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Home and away: Area socioeconomic disadvantage and obesity risk

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ABSTRACT

Although residential context is linked to obesity risk, less is known about how the additional places where we work, shop, play, and worship may influence that risk. We employ longitudinal data from the Los Angeles Family and Neighborhood Survey (LAFANS) to derive time-weighted measures of exposure to home and activity space contexts to ascertain the impacts of each on obesity risk for adults. Results show that increased exposure to socioeconomic disadvantage in the residential neighborhood significantly increases obesity risk, and although activity space disadvantage does not directly influence obesity, it reduces the association between residential disadvantage and obesity. We further explore the ways in which residential and activity space disadvantages may interact to influence obesity and discuss the value of integrating personal exposure and activity space contexts to better understand how places contribute to individual health risks.

1. Introduction

The places in which people live, work, and play are increasingly being implicated as contexts which provide opportunities for both healthy and unhealthy behaviors and are intrinsically linked to health outcomes like obesity. Although a substantial body of work has demonstrated the links between residential neighborhood characteristics and the likelihood of obesity (e.g., Boardman et al., 2005; Robert and Reither, 2004; Ullmann et al., 2013; Jones and Huh, 2014), much less is known about how additional contextual environments, often called activity spaces – the workplace, places of worship, places to shop, and healthcare facilities – may influence obesity. This is likely to be an important oversight, because most American adults spend a large proportion of waking time away from their home environments (Basta et al., 2010; Jones and Pebley, 2014). Thus, for many adults, salient environments for both dietary and physical activity behaviors, as well as exposure to factors such as crime and institutional resources, are likely to be outside the residential environment, rather than inside it. Answering calls for more research into which contexts are most influential for behavior and for health (Jones and Pebley, 2014; Shareck et al., 2014), scholars are just beginning to tackle the important question of how these activity spaces influence health behaviors and outcomes (Sharp et al., 2015; Hoehner et al., 2013; Inagami et al., 2007; Kestens et al., 2012; Kestens et al., 2010).

Most studies which investigate the relevance of activity spaces for obesity risk focus on the context of the workplace (e.g., Moore et al., 2013). Though workplace flexibility allows more adults to work from home or work remotely than ever before, over 90% of working adults spend at least part of the work week away from home (Mateyka et al., 2012). Accordingly, researchers have focused on whether workplace food and physical activity environments associate with weight. Findings are generally mixed, likely due to the wide range of techniques used to delineate activity spaces as well as the number of contextual characteristics studied (Crawford et al., 2014; Zenk et al., 2011). Some studies find that healthy food environments in activity spaces are associated with reduced risk of obesity (Moore et al., 2013; Kestens et al., 2012). Similarly, researchers have found links between access to unhealthy food sources over the course of a week of tracking, such as fast food outlets, and obesity risk (Zenk et al., 2011), but these findings are not universal (Jeffery et al., 2006; Daniel et al., 2010). Others focus on built environment features such as intersection density and private exercise facilities and find that workplace built environment features are associated with weight status (Hoehner et al., 2013). While these studies lend support to the idea that the contextual features of activity spaces, especially of workplaces, influence obesity, it remains unclear how best to measure activity spaces; whether activity spaces beyond the workplace matter; and whether residential or other activity space context matters more for obesity risk.

Activity spaces have been defined and measured in many different ways. Some scholars focus on home and workplace environments defined as geographic buffers around reported locations (Hoehner et al., 2013), others use mobility data to determine activity spaces (Kestens et al., 2012, 2010; Zenk et al., 2011), others rely on respondent reports of their travels (Sharp et al., 2015; Moore et al.,

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2013; Jones and Pebley, 2014), and still others rely on a combination of these methods but weight the results by the amount of time respondents spend in each area (Crawford et al., 2014). One thing most of these studies agree on, despite measurement differences, is that contextual characteristics of residential and activity spaces differ, and that these differences have important implications for scholars interested in contextual effects on health (Kestens et al., 2010; Zenk et al., 2011; Jones and Pebley, 2014; Crawford et al., 2014).

The few studies which contrast residential and activity spaces generally find low correlations between characteristics of home and activity space contexts (Shareck et al., 2014; Zenk et al., 2011; Jones and Pebley, 2014; Kestens et al., 2010), suggesting that focusing just on the residential environment obscures the full range of contextual exposures of daily living. Moreover, not accounting for activity space contexts may suppress the relationship between residential context and health (Inagami et al., 2007), or bias estimates of residential environment and health status (Zenk et al., 2011; Chaix et al., 2009). Despite these findings, few studies actually compare the home and activity space environment in terms of their influence on health status. One study contrasted the home and workplace environment's influence on obesity and found that the links between the residential context and BMI were stronger than were the links for the workplace (Moore et al., 2013). Fast food availability in the activity space, but not home, environment is associated with higher saturated fat intake (Zenk et al., 2011). A study using mobility data to characterize activity spaces found gender differences in this relationship, such that residential and activity spaces considered together mattered more for men's obesity risk, while residential environments mattered more for women's risk (Kestens et al., 2012).

Previous research on neighborhoods and health has largely neglected the temporal dimension of people's contextual exposures – not just how exposure can change over the day but also over a number of years (Matthews and Yang, 2013; Perchoux et al., 2013; Kwan, 2012; Chaix et al., 2009). While there have been methodological advancements, recent work continues to be exploratory, cross-sectional, and lacks information on the duration of individual time spent in the many contexts through which people traverse (Kwan, 2012; Matthews and Yang, 2013, but see Sharp et al. (2015)), which is critical to our understanding of whether and how places influence health (Cummins et al., 2007). Therefore, we can better understand how neighborhoods 'get under the skin' (Taylor et al., 1997) and influence obesity risk by conducting spatiotemporal investigations that capitalize on information about where and how long people spend in their activity locations *over time*, which will in turn provide insights into how *changes* in both individuals and the places in which they live and visit shape health and well-being.

In this paper, we aim to contrast the residential and activity space (non-residential) environments in terms of obesity risk. A central question is how to measure activity spaces, for which we propose three key innovations, first described in Sharp et al. (2015). First, we do not rely solely upon respondents' home and workplace census tracts to construct activity spaces, or on the places visited on a limited set of days, but rather, we assess the various places where each respondent spends time in a typical week (Jones and Pebley, 2014; Shareck et al., 2014). Second, because the amount of time in each activity space may differ from respondent to respondent (Kestens et al., 2010), we rely upon respondent reports of time spent in each location to generate exposure weights. These time-weighted estimates allow us to take into account the relative amount of time respondents spend in each location, and thus how much exposure to each context respondents may experience. Below, when we refer to residential and activity space (non-residential) characteristics, we are referencing measures of the places where adults spend time while taking into account how much time they spend in these environments. And third, we use longitudinal survey data to examine how changes in residential neighborhood and activity space characteristics, in addition to changes in individual and household characteristics, influence the likelihood of obesity.

We also argue that the primary contextual characteristic of interest when studying activity spaces and health outcomes is that of socioeconomic disadvantage, because of its fundamental nature in causing health disparities (Link and Phelan, 1995). Numerous studies have illustrated the importance of neighborhood socioeconomic status for predicting obesity (Robert and Reither, 2004; Boardman et al., 2005). In stark contrast to work linking contextual socioeconomic status to obesity risk, research demonstrating links between food retail and obesity and cardiovascular risk is extensive but decidedly mixed (for example, see Ford and Dzewaltowski (2011), Black et al. (2010), Daniel et al. (2010)). For this reason, although we focus on socioeconomic context as a key factor for obesity risk, we also account for the food retail environment in each context of interest.

1.1. Hypotheses

Drawing from the extant literature on neighborhood effects and health, we test the following hypotheses on the relationship between contextual socioeconomic disadvantage and the likelihood of obesity.

H1. *:* On average, residential socioeconomic disadvantage and activity space disadvantage will be independently associated with a higher risk of obesity, and increases in residential socioeconomic disadvantage and activity space disadvantage over time will increase the likelihood of being obese.

H2. *:* Activity space socioeconomic disadvantage will reduce the association between residential disadvantage and obesity, but because individuals spend the majority of their time in their residential surroundings, residential socioeconomic disadvantage should play a more impactful role on obesity than activity space disadvantage.

H3. *:* Residential and activity space food and retail environments will reduce the magnitude of the effects of residential and activity space socioeconomic disadvantage on obesity.

H4a:. Residential and activity space disadvantage will accumulate such that those residing in high disadvantage areas will experience increased risk of obesity when their activity spaces are also characterized by high disadvantage.

H4b:. Residential and activity space disadvantage will interact such that those residing in high disadvantage areas but exposed to low disadvantage activity spaces – or incongruence between residential and activity spaces – will have increased obesity risk, and those residing in low disadvantage areas but exposed to high disadvantage activity spaces will face increased obesity risk.

2. Materials and methods

2.1. Data sources

To test these hypotheses, we rely on data from the Los Angeles Family and Neighborhood Survey (LAFANS), which was collected in two waves (2000–02 and 2006–08). LAFANS is based on a stratified random sample of 65 neighborhoods (census tracts) in Los Angeles County, including an oversample of poor neighborhoods. In Wave 1, LAFANS randomly selected and interviewed adults and children living in 3,085 households across the 65 sampled tracts. In Wave 2, an attempt was made to re-interview all respondents in the original sample, while also interviewing a sample of newly arrived residents in each neighborhood. Although sampled households were tracked even if they left the county, state, or country, telephone interviews were the sole interview method rather than the standard face-to-face interview and health-related questions were not asked (Sastry et al., 2006). Nonetheless, an important advantage of LAFANS is the ability to link a panel study of individuals with characteristics from repeated cross-