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Review

Inventory of the physical environment domains and subdomains measured by neighborhood audit tools: A systematic literature review

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ABSTRACT

The purpose of this review was to inventory and document existing neighborhood physical environment audit tools and the domains and subdomains measured by these tools. At total of 31 articles met inclusion criteria. We identified 20 major domains and 291 subdomains. Audit instruments most commonly assessed *Streets/Traffic*, *Safety*, *Land Uses*, and *Physical Disorder* domains. Least commonly assessed domains were *Barriers*, *Neighborhood Identification/Legibility*, *Steepness*, *Views/Enclosure*, and *Ethnic Identification*. Within a domain, between 1 and 36 subdomains were assessed. This review will help neighborhood auditors identify instruments that measure domains and subdomains most relevant to their study. This information may also be used to develop customized audit tools that capture those physical environmental characteristics of neighborhoods that auditors are most interested in.

1. Introduction

Quality of life is clearly linked to the physical environment in which people live (World Health Organization, 1997). The physical environment includes both the natural and built environments (Secretary's Advisory Committee, 2010). The physical environment can include particular settings, such as homes, worksites, and schools; and it can include the neighborhoods and communities in which people live, work, and play. Neighborhoods are geographic and social units that can have profound effects on quality of life (Leung, Gregorich, Laraia, Kushi, & Yen, 2010). However, the nature of the relationship between neighborhood conditions and residents' well being (and the mediating and moderating factors at play) remains unclear (Parsons et al., 2010). Characterizing neighborhoods and the specific physical features of neighborhoods that may contribute to residents' quality of life is a complex and difficult undertaking (Parsons et al., 2010). To do so, neighborhoods must be defined by both specific boundaries and then by the physical characteristics within those boundaries.

Residents living within the same neighborhood have varying definitions of neighborhood boundaries (Sastry, Pebley, & Zonta, 2002), which exacerbates the difficulty relating neighborhood conditions to quality of life. The U. S. Census typically defines neighborhoods in terms of census tracts, which reflect prominent physical features of neighborhoods as well as social and ethnic divisions (Kohen, Brooks-Gunn, Leventhal, & Hertzman, 2002). Census tracts can vary in size, but are usually so large that smaller areas within census tracts must be sampled for research purposes. To maintain a consistent, reproducible sampling area, studies often define their units of analysis as street segments or block faces (e.g., a section of a street bounded by two intersections or a dead end). Sometimes specific settings within a neighborhood are studied, such as housing units, schools, parks, or playgrounds.

Schaefer-McDaniel et al. (2010) reviewed the most common methods employed to document the physical characteristics of neighborhoods. Three major approaches used are: (1) resident surveys that give subjective accounts of the perceived environment, (2) administrative data including those derived by censuses, crime reports, etc., and (3) direct observation by outside raters (including by use of audit instruments). Geographic information systems (GIS) are also being employed to allow features of the environment derived by any of the above methods to be mapped to specific neighborhood locations. Each of these approaches has advantages and disadvantages (Schaefer-McDaniel et al., 2010). Although direct observation is subject to its own limitations and observer bias (see Schaefer-McDaniel et al. for a discussion of methodological rigor), it does overcome some of the limitations of subjective and administrative data. For example, direct observation methods are not subjected to residents' social desirability bias and can identify neighborhood characteristics (such as the presence of

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trash) that are not captured by administrative data (Schaefer-McDaniel et al., 2010). Many of the direct observation methods employed are derived from the work of Raudenbush and Sampson (1999), Caughy, O'Campo, and Patterson (2001), and Pikora et al. (2002). The systematic social observation method developed by Raudenbush and Sampson (1999) involves driving through neighborhoods while one researcher videotapes and two others record their observations in a log. This method involves coding observations after driving through the neighborhood. Caughy's and Pikora's groups created audit instruments that allow trained observers to objectively rate components of the neighborhood environment while they are physically present in the neighborhood.

Neighborhood audit instruments traditionally have been developed and used by social scientists and urban planners to examine community needs and assets, and their application to public health issues also has been well recognized (Dannenberg et al., 2003). For example, social scientists have used neighborhood audit instruments to examine the role of the physical environment on residents' perceptions of safety and crime (see, for example, Perkins, Meeks, & Taylor, 1992). Theoretically, neighborhoods can be designed to minimize crime and promote safety, and audit instruments have been used to assess the relationship between neighborhood design and crime (e.g., Minnery & Lim, 2005). Much of the attention to the influence of the physical environment on health has been directed toward the walkability or bike ability of neighborhoods, and a variety of instruments have been developed to assess these features (e.g., Pikora et al., 2002).

Neighborhood environment audit tools have been developed or revised to meet particular needs. Some instruments assess both the social and physical environment; some address only the physical environment. Some assess the environment for qualities that might influence a particular health or social issue (such as pregnancy or crime), behavior (such as walking or bicycling), or population (such as African Americans or older adults). Because audit instruments are used for an array of purposes, numerous neighborhood characteristics or domains have been assessed. For researchers trying to select or develop an instrument to meet their own specific needs, a complete listing of available audit instruments and domains assessed would be helpful. A domain can be defined as a broad category of similar environmental characteristics, such as land use or physical disorder. The individual items comprising a domain, such as types of residential land use and presence of graffiti, can be called subdomains. Domains and subdomains are conceptually similar to Pikora et al.'s (2002) elements and items, respectively.

Schaefer-McDaniel et al. (2010) have recently reviewed the literature on neighborhood observations, focusing on methodological rigor, geographical boundaries, and the relationship between neighborhood characteristics and residents' health. Whereas their review does provide domains assessed, this is not the focus of their paper, and they do not limit their review to observations using audit instruments. A comparison of audit tools that have been used to assess characteristics of the built environment that may be associated with physical activity was developed by Day (n.d.) and is posted on the Active Living Research website (http://www.activelivingresearch.org/files/AuditToolsComparisonTable.pdf). This is a useful comparison with many domains and subdomains provided, but it is limited to five tools that are concerned only with the physical activity environment. Other reviews (e.g., Moudon & Lee, 2003) also focus exclusively on the physical activity environment, whereas investigators may be interested in physical environment factors that are related to other behaviors or quality of life issues that may not be affected by physical activity. Therefore, the purpose of this review is to fill the gap in the literature by providing a complete inventory of domains and subdomains assessed by existing neighborhood physical environment audit instruments.

2. Methods

2.1. Search procedure

We searched the following social and medical sciences databases for publications in peer-reviewed journals related to direct observations of neighborhood physical environments: *Pubmed*, *CINAHL Plus*, *PsycINFO*, *Health Technology Assessments*, *International Bibliography of the Social Sciences*, *Criminal Justice Abstracts*, *Social Services Abstracts*, and *Sociological Abstracts*. Key search terms included the following *methodological* terms: audit, scan, assessment, observation, checklist, inventory, measure, rating, windshield survey, direct observation, social observation, systematic observation, and systematic social observation; and the following *neighborhood* terms (using both spellings, neighborhood and neighbourhood): neighborhood/neighbourhood, built environment, neighborhood/neighbourhood environment, community environment, urban environment, and rural environment.

2.2. Inclusion and exclusion criteria

The inclusion criteria used to determine a publication's relevance to this study are as follows: (1) measures include direct observations of neighborhood physical (i.e. as opposed to social) environments, (2) the unit of analysis measured was a segment of a street (e.g., block, block face, or street segment as opposed to a housing unit or playground), (3) measures were original (including modifications of existing measures that made them essentially a different instrument), (4) the article was published in an English-language peer-reviewed journal between 1990 and June 2010, and (5) studies were conducted in developed countries, as defined by the United Nations (2012), as developed and developing countries may have varying physical environment characteristics and needs (see, for example, Konteh, 2009). Studies that used geographic information system (GIS) or administrative data without also using a neighborhood audit instrument were excluded. Measures in the form of participatory surveys and measures of the social environment were also excluded (unless they also included direct observations of the physical environment). In the event that a publication included measures that were not clearly delineated within the manuscript, we contacted the author using the contact information provided within the publication. If the author could not be reached for, or was unwilling to provide, further clarification of the measures, the publication was excluded. If a measure was described multiple times in the literature without modification to the instrument, only the publication that most fully described the instrument development and psychometric testing was included.

The initial literature search generated a total of 11,565 citations. To create a more manageable number of articles to review, duplicate citations were eliminated and citations were systematically searched for exclusion criteria and specific disciplines for which environment may be a common term (e.g., microbiology, climatology, etc.). Articles that clearly did not meet inclusion criteria were excluded, resulting in 2374 citations. From these, titles were assessed for inclusion in this review, resulting in 391 citations. Each of these citations' abstracts and, if necessary, full articles, was reviewed to determine if they met inclusion criteria. A total of 87 publications were reviewed in their entirety. Of these, 31 (Table 1) were included in this literature review.

2.3. Data abstraction

Data abstraction involved two phases. In the first phase, an Excel file was developed based upon a similar one designed by Day (n.d.).