers. 1996; 21(1):256.
15. Anselin L. Spatial Econometrics: Methods and Models. Studies in Operational Regional Science. Springer Netherlands; 1988.
16. Arbia G. A Primer for Spatial Econometrics. 1st ed. Basingstoke; New York: Palgrave Macmillan; 2014.
17. Elhorst JP. Spatial Econometrics: From Cross-Sectional Data to Spatial Panels. Heidelberg: Springer; 2014.
18. Entwisle B. Putting people into place. Demography. 2007; 44(4):687-703.
19. Diez Roux AV, Mair C. Neighborhoods and health. Annals of the New York Academy of Sciences. 2010; 1186(1):125-45.
20. Lawson, Andrew. Bayesian Disease Mapping: Hierarchical Modeling in Spatial Epidemiology. New York: CRC Press 2013.
21. How Healthy is Your County? County Health Rankings. County Health Rankings & Roadmaps. Available from: http://www.countyhealthrankings.org/. [Last accessed on 2017 Feb 04].
22. Institute for Health Metrics and Evaluation. Institute for Health Metrics and Evaluation. Available from: http://www.healthdata.org/. [Last accessed on 2017 Feb 04].