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The role of socio-economic status and spatial effects on fresh food access: Two case studies in Canada

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ABSTRACT

This article comprehensively explores the effects of socio-economic status on residents' fresh food access in Saskatoon and Regina, Saskatchewan, Canada. Spatial effects potentially resulting from agglomeration of food retailers and clustering of neighborhoods with similar characteristics have been integrated into analysis using spatial regression models. Key findings include: areas with a larger percentage of population density, single-parent households, senior populations, higher educational populations, and minority groups tend to have higher access to supermarkets and local grocery stores, although the effects vary by city. Areas with higher private car access are more inclined to be farther from these food retailers, meanwhile the influence of public transportation is found to be insignificant in both cities. Regression results demonstrate that ignoring spatial interaction leads to overestimates of the true disparities when investigating food-access inequality among residents with different socio-economic status.

1. Introduction

A growing body of literature pertaining to access to a fresh food environment has been documented, particularly in response to the concern of the "food desert" issue (McKenzie, 2014; Widener & Shannon, 2014). Meanwhile, there has been an extensive review of the relationship between fresh food environments and dietary habits. For example, existing studies have shown that the lack of a fresh food environment, in addition to individual- and household-level factors, can result in adverse health outcomes (Lebel, Pampalon, Hamel, & Theriault, 2009; Matheson, Moineddin, & Glazier, 2008), with obesity the most evident consequence among all chronic health diseases (Black & Macinko, 2008; Holsten, 2009). While fresh food environments are found to be correlated with diet-related health outcomes, vulnerable subpopulations may be at particular risk considering their differential access to fresh food. As a result, the linkage between fresh food access and neighborhood socio-economic status has been widely explored (see Walker, Keene, & Burke, 2010).

Although a great deal of studies have investigated the role of neighborhood socio-economic status on food accesses using different techniques, the spatial effects resulting from the agglomeration of food retailers and the clustering of neighborhoods with similar characteristics have been generally neglected. Compiling a GIS database and taking advantage of the spatial regression models to investigate community fresh food environment, we make a contribution to the literature by simultaneously exploring the potential impacts of neighborhood effects and various socio-economic status on community fresh food access. Applications are to Saskatoon and Regina, the two biggest cities in the prairie province of Saskatchewan in Canada. The comparison of two cities also makes a contribution to the literature as most previous studies focused on a single city. In the empirical analysis, we: (1) mapped the distribution of supermarkets and local grocery stores as well as socio-economic status at the dissemination area (DA) level; (2) measured both the nearest and second-nearest distance and minimum travel time to fresh food retailers through road networks; (3) quantified the impact of socio-economic status and spatial effects on fresh food accessibility.

By identifying a comprehensive list of potential influences in the analysis of access to fresh food retailers, our empirical results provide new insights into fresh food access research, and more broadly, the food environment assessment. In addition, our analyses offer new information on empirical modeling by taking spatial effects into consideration. The methods discussed in this study may assist in the development of an in-depth perspective on food assessment and a more nuanced understanding of fresh food access

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for policy makers and other interest groups.

2. Background literature

2.1. Fresh food access

Fresh food access is a complicated concept. For example, Gulliford et al. (2002) suggested four different dimensions regarding the access evaluation. Despite the complexity of the term which includes various aspects of access (e.g., cost, personal tastes, physical ability), the availability of the service is the most commonly used in empirical studies. This primarily refers to the spatial access or simply the proximity to fresh food suppliers, using the distance-based metric (see Walker et al., 2010 for a review in the United States). In most cases, the nearest distance from a study area (e.g., neighborhood) to supermarkets is calculated. In addition, prior research adopted the "service area" method as an alternative to assess fresh food access (Larsen & Gilliland, 2008; Russell & Heidkamp, 2011). Based on food retailers rather than the study areas, this approach defines an area around which a food outlet can serve given certain criteria such as distance or travel time.

In terms of the fresh food suppliers, there are a number of types that have been investigated in previous studies, with the majority of them focusing on supermarkets (Apparicio, Cloutier, & Shearmur, 2007; McKenzie, 2014; Smoyer-Tomic, Spence, & Amrhein, 2006). Supermarkets can provide a full range of food products (e.g., fruit, vegetables, fresh meat) to meet residents' daily needs. A few studies also incorporated local grocery stores or specialty stores into the analysis, depending on different study areas (Engler-Stringer, Shah, Bell, & Muhajarine, 2014; Gould, Apparicio, & Cloutier, 2012; Martin et al., 2014). These local grocery stores are gaining attention as they can offer one or some types of fresh food such as meat, fish, vegetables and fruits for residents who may not live near full-service supermarkets. More recently, literature started to incorporate farmers' markets into the analysis as they are considered to be able to relieve the deficient fresh food access problems to a temporary extent (Lu & Qiu, 2015; Wang, Qiu, & Swallow, 2014).

2.2. Space and time

Instead of calculating a fixed distance, some recent analyses focus on actual shopping time (e.g., the travel time for shopping and the time spent on transfers, waiting and scheduling public transit) as an alternative way to measure accessibility. For example, Farber, Morang, and Widener (2014) calculated the time it takes to travel from each census block to its nearest supermarket at different times of the day. Such transit-travel-time approach helps to investigate the dynamics of food desert issues given the specific time of a day. Widener, Farber, Neutens, and Horner (2015) analyzed residents' spatiotemporal constraints to the access of supermarkets, focusing on the transit commuting populations. Their results indicated that a significant number of residents improved access to supermarkets when grocery shopping was made on the way home from work than if the trip was to be started from home. Additionally, as food acquisition is not only geographically dictated but also temporally constrained, Chen and Clark (2013) proposed a three-dimensional (3D) construct to delineate the limited food access to a retailer location over its time of operation by taking into account the limited opening hours of food retailers that create a temporal restriction for shoppers.

2.3. Socio-economic status

Another stream of studies examines the association between neighborhood fresh food environment and socio-economic status, including population density and other aggregate neighborhood characteristics that define deprived individuals, such as low income, senior populations, single-parent families and minority groups (Black, Moon, & Baird, 2014; Caspi, Sorensen, Subramanian, & Kawachi, 2012).

For example, low-income neighborhoods were found to have fewer chain supermarkets compared with higher-income neighborhoods (Giang, Karpyn, Laurison, Hillier, & Perry, 2008; Powell, Slater, Mirtcheva, Bao, & Chaloupka, 2007). In addition, regarded as a deprived group due to physical mobility, senior residents are given particular attention in literature. Baltas, Paraskevas, and Skarmeas (2010) identified a negative association between age and the number of patronized supermarkets. In addition to low-income residents and seniors, a few studies have recently targeted the single-parent family group. Single parents, especially young single parents, are under a great burden to make a living and raise their children (Páez et al., 2009). Coveney and O'Dwyer (2009) conducted household interviews that ranged from single-member households to single-parent and two-parent families, and they found that having small children in tow influenced shopping habits. As a result, single-parent families are more likely to buy non-perishable items that can last several weeks rather than fresh foods that can only be good for a few days, if supermarkets and fresh food groceries are less accessible.

Meanwhile, a substantial number of studies emerged in the exploration of minority groups such as race/ethnicity. In general, the literature found that compared to predominantly white areas, neighborhoods/communities with predominantly minority and mixed races had lower supermarkets accessibility and had to travel more to get fresh foods (Morland & Filomena, 2007; Powell et al., 2007). As a result, this disadvantaged group was more likely to live in a food desert within their neighborhood environment (LeDoux & Vojnovic, 2013). In the line of such study in Canada, only a few cases were conducted targeting the minority group. Smoyer-Tomic et al. (2008) found out that visible minority groups tended to have lower access to supermarkets, while aboriginal group and newly immigrants were more likely to live close to supermarkets.

2.4. Modes of transportation

Transportation options also play a substantial role in determining fresh food access, particularly in automobile-oriented cities where residents and supermarkets are generally beyond a reasonable walking distance. McKenzie (2014) had a comprehensive review of measuring supermarket access regarding transit and transportation options.

Current studies mainly focus on two kinds of travel modes. One takes into account the private car or automobile access (Bader, Purciel, Yousefzadeh, & Neckerman, 2010; Páez et al., 2009). The other type is public transportation, which provides a crucial transit alternative for residents without automobile access (Bader et al., 2010; Neckerman, Bader, Purciel, & Yousefzadeh, 2009). In general, studies that considered transit access found that it mitigates some of the neighborhood disadvantages in terms of access to supermarkets, especially for low-income neighborhoods (Bader et al., 2010; Larsen & Gilliland, 2008). Jiao, Moudon, Ulmer, Hurvitz, and Drewnowski (2012) indicated that driving a car or taking a bus allows residents in deprived areas to reach low- or medium-cost supermarkets. In Canada, private car access in particular plays a key role when considering fresh food accessibility. Statistics Canada (2013a) indicated that about four out of five Canadian commuters use private vehicles (including cars, trucks, and vans). For example, Wang et al. (2014) found that the distance to a closest supermarket tends to be longer for neighborhoods with higher private car access.