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Activity space environment and dietary and physical activity behaviors: A pilot study

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ABSTRACT

This study examined relationships among individual demographics, environmental features (e.g., fast food outlet density, park land use) of residential neighborhoods and activity spaces, and weight-related behaviors (diet, physical activity). Participants' movement was tracked for 7 days using global positioning systems (GPS). Two activity space measures (one standard deviation ellipse, daily path area) were derived from the GPS data. Activity spaces were generally larger than residential neighborhoods; environmental features of residential neighborhoods and activity spaces were weakly associated; and some activity space environmental features were related to dietary behaviors. Activity spaces may provide new insights into environmental influences on obesity-related behaviors.

1. Introduction

Research over the past decade has advanced understanding of geographic environmental features that are associated with dietary and physical activity behaviors and body weight status. Some of this research has shown that living in a neighborhood with more supportive environmental features (e.g., walkability, accessibility of recreational places, pleasing esthetics) is associated with greater physical activity and lower body weight status (Black and Macinko, 2010; Coogan et al., 2009; Duncan et al., 2010; Frank et al., 2005; Gomez et al., 2010; Kondo et al., 2009; Rodríguez et al., 2009). Other studies have found associations between neighborhood accessibility of (un)healthy foods and dietary behaviors and body weight status (Franco et al., 2009; Li et al., 2009; Moore et al., 2009; Morland et al., 2002; Rose et al., 2009; Paquet et al., 2010). However, overall, findings for many environmental features are inconsistent (Ball et al., 2006; Casagrande et al., 2009; Fleischhacker et al., 2011; Giskes et al., 2011; Lopez and Hynes, 2006; Lovasi et al., 2009; Witten et al., 2008; Pearce et al., 2008).

Two recent reviews indicate that research has concentrated almost exclusively on environmental features of the residential neighborhood, defined as a surrounding administrative unit (e.g., census tract, ZIP code) in most studies (59–73%) and as a 'buffer' (e.g., 0.5 mile radius) in the remaining studies (Feng et al., 2010; Leal and Chaix, 2011). Measuring environmental features for non-residential locations in relation to weight-related behavior has been rare (Inagami et al., 2006; Jeffery et al., 2006; Troped et al., 2010). In fact, a review on geographic environments and cardiometabolic risk factors found that 90% of studies measured environmental features in the residential neighborhood only and just 4% in both the residential neighborhood and around a non-residential location (Leal and Chaix, 2011). The very small number of studies that have examined associations between non-residential environmental features and dietary and physical activity behavior or body weight status have been typically limited to one (i.e., work) (Jeffery et al., 2006; Troped et al., 2010) and at most five (Inagami et al., 2006; Vallee et al., 2010)

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non-residential locations. Even among studies that measure environmental features based on proximity (rather than density) and thus can incorporate features outside the residential neighborhood, measures are still generally constructed in relation to the place of residence (Apparicio et al., 2007; Sharkey and Horel, 2008; Smoyer-Tomic et al., 2006; Burns and Inglis, 2007; Giles-Corti et al., 2005; Kaczynski et al., 2008).

Yet, individuals routinely conduct day-to-day activities (e.g., work, child care, social engagements, shopping) outside their residential neighborhood. For example, the average travel time to work in the United States is 25.3 min (United States Census Bureau, 2009). In an ethnographic study of low-income families in Boston ($n=10$), just 6% of day-to-day activities took place in their residential census tract, another 21% in adjacent census tracts, and a startling 73% in other areas of the city (Matthews et al., 2005; Matthews, 2010). Research in the Paris metropolitan area found that 19–47% of individuals engaged in five activities (food shopping, using services, going for a walk, meeting friends, going to a restaurant or café) mainly outside their neighborhood of residence, though 54% reported mainly shopping for food in their residential neighborhood (Vallee et al., 2010). Further, with regard to food shopping, the Los Angeles Family and Neighborhood Study ($n=2144$) found that only 22% of participants grocery shopped within their own census tract, 42% in adjacent census tracts, and 37% beyond surrounding census tracts (Inagami et al., 2006). Studies of predominately African-American and/or Latino samples in Philadelphia ($n=1440$) and Detroit ($n=919$) revealed that individuals traveled, on average, 2.2–3.3 miles to shop for food (Matthews, 2008a; Zenk et al., 2008). With regard to physical activity, a Boston study found that, on average, less than one-third of moderate and vigorous physical activity among a convenience sample of 148 adults occurred within 1 km (0.62 mile) of participants' homes (Troped et al., 2010).

Thus, focusing solely on the residential neighborhood may mischaracterize environmental influences on dietary and physical activity behaviors and body weight status (Inagami et al., 2006; Troped et al., 2010; Morenoff, 2003; Rodriguez et al., 2005; Kestens et al., 2010). Scholars have called for research on non-residential environmental influences on health (Chaix et al., 2009; Cummins et al., 2007; Inagami et al., 2007; Kwan and Weber, 2003; Matthews, 2008b; Rainham et al., 2009; Saarloos et al., 2009). Characterizing the space within which people move or travel during the course of their day-to-day activities (activity space) (Golledge and Stimson, 1997; Horton and Reynolds, 1971), rather than only where they live, may provide a more comprehensive and accurate assessment of the environment to which individuals are exposed and utilize. In turn, this could help to elucidate the mechanisms by which geographic environments affect dietary and physical activity behaviors and body weight status. However, little is known about activity space environments and obesity or related behaviors.

2. Purpose

In this exploratory pilot study, we drew upon data from the Detroit Activity Space Environments Study (DASES), designed to pilot test methodology to measure individuals' activity space using wearable global positioning systems (GPS) and associated environmental exposures in this space that may affect dietary and physical activity behaviors and, ultimately, body weight status. We addressed the following questions:

1. To what extent do activity space characteristics (size and environmental features, specifically fast food outlet density, supermarket availability, park land use) vary across individuals and differ by individual demographics?
2. How similar are environmental characteristics of activity spaces and residential neighborhoods?
3. Are activity space environmental features associated with dietary and physical activity behaviors, controlling for residential neighborhood environmental features?

3. Methods

3.1. Design and overview

The Detroit Activity Space Environments Study (DASES) was conducted in September 2008–April 2009. It employed an exploratory observational design. Data collection consisted of three phases: baseline interview, 7-day study period (which included wearing a GPS and accelerometer except during bathing or other water activities), and follow-up interview. All materials were available in English and Spanish, and the research team included Spanish-speaking interviewers.

3.2. Sample

Participants were recruited from respondents to a 6-year follow-up, two-stage probability sample survey of residents in three areas (eastside, northwest, and southwest) of Detroit, Michigan, United States (Schulz et al., 2005). The "Lean & Green in Motown" survey was implemented by the Detroit Healthy Environments Partnership, a community-based participatory research partnership comprised of representatives from community-based organizations, health services organizations, and academic institutions. After completing the survey, respondents were provided with information about the DASES and asked if they were interested in participating. The DASES staff attempted to contact interested individuals via telephone. We enrolled 28.3% ($n=131$) of Lean & Green in Motown respondents overall, 40.9% of those who expressed interest, and 85.6% of those we successfully reached by telephone (Fig. 1). A significantly lower

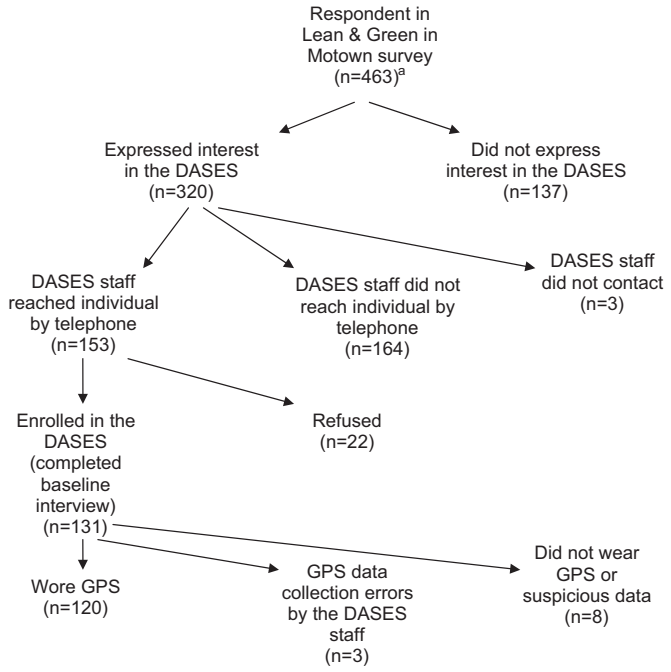

Fig. 1. Depiction of participation by stage for respondents in the parent study, the Healthy Environments Partnership's Lean & Green in Motown survey, and completion of the Detroit Activity Space Environments Study (DASES).
[a]Only 457 Lean & Green in Motown respondents had completed the survey when the DASES stopped all recruitment due to lack of funds.