Participatory Geographic Information Systems (GIS): A Critical Methodological Approach for Urban Social Work Research

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Abstract: This paper explores the utility of participatory GIS as a methodological approach for urban social work research focused on socioeconomically disadvantaged neighborhoods and resident health and well-being. The discussion begins with a brief overview of social work's person-in-environment framework and the historical use of mapping in social work research and practice. Participatory GIS is then outlined and evaluated in the context of social work values and critical social work scholarship. Finally, consideration is given to the steps social work researchers can take to develop GIS skills and integrate participatory GIS into their community-based scholarship.

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Introduction

Geographic information systems (GIS) are computer-based systems that allow for the integration, storage, analysis, and visual display of spatial data (Centers for Disease Control and Prevention [CDC], 2016; Cromley and McLafferty, 2012). 'GIS allows users to visualize (map) geographic aspects of data including locations or spatial concentrations of phenomena of interest' (Teixeira, 2018, p. 10). The fields of urban planning, public health, and social and medical sciences employ GIS to explore how environment impacts individual health, well-being, and behavior (Suplee et al, 2018). GIS enables analysis of the complex spatial relationships between health outcomes and socioeconomic, political, and environmental factors (Nykiforuk and Flaman, 2011). By integrating data at the micro, mezzo, and macro levels, GIS supports the visualization of salient multilevel, spatial relationships (Nykiforuk and Flaman, 2011; Suplee et al, 2018). GIS maps present spatial findings in a 'vivid and meaningful way' (Nykiforuk and Flaman, 2011, p. 65) that can be used to engage communities, service providers, and policymakers in the development of interventions and policies that support positive health outcomes (Suplee et al, 2018).

Health disparities research has shifted its attention from individual-level factors that influence health outcomes to the social, economic, and political factors that shape the conditions in which people live, work, and play (American Public Health Association, 2006; CDC, 2017). These upstream social determinants of health have far reaching implications for individual and population health, both directly and indirectly influencing health outcomes (Braveman et al, 2011b). Upstream social determinants of health shape downstream social determinants of health, which include health behaviors and health-related knowledge, attitudes, and beliefs (Braveman et al, 2011b).

Neighborhoods, an important upstream social determinant of health, can influence health outcomes through their physical, social, and service environments (Edmonds et al, 2015). Studies have consistently linked these neighborhood environments to mortality, chronic disease, mental health, disabilities, and birth outcomes (Braveman et al, 2011a). Neighborhood air and water quality, proximity to environmental hazards, housing quality, and crime can directly affect resident health through health-compromising exposures (Braveman et al, 2011b; Edmonds et al, 2015). The extent of access to nutritious food, safe recreational spaces, and sidewalks can encourage or constrain health-promoting behaviors (Braveman et al, 2011b; Edmonds et al, 2015). The quality of neighborhood schools and local employment opportunities can affect social mobility and therefore health status across the life course (Edmonds et al, 2015). Understanding how neighborhood conditions impact health is vital for developing solutions that improve health for all members of our community, but particularly for low-income and marginalized groups who are disproportionately affected by unsafe and unhealthy neighborhood conditions (Edmonds et al, 2015).

According to Cromley and McLafferty (2012), GIS has significantly improved the study of the relationship between the built environment and health and enhanced our understanding of neighborhood effects on health. Dennis et al (2009) argue that health disparities and the relationship between the built environment and health outcomes have heightened interest in people's experiences of health and place, resulting in methodological approaches that capture lived experiences and integrate local knowledge. This paper explores the utility of participatory GIS as a methodological approach for urban social work research focused on socioeconomically disadvantaged neighborhoods and resident health and well-being. The discussion begins with a brief overview of social work's person-in-environment framework and the historical use of mapping in social work research and practice. Participatory GIS is then outlined and evaluated in the context of social work values and critical social work scholarship. Finally, consideration is given to the steps social work researchers can take to develop GIS skills and integrate participatory GIS into their community-based scholarship.

Mapping the urban environment: An early social work tradition

Social work's theoretical foundation in the person-in-environment framework positions the profession to engage GIS as a research and practice-based tool. Despite the person-in-environment orientation to social work research and practice, social work often maintains a narrow conceptualization of *environment*, 'limiting attention to the connection between individuals and their social environment' (Gray et al, 2013, p. 11). Within social work, critics of this incomplete interpretation of environment have called for a reconceptualization of the person-in-environment framework that integrates the physical environment (Hetherington and Boddy, 2013; Hillier, 2007; Kemp, 2011; Teixeira, 2018). This call for a broader conceptualization of environment aligns with the historical foundations of social work, specifically the social survey tradition (Hillier, 2007; O'Dare Wilson, 2016; Teixeira, 2018).

During the late 1800s, social workers played a critical role in community mapping and foot surveys to document the living conditions of poor and underserved communities living in urban environments. Social worker Florence Kelley led Hull House residents in Chicago to map and explore poverty, race, nationality, and health outcomes as a part of the U.S. Congress' investigation of poverty in American cities (Hillier, 2007; Teixeira, 2018). These early mapping practices in social work demonstrated the impact of structural influences (such as capitalism, urbanization, and immigration) on neighborhood conditions and the health and well-being of disadvantaged urban populations (Hillier, 2007; Teixeira, 2018), transcending the biomedical perception that the urban poor were

'individually pathological' (Teixeira, 2018, p. 3). Jane Addams, during her work with Hull House, documented the relationship between place and health: 'nothing was more painfully clear than the fact that pliable human nature is relentlessly pressed upon by its physical environment' (Addams, 1990, p. 111). Progressives that steered the social survey movement leveraged their findings to influence policymakers with the power to affect social change and improve the living conditions of the urban poor (Hillier, 2007).

Despite a tradition of mapping in urban social work and attention to the contextual factors impacting health and well-being for marginalized populations, social work has engaged minimally with GIS (Hillier, 2007; O'Dare Wilson, 2016; Teixeira, 2018). The high cost of the technology, limited training and educational opportunities for GIS skill development in social work programs, and the marginalization of ecologically-oriented social work practice are argued as key barriers to the adoption of GIS in social work (Hillier, 2007; O'Dare Wilson, 2016; Teixeira, 2018). Participatory GIS may be an important approach to facilitate social work researchers' engagement with the urban physical environment and expand professional understanding of how socioeconomic, political, and environmental factors converge in the everyday lives of neighborhood residents to influence their health.

Overview and application of participatory GIS

Participatory GIS, also known as public participation GIS, 'are systems that facilitate and enhance the participation of individuals and community groups around issues of local concern' (Cromley and McLafferty, 2012). Participatory GIS strives to incorporate the concerns, lived experiences, and lay-knowledge of communities and residents into decision-making. Importantly, participatory GIS aims to shift control over place-based decision-making back to the communities most affected by local issues (Cromley and McLafferty, 2012). Cromley and McLafferty (2012) indicate that community involvement in health applications of GIS have been historically limited due to the positivist perception that community input and lay knowledge would weaken the validity of GIS analyses. However, there is growing consensus that community input and expertise are vital to understanding place-based health issues and developing contextually-relevant solutions (Cromley and McLafferty, 2012; Dennis et al, 2009).

Communities and residents may participate in GIS in a variety of ways (Cromley and McLafferty, 2012; Elwood, 2006a). For example, participatory GIS can be used as a tool for informing communities about health concerns, providing educational resources that emphasize health prevention, and eliciting resident knowledge about local health issues (Cromley and McLafferty, 2012). In Long Island, New York,

women activists working to understand the high rates of breast cancer in their community partnered with researchers at Hunter College to map and analyze the spatial data they had collected through pin maps (McLafferty, 2002). GIS maps enabled these activists to share their local knowledge and generate hypotheses about the links between environmental exposures and breast cancer incidence in their community. This case study demonstrated the utility of participatory GIS as a women's empowerment tool. Women activists in Long Island effectively harnessed the power of maps to garner public attention and secure funding for a multimillion-dollar GIS to examine the relationship between environmental and social hazards and breast cancer in Long Island.

In studies exploring neighborhood effects on health, neighborhood is often defined and measured according to zip code or census tract (Cromley and McLafferty, 2012; O'Dare Wilson, 2016). These artificial delineations exclude resident perceptions of neighborhood boundaries, and therefore potentially fail to capture residents' 'activity spaces' (Cromley and McLafferty, 2012, p. 396), networks, and access to resources. Through participatory GIS, resident perceptions of neighborhood boundaries can be integrated into decision-making that impacts resource allocation and neighborhood development (O'Dare Wilson, 2016).

Participatory GIS can also be used to include communities in data collection, analysis, and decision-making, thus emphasizing the role of participatory GIS as an empowerment practice (Cromley and McLafferty, 2012; Elwood, 2006b). Dennis et al (2009) used participatory photo mapping with young people to assess the health and safety of socioeconomically disadvantaged and residentially segregated neighborhoods in Madison, Wisconsin. Three groups of young people (upper elementary school, middle school, and high school) viewed aerial photographs of their neighborhood, used digital photography to document their own lived experiences in their neighborhood, and co-presented their mapped photographs and narratives to adult decision-makers in their community. The researchers, in their evaluation of the use of participatory photo mapping, determined that this methodological approach fostered community participation, supported the dynamic visualization of the health implications of place, and created a shared language and conceptual framework for researchers, practitioners, policymakers, and residents to coalesce on place-based health issues and solutions. Another significant implication of the researchers' use of participatory photo mapping was the engagement and empowerment of young people, who were initially skeptical that anyone would listen to them. Young people, who may otherwise be traditionally left out decision-making, were empowered to share their stories and leverage their expertise to inform key decision-makers around issues that impact their lives.

More recently, a social work scholar employed participatory photo mapping to explore young people's perceptions about the influence of the built environment in a racially segregated neighborhood in Pittsburgh, Pennsylvania (Teixeira, 2018).

Participants guided the researcher on neighborhood walking tours, used digital photography, and generated maps to contextualize their individual geographies. Qualitative data produced by the participants were integrated with spatial data 'to produce rich, contextual understandings of [young] people's lived experiences in their neighborhoods' (Teixeira, 2018, p. 14), which facilitated a more nuanced understanding of the social construction of space and place.

Participatory GIS not only allows us to locate individuals within their broader environmental contexts, it also recognizes and values multiple ways of knowing and empowers the voices of marginalized members of society (Hillier, 2007; Teixeira, 2018). According to Dunn (2007), 'A Participatory GIS celebrates the multiplicity of geographical realities rather than the disembodied, objective, and technical 'solutions' which have tended to characterize many conventional GIS applications' (p. 616). With the meaningful integration of local knowledge and resident expertise, participatory GIS facilitates the inclusion of marginalized voices into decision-making and fosters social change that is accountable to the needs of individuals and communities most affected by structural inequality.

Participatory GIS: A methodological approach to advance social justice

United States-based social workers, guided by the National Association of Social Workers' *Code of Ethics*, are called to advocate for and work with and on behalf of vulnerable and oppressed members of our community (NASW, 2017). According to the *Code of Ethics*, 'Fundamental to social work is attention to the environmental forces that create, contribute to, and address problems in living' (NASW, 2017, p. 1). Through values of *Social Justice* and *Dignity and Worth of the Person*, social workers strive to affect sustainable social change that transforms the inequitable conditions and social systems that perpetuate injustice (NASW, 2017). There is an intentional commitment to strengthen opportunities for marginalized individuals and communities to participate in decision-making and increase their capacity to respond to their own needs.

Participatory GIS can be a useful methodological approach in social work scholarship, with several valuable outcomes. First, participatory GIS may facilitate social work's engagement with the physical environment, thereby expanding the conceptualization and utility of the person-in-environment framework. Mapping, at a basic level, provides a tool for social work researchers to identify spatial relationships (Hillier, 2007). By developing our professional understanding of the ways in which the physical environment influences individual and community health, the profession is situated to more effectively advocate for policies that improve neighborhood conditions and address place-based health inequities.

Second, participatory GIS fosters the integration of the voices and expertise of individuals and communities the social work profession aims to serve. In this way, participatory GIS is a methodological approach that can empower residents and create opportunities for marginalized individuals and communities to inform and influence decision-making. According to Branom (2012), 'those who are best equipped to investigate and report on an experience are those closest to it' (p. 262). Participatory GIS challenges traditional top-down research approaches and GIS applications (Elwood, 2006b). thereby deconstructing the narrow positivist perspective on 'expertise' and 'truth.'

Finally, participatory GIS challenges the social work profession to learn about and expand understanding of the nuanced and complex ways socioeconomic, political, and environmental factors converge in the daily lives of residents to influence their health. Participatory mapping allows social work to transcend the individual deficit model by situating human behavior in a broader, socially constructed geographic context (Hillier, 2007; O'Dare Wilson, 2016). By privileging residents' 'naïve geographies' (Teixeira, 2018, p. 10), social work scholars can develop an enhanced understanding of neighborhood-level health barriers and health opportunities and in turn more effectively advocate for contextually-relevant policy and practice interventions.

Integrating participatory GIS into social work scholarship

Participatory GIS is an innovative methodological approach that can support and enhance social work scholarship. Though the social work profession has been slow to embrace GIS (Hillier, 2007; Teixeira, 2018), the increasing financial and technical accessibility of GIS software improves the feasibility of its integration into social work education, practice, and scholarship (O'Dare Wilson, 2016). There are opportunities for social work scholars interested in GIS applications to develop skills through free online trainings offered through the Environmental Systems Research Institute (Esri, 2018) and open educational resources provided through institutes of higher education like Pennsylvania State University's (PSU) College of Earth and Mineral Sciences (PSU, 2018). Quantum Geographic Information Systems (QGIS) is a free, open source GIS application that provides training materials and technical support resources (QGIS, 2018).

However, free, open source GIS resources are not sufficient alone. Schools of social work need to increase opportunities for students and faculty to develop and utilize participatory GIS. Social work programs at Boston College (2018), Florida Gulf Coast University (Felke, 2014), and the Ohio State University (B. Freisthler, personal communication, May 10, 2018) offer workshops and courses to expand the use of GIS in social work research and practice. GIS content and interdisciplinary

applications can also be integrated into existing community and clinical social work courses to increase exposure to its utility in social work research and practice. Finally, social work programs can explore opportunities for collaboration with other on-campus university programs to provide advanced methodological training to doctoral students and faculty.

Conclusion

Participatory GIS is a critical methodological approach with the capacity to reinvigorate the social work profession's historical use of mapping to understand how urban neighborhood environments influence health and well-being. By understanding how broader environmental contexts impact individuals and communities, social work is better positioned to advocate for policy and practice interventions that can improve neighborhood conditions and promote the more equitable distribution of health-promoting resources. Perhaps most importantly, participatory GIS aligns with the profession's commitment to social justice and the empowerment of marginalized and vulnerable members of our community. Social work researchers using participatory GIS can facilitate the meaningful and intentional inclusion of individuals and communities historically excluded from decision-making. Local knowledge and resident expertise are vital for the development of sustainable and contextually-relevant policies and interventions that aim to improve the health opportunities of disadvantaged urban populations. Accredited schools of social work in the U.S. are called by the Council on Social Work Education (2008) to 'continuously discover, appraise, and attend to changing locales, populations, scientific and technological developments, and emerging societal trends to provide relevant services.' Increased opportunities for GIS skill development and advanced methodological training in participatory GIS will support social work scholars and practitioners as they respond to complex, place-based social injustices.

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