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Focus on Research Methods

Sociospatial Knowledge Networks: Appraising Community as Place

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Abstract: This article introduces a new theory of geographical analysis, sociospatial knowledge networks, for examining and understanding the spatial aspects of health knowledge (i.e., exactly where health beliefs and knowledge coincide with other support in the community). We present an overview of the theory of sociospatial knowledge networks and an example of how it is being used to guide an ongoing ethnographic study of health beliefs, knowledge, and knowledge networks in a rural community of African Americans, Latinos, and European Americans at high risk for, but not diagnosed with, type 2 diabetes mellitus. We believe that the geographical approach to understanding health beliefs and knowledge and how people acquire health information presented here is one that could serve other communities and community health practitioners working to improve chronic disease outcomes in diverse local environments. Res Nurs Health 25:159–170, 2002

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Nurses traditionally have been concerned about the prevention of disease in the community and have addressed problems from a community perspective. This tradition goes back to the time of Florence Nightingale, whom nursing historians credit with demonstrating the role of nurses in prevention through attention to the environment (Stanhope & Lancaster, 1992). Since the late 1800s community health nurses in the United States have been leaders in the movement to improve health outcomes and quality of life for individuals, families, and communities. Nurses and other health care workers have examined how community health beliefs and health practices interact to influ-

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ence health outcomes. For nurses the concept of ''community'' includes essentially three dimensions: (a) people, the residents of the community; (b) place, the spatial and time dimensions of the community; and (c) function, the aims and activities of the community (Goeppinger, Lassiter, & Wilcox, 1982). To acquire usable information about a community and its health, community-oriented nurses have employed a variety of widely used and accepted methods, including surveys and inventories, indirect sources such as secondary data analysis, and ethnographic methods such as in-depth interviews with informants and participant observation (Hunt, Arar, & Larme, 1998; Ruffing-Rahal, 1985; Tripp-Reimer, 1984).

As communities become more ethnically diverse, it is important for nurses to develop effective and efficient methods to assess how laypeople in a community, particularly those of different cultures and ethnicities, learn about disease. This understanding extends beyond what is learned as a child through folk knowledge and what is taught in school to how adults learn from leaders in the community (e.g., ministers) and from other community residents and workers (e.g., bartenders, beauticians) and to how and why they use specific community resources (e.g., health care centers). Nurses need to identify these community-based sources of information, or ''information nodes,'' learn which people use which nodes, and learn how health care providers can use these nodes to understand and influence the health care practices of the residents of a specific community.

Medical geographers examine the spatial aspects of health, illness, disease, and health care. Medical geography uses spatial analysis techniques to understand (a) spatial patterns of morbidity and mortality, factors associated with these patterns, disease diffusion, and disease etiology; (b) spatial distribution, location, diffusion, and regionalization of health care resources, access and utilization of resources, and factors related to resource distribution and use; and (c) spatial aspects of the interactions between disease and health care delivery (Gesler, 1989). Geographers examine space on different levels—global, national, regional, and local. Classic examples of types of studies conducted by medical geographers include studies of HIV and malaria, regional differences in mortality and morbidity, and health services research related to specific areas or regions of a country or state (Gesler & Ricketts, 1992).

Geographers recognize the importance of place to health and have conceptualized this relation as ''healing places'' (Gesler, 1996). Knowledge also can be thought of as having spatial aspects, having knowledge space. Aspects of knowledge space include the sources of knowledge as well as how often these sources (or nodes) are being accessed and what individuals think about the usefulness of these nodes. Knowledge space extends beyond the traditional settings for health education to other places where people discuss health, such as at church functions or with coworkers over lunch—any place where people talk and feel comfortable about discussing health issues. This geographic approach, assessing knowledge space, is an important and useful technique for nurses because it expands our ability to understand how people use the environment to learn about health and disease and access health care.

In this article we introduce a new theory of geographical analysis, sociospatial knowledge networks, which nurses can use to examine and understand the spatial aspects of health knowledge (i.e., exactly where health beliefs and knowledge coincide with other social support in a community). We discuss simple methods in applying the theory, such as mapping social networks and sites in which people share their knowledge and beliefs about a disease, permitting identification of key sociospatial information useful to developing new or refining existing intervention programs. We also present an example of the operationalization of this theory in an ongoing ethnographic study of health beliefs, knowledge, and knowledge networks in a rural community of African Americans, Latinos and European Americans at high risk for, but not diagnosed with, type 2 diabetes mellitus. We believe that the geographical approach to understanding health beliefs and knowledge and how people acquire health information presented here is one that can serve other communities and community health practitioners who are working to improve chronic disease outcomes in diverse local environments.

HEALTH BELIEFS, KNOWLEDGE, AND SPACE: A THEORETICAL FRAMEWORK

Nurses traditionally have understood that people's knowledge and beliefs influence their health practices. The experience of health and illness is specific to a community or a place. Family and friends, along with local sources such as work places, churches, and social clubs, often provide information to individuals about the causes of illness, its treatment, and ways to stay healthy. Potentially there are multiple specific sources of health information including relatives and fri-

ends; other individuals at such places as home and work and recreation sites; those at institutions such as health clinics, churches, and schools; and the media (Zola, 1972). These sources provide the context in which knowledge and beliefs are communicated.

Medical geographers have developed the in-place approach to deal with these multiple point sources of information. Geographers studying health issues use this approach to examine how people experience health and disease in places. The in-place approach recognizes that people deal with disease and its treatment in specific places, settings, or locales (Kearns, 1993; Kearns & Gesler, 1998; Kearns & Joseph, 1993). Miewald (1997) described "people space" as "the space within which illness is experienced and decisions are made regarding compliance with or resistance to the demands of biomedicine" (p. 72). People develop strong feelings of identity with places because their experiences there have great meaning or significance for them (Gesler, 1991). Furthermore, social networks and interactions are important in obtaining information about health and disease. People move around within places, making contacts with others and with specific sites such as workplaces, churches, and the homes of others in ways that have meaning for them. These ideas combine to produce the theory of sociospatial knowledge networks, one specific way of thinking about an in-place approach.

The results of two studies indicate the potential usefulness of discovering where people obtain information about disease and its treatment. Cornwell (1984) conducted an in-depth study of the health beliefs and practices of 24 residents of a poor section of East London. She explicated how their health beliefs arose from both the dominant political, economic, and medical institutions in society and from the choices people had to make about health matters in their everyday lives. Throughout their day people made contacts with family in the home, friends, coworkers, medical personnel, and many others with whom they shared information and by whom they were influenced to varying degrees in their beliefs. Eyles and Donovan (1986) carried out an ethnographic study of 30 working-poor individuals in a West Midlands town in England to understand how people made sense of their illness and treatment through listening to "stories" of their experiences. They discovered that people achieve meaning about disease and health issues in relation to their everyday lives and the lives of others. Individual experience was related to their work, society in general, historical memory, and the place in which they lived. Meaning was affected by their position within society and the quality of their communications with others.

SOCIOSPATIAL KNOWLEDGE NETWORKS

Basic Constructs and Their Definitions

Three constructs are integral components of the theory of sociospatial knowledge networks: (a) activity spaces, (b) place inventories, and (c) information nodes. Activity spaces are a detailed description of a person's locations for a typical time period such as a week or a month. This description provides information about the duration and frequency of contacts a person makes with each place in the community. An activity space is the normal space in which an individual acts. Each person has different activities in which he or she engages—shopping, going for health care, going to church, participating in recreation, or socializing with family and friends. Each individual's activity space is unique. However, there is sufficient overlap of points in the individual activity spaces of community members to enable the identification of information nodes.

A place inventory is a list of places in a community used for specific activities, such as the places in a community where a person can shop, receive health care, worship, recreate, and socialize. It is not possible to create an exhaustive list of the places at which a specific activity (e.g., obtaining health information) occurs, as some places have few or unique users and the activities that transpire at a place may change. For the purpose of understanding health information networks, it is only important to have an inventory of accessible places used by a sizable (however defined) number of residents for health information.

Information nodes are points in a community place inventory (relative to the phenomenon of interest) that are parts of the activity spaces for a sizable number of residents. For example, a node might be a place where a significant number of community residents receive health information. Although this might be a clinic, it might also be at a site used for recreation. For example, breast cancer screening information could be distributed at a beauty salon because beauty salons are places used by women (those at most risk for breast cancer) and are places where health issues often are discussed.

We defined seven types of health information nodes, called health knowledge nodes (HKNN), four of which exist empirically and three of which exist theoretically. These seven types are defined in Table 1. The type of HKNN depends on the combination of its use by respondents, the availability of health information, and whether it is viewed favorably or unfavorably. This collection of nodes in a community with which residents interact and learn about health issues forms a network. Knowledge networks are a fluid expression of complex sociospatial interactions (Abler, 1974) for which we use the term *sociospatial knowledge networks.* The documentation of sociospatial knowledge networks permits the examination of the content and intensity of knowledge transfer, of the social relationships between people exchanging information, and of the places where information transfer occurs. As people receive information and exchange it with others, the feedback can reinforce old beliefs and knowledge or persuade people to consider new beliefs or behaviors. Maps showing where people share information about a topic and the content and intensity of information flow reflect people's knowledge networks. That is, the spatial and the social are mutually constitutive (Gregory & Urry, 1985). Thus, barriers and facilitators to knowledge exchange are revealed.

Understanding the places where people gather to exchange information is important in sociospatial knowledge networks. Churches, schools, stores, clinics, homes, and locations of employment are places where family, acquaintance, and business relations occur (Gilbert, 1995). These overlapping webs of human relationships may be dense in some places and ''stretched'' across vast geographical spaces in others (Giddens, 1990: Massey, 1994). Examples of stretched relationships are the kinship networks of Latino immigrants and the business relationships between the large poultry processing managers and their recruiting agents at the U.S.–Mexico border (Grey, 1999).

The geography of knowledge networks, that is, the overlapping of social relations within the spatial pattern of information flow, is of special importance in understanding sociospatial knowledge networks. For example, an individual's primary source of health information may be within a long-standing membership in a church group. The source is thus rooted to the shared faith of the individual and to a system of mutual emotional support that enhances information flow. Overlapping social relations as they relate to information flow and place are identified and examined in sociospatial knowledge network analysis.

The remaining sections of this article focus on how data can be collected, analyzed, and reported so that an in-place approach to the analysis of health and illness information can be used to improve health outcomes. We also present a brief overview of how the theory of sociospatial knowledge networks is being applied in an ongoing ethnographic study in a rural community in the southeastern United States. We propose that research designs for an in-place approach can be completed with a variety of qualitative and quantitative methods. In our own experiences with this approach we have employed ethnographic and survey data collection methods.

Data Collection

Numerous methods employing various designs can be used to collect the data needed to develop a place inventory and to describe the activity spaces of the residents of a community. This information provides the basis for the delineation of information nodes (HKNNs) in the sociospatial knowledge network in which health information is or can be disseminated. Information about respondents' sociospatial knowledge networks is gathered by looking at those places in the community they visit and those that they don't. This information is collected in two ways: by asking people about their activity spaces and by asking them about places listed in a place inventory. The activity spaces questionnaire generates information concerning where people actually visit in a specific time period, such as the preceding week. The place inventory generates information concerning places not actually visited recently, which may have been visited less frequently or even be places the respondent avoids. The collection of place inventory information follows the collection of activity space information.

Activity spaces. To collect data on community residents' activity spaces, respondents are asked to recall where they went over a given period of time (e.g., week, month). The period should be brief to facilitate the general recall of basic events. It is preferable to avoid collecting data for a week that contains holidays so that the sociospatial activities described are more typical of daily events. The respondents are asked to describe the locations visited throughout each day of the week, addresses if known, the type of environment, the purpose of being in the location, the duration of time spent in each location, and whether contacts with friends, relatives, acquaintances, or other people were made at that location.

Table 1. Potential Types of Health Knowledge Nodes (HKNN) Operant in a Community

Node	Type	Characteristics	Examples
Strong, existing HKNN	Empirical	—community residents visit —rate favorably as a site they like to visit —site at which they obtain health information	—health screenings held regularly at a community center or church —health screenings at a nutrition site
Primary, potential HKNN	Empirical	—community residents visit —rate favorably —would be willing to accept health information at this site if available	—community center
Secondary, potential HKNN	Empirical	—community residents visit —rate favorably —health information not available or desired	—market site; social club; recreational location
Reluctant HKNN	Empirical	—community residents visit —rate unfavorably —health information available	—clinic in a community where minority residents have suffered discrimination
Latent HKNN	Theoretical	—community residents do not visit —rate favorably —would like health information to be available	—library, churches, community centers, or clinics with inconvenient hours or problems of access such as transportation barriers
Isolated HKNN	Theoretical	—community residents do not visit —rate unfavorably —health information available	—places where only certain groups are allowed to congregate (e.g., men-only social clubs, a workplace) —places where community residents have had a bad experience —N.B.; an isolated node (or site for one group) may be a strong, existing node for another group
Irrelevevant HKNN	Theoretical	—community residents do not visit —rate unfavorably —health information unavailable	—places with limited access for most people (e.g., private residences)

Note: Health knowledge nodes (HKNN) are where community residents receive health information.

Place inventory. First, a community reconnaissance should be conducted to generate a list of major locations. A community reconnaissance is an on-the-ground assessment of an area or community made either by walking through or driving through specific locations. The goal of this activity is to generate a list of places that residents are using to obtain health information, as well as places they might use or will not use. Interviewers prompt respondents to answer a series of questions for each place listed in the place inventory developed from a community reconnaissance and expanded using information from the activity spaces data. These questions focus on the respondent's travel to the place, the rating of the place, and information obtained at the place. The investigator asks each respondent to rate each place in favorability, with 5 being the most favorable, 1 being the least favorable, and 3 being neutral. Finally, the interviewer asks the respondents if health issues are discussed at the location, whether information about health could be obtained there, and if not, whether the place might be a good location to obtain information. For example, specific questions might address obtaining information about type 2 diabetes at each place. Examples of qualitative approaches to creating a place inventory include in-depth and group interviews. Respondents are asked to discuss where they go in the community to obtain their health information, what they do at each place, and their feelings about these places. Other techniques that a researcher might use to obtain this information include a 24-hr or weekly recall of activities (similar to a dietary recall), asking community residents to list where they go for activities or to keep a diary of their activities for a certain period of time, and field observation. Quantitative methods include use of a fixed-response survey.

Quantitative data collection and analysis have been made easier with the use of technology such as the GPS/GIS. The Global Positioning System (GPS) receiver is a handheld unit that records an accurate, digitally formatted, and standardized account of its position anywhere on earth (Fig. 1). This instrument receives information from

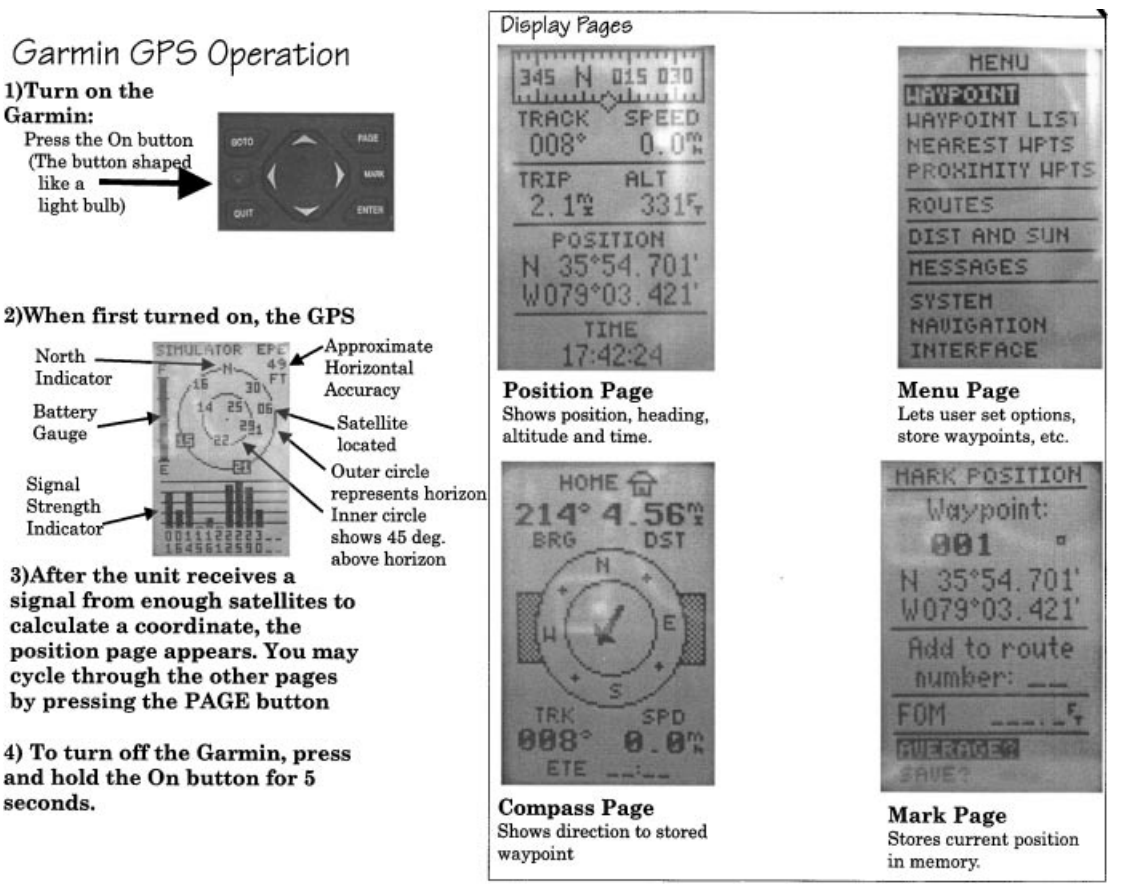

FIGURE 1. Global Positioning System.

several satellites, calculating an extremely accurate position on the earth's surface in longitude and latitude that can be transferred easily to a map. The Geographical Information System (GIS) is the software interface that is used to map the coordinates obtained from the GPS units. Qualitatively, similar information can be obtained by asking respondent, ''Where do you go to the doctor?'' and using the GPS to pinpoint the exact location.

The GPS coordinates of locations can be cross-referenced with the address information given and checked against an address directory so that the locations mentioned can be accurately mapped (Fig. 2). Note that there may be some overlap between these locations and the sources used for health information. Figure 3 illustrates the way in which individual activity space maps can be combined in order to find points of high-intensity contact that can be potential intervention sites. These points can be used in developing the typology of places for an intervention.

The type of information collected via fixed format interview for activity spaces can create reams of data that are extremely difficult to manage and analyze. Fortunately, the availability of Geographic Information Systems technology provides the opportunity for parsimonious analysis of these quantitative data. The GPS data can be stored in a relatively small GIS environment in which each place mentioned is referenced as a geocode and can be mapped.

Data Analysis

The data analysis plan is guided by the theory of sociospatial knowledge networks and can be accomplished using qualitative and quantitative methods. The ultimate goal of the quantitative analysis is to develop maps that for each group studied represent the best ordering of sites in a person's or population's sociospatial knowledge network. This analysis reveals differences among groups and identifies for each group which nodes of these networks might be potential intervention sites.

Mapping the data—Typology of places. The information generated by the (a) sources used for health information, (b) the activity space interview, and (c) the place inventory provides the following variables: places actually used to obtain information, places identified as part of individual activity spaces, hours spent at the places

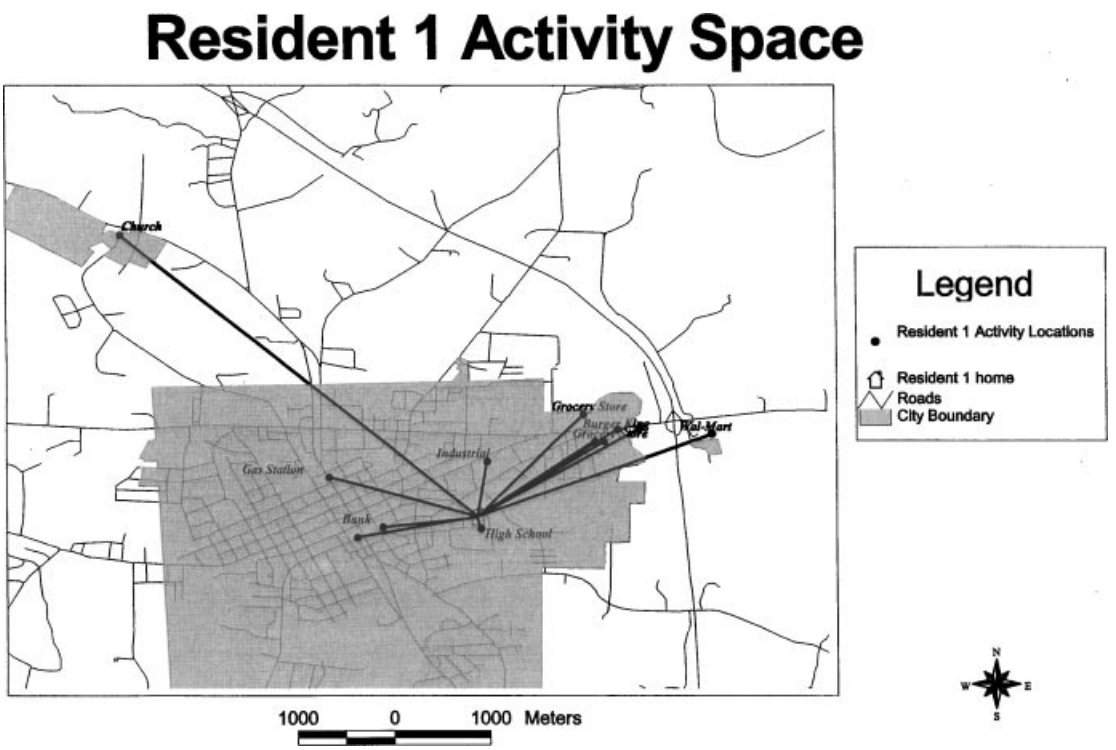

FIGURE 2. Example maps of individual resident sociospatial knowledge networks.

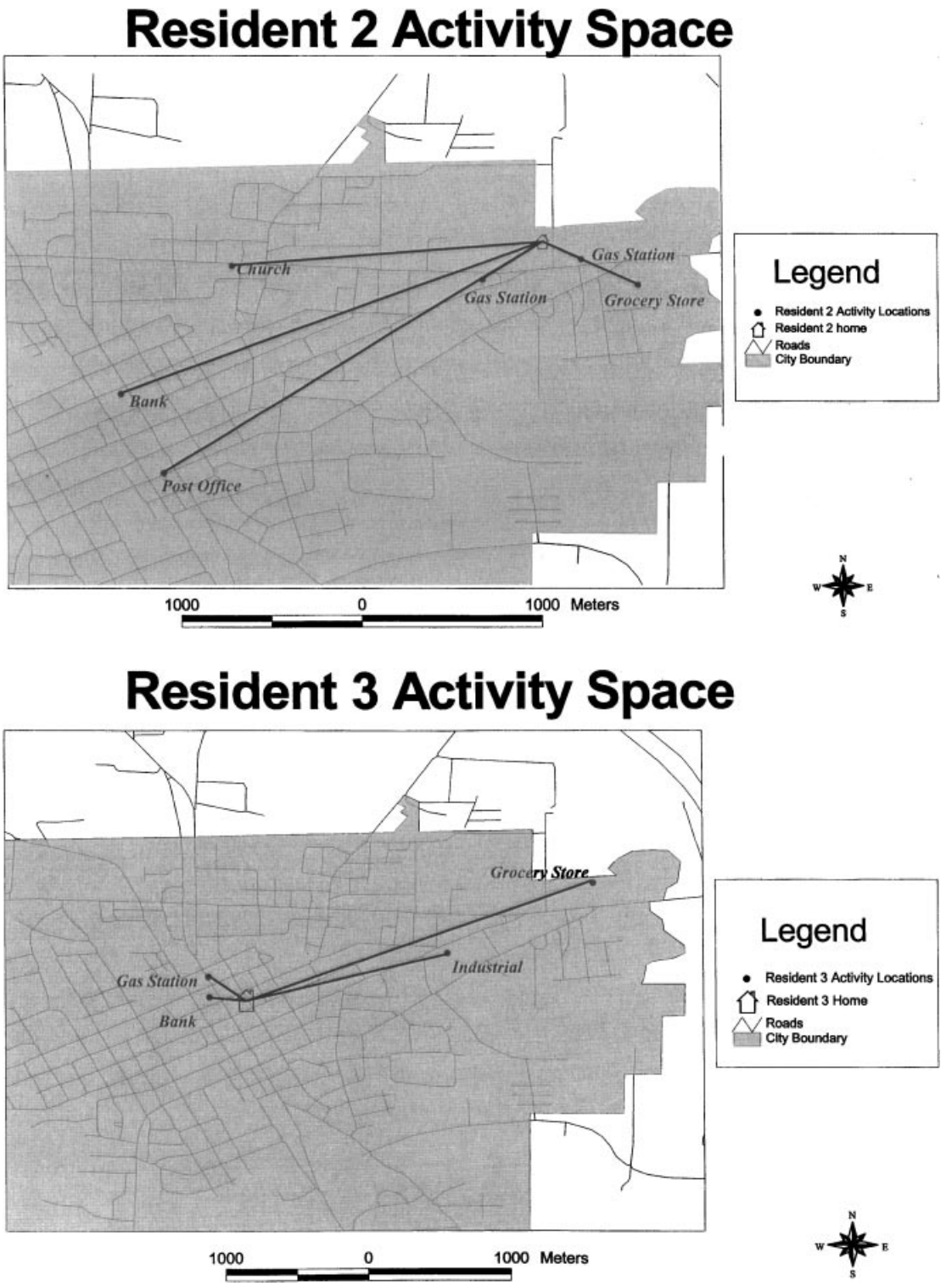

FIGURE 2. (*Continued*)

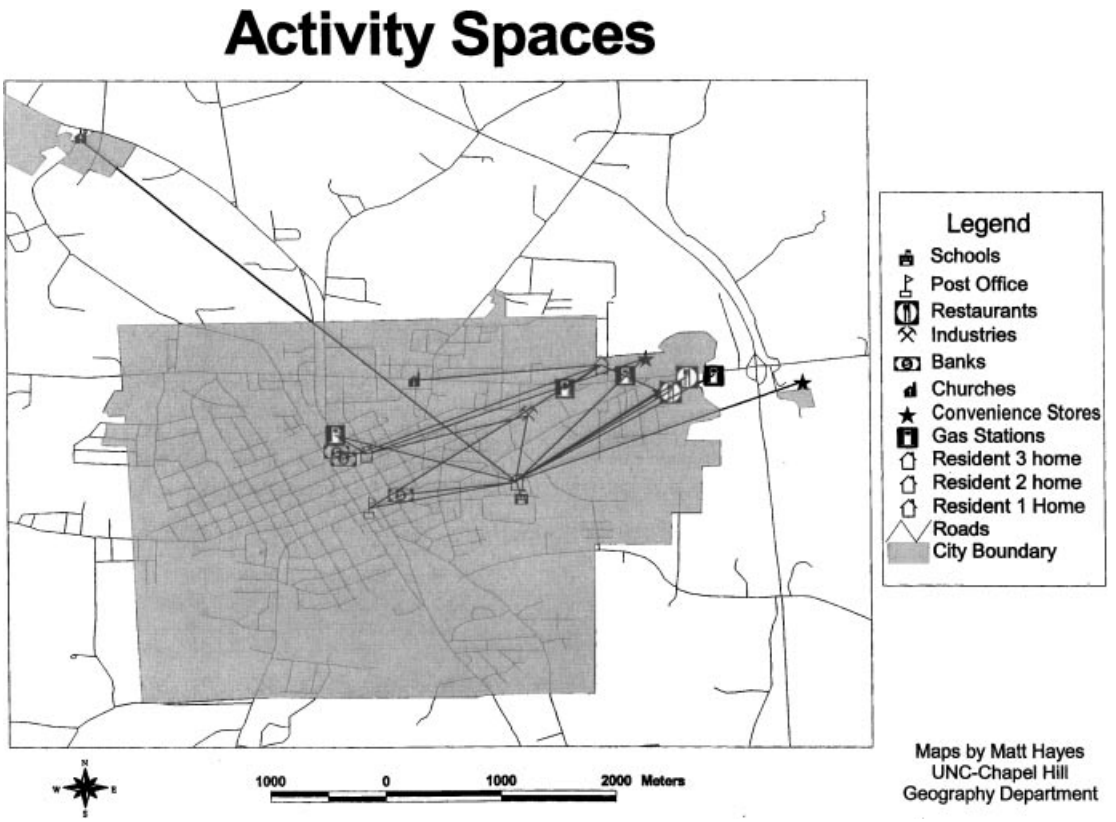

FIGURE 3. Combination of individual activity space maps to identify potential intervention sites.

mentioned, number of times visited in a week, the purpose of going there, the contacts met when going there, the favorability rating of places visited, and the places where information can be obtained. We use the data collected via interview or other ethnographic methods, on activity spaces, the place inventory, and sources of health information to develop a typology of places integrating the quantitative (geographic) and qualitative analyses.

Once a community health researcher collects this information and develops typology maps for each individual and each group, she or he can determine whether there are differences in place typologies. A site could be an existing (favorable) health knowledge network node for European Americans, whereas it could be a reluctant (unfavorable) HKNN for African American respondents. These qualitative spatial analyses can help to refine information on community residents' health beliefs by providing maps of where health knowledge is shared and among whom. These insights can be used to develop culturally appropriate information. In addition, these qualitative spatial analyses can help researchers and clinicians target culturally appropriate information to ''community relevant'' places.

Integrating the qualitative and quantitative components. The geographic analysis and the qualitative analysis can be fully integrated. This provides a certain synergism such that the results of the qualitative and geographic methods yield more than the sum of their parts. Merging the results also serves to facilitate a community intervention at a later date. Spatial mobility, spatial barriers to access, and spatial behavior patterns identified in the geographical analysis will enrich the empirical analysis and, perhaps, challenge the overall conceptual framework concerning health beliefs and knowledge.

The integrative step of the analysis is an iterative process. In this instance the iterations focus on the geographic or spatial dimensions of the preliminary results from the qualitative analysis. That is, place and spatial relations will be considered significant analytic variables as we seek, verify,

reformulate, and reverify configurations of variables. As above, we return to the case-level data (e.g., maps of source information, maps of activity spaces) and look for instances of agreement with the analysis as well as counterexamples.

The specific ways in which qualitative and quantitative analyses are integrated are dependent on the empirical problem being studied and the exact types of data collected. However, two general examples illustrate the integrative process. In the first example quantitative data are used to list in order the most used nodes by different ethnic groups in a community and the purposes for which the nodes are visited. Text from in-depth individual interviews in which the different nodes are discussed are reviewed to learn the different themes and symbols that different ethnic groups or age groups or genders attach to specific highly ranked places. For example, a node visited by a broad spectrum of community members may have a positive symbolic value to one group of community residents (e.g., a church that older adults see as a focal point of their social lives from their youth through older adulthood), whereas it has a neutral or even negative symbolic value to another group of community members (e.g., this same church seen by younger recent immigrants to the community as a bastion of the status quo that restricts important change).

As a second example, the researcher could review textual data from in-depth individual or group interviews to learn the attributes that community residents value most highly in a place (node) from which they would seek health information. These general themes might include accessibility, location, various symbolic attributes (e.g., historical significance, affiliation with a high status church, affiliation with a local college), hours of operation, and feelings of personal safety. The GIS database is then searched to find those nodes that have these attributes, and health education programs are developed at these nodes.

Space and Place in Research

This theory is currently being used to guide an ongoing ethnographic study of diabetes health beliefs and sociospatial knowledge networks among three groups of low-income African American, European American, and Latino residents of a small, rural Southeastern community in the United States. In this study our specific aims are to (a) describe the knowledge and beliefs about diabetes causality, pathology, treatment, and sequelae among male and female members of these three groups, and (b) describe and compare the sources of information, including people, institutions, and places, where members of these groups share information about diabetes, and whom they trust regarding this information. Our sample consists of 120 working-poor men and women between the ages of 18 and 50 years who are considered at high risk for, but not diagnosed with, type 2 diabetes mellitus.

Our community reconnaissance enabled us to identify sites that were included in our place inventory and community experts whom we interviewed subsequently about their knowledge of the problem of diabetes in their community, their beliefs about the prevention of diabetes, and the resources available to community residents with diabetes. The research team has developed and pretested an interview guide to assess participants' knowledge and beliefs about diabetes, an activity spaces questionnaire, and a place inventory. Our study respondents are participating in 90-min-long in-depth, semistructured interviews aimed at having them identify and describe their knowledge and beliefs about the causes of diabetes, its treatment and sequelae; complete a place inventory, and identify and describe their activity spaces for the preceding week. Coordinates for each location identified by participants in the place inventory and activity space questionnaire are being mapped using the GIS/GPS systems, which will enable us to produce individual activity space maps along with aggregate maps showing the activity spaces for larger groups. In addition, as descriptors of the sample, we are obtaining anthropometric data on each participant (body mass index, blood pressure averaged over two readings) and some basic health status information.

Our research team is using the geographic theory of sociospatial knowledge networks to guide data collection and facilitate the analysis and interpretation of the information sources component of our study—specific aim (b). Geographic methods have been used by other health care researchers investigating different questions. For example, Lee & Culhane (1998) also have used GIS, which is a specific cartographic or mapping technique, to measure spatial segregation. We believe the geographic methods used in this study have enhanced the cultural sensitivity of our observations and enabled us to better understand how and where members of these three ethnic groups seek information in the community. For example, in our community reconnaissance we identified areas in the community specific to one of the three groups and structures that residents of

similar ethnic backgrounds might frequent as part of their daily lives. Stores (*tiendas*) in the Latino neighborhoods are such structures. As part of our identification of activity spaces for Latino participants in our study, we were able to identify and describe the multiple services to community residents by these tiendas, including offering a service for sending money orders to Mexico, providing immigration information, distributing community information (e.g., sporting events), and making available informal English translation services. We were able to describe and develop further the concept of tiendas as information nodes through the use of our place inventory, which provided information on the frequency of contact at specific tiendas, participant favorability ratings of each site, and what type of information (in our case, health information) could be obtained there. In the community under study we could find no stores that provided similar functions for either African Americans or European Americans. However, we found churches that serve these functions for African Americans, and small diners that serve these functions for European Americans.

Based on the data obtained in this study, we intend to develop a culturally sensitive intervention (training, reinforcing materials, behavioral change strategies, technical assistance that reflects health beliefs) that health care providers can implement in any community once they are familiar with that community's health beliefs and sociospatial knowledge networks. The information we are collecting will lead to the identification of community-based sites for interventions as well as provide us with direction to adapt existing programs to make them more culturally sensitive to community residents. In this example this synergistic qualitative and geographic approach allows us to proactively address the prevention of diabetes in an informed, culturally specific manner and thus reduce the burden of the mortality and morbidity from this disease in an at-risk population. These techniques can be used by nurses in a variety of community settings to yield data on which to base health interventions relevant to the cultural beliefs and preferences of ethnic groups.

Qualitative researchers, like their quantitative counterparts, need to be sensitive to issues of place and space. An analysis of sociospatial knowledge networks allows researchers to begin to understand disparities in health information networks as well as differences in health information distribution. For example, the impact of residential segregation may contribute to greater accessibility to a community clinic for just one ethnic group. This process influences the relative accessibility of the other ethnic groups while being fairly opaque to standard nongeographic analysis.

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