Health & Place 51 (2018) 107–117

Contents lists available at ScienceDirect

Health & Place

journal homepage: www.elsevier.com/locate/healthplace

Neighborhood social and economic change and retail food environment change in Madrid (Spain): The heart healthy hoods study

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ARTICLE INFO

Keywords:
Residential environments
Neighborhood change
Food environment
Finite mixture model
Geographic information systems

ABSTRACT

This study explores the association between neighborhood social and economic change from 2009 to 2013 and changes in the retail food environment from 2013 to 2017 in Madrid (Spain). We classified neighborhoods into four types: decreasing SES, new housing/gentrifying, increasing SES, and aging (population and housing). Food store data was obtained from a retail spaces census and classified as supermarket, specialized small store, or fruit and vegetable store. Compared to aging areas, new housing/gentrifying and areas with increasing SES had a higher baseline presence and proportion of supermarkets and a lower proportion of specialized stores and fruit and vegetable stores. Areas with decreasing SES had an initially higher presence and proportion of fruit and vegetable stores but showed a declining trend in both presence and proportion of fruit and vegetable stores.

1. Introduction

Population dietary patterns are shaped by upstream determinants that differ across populations or within populations over time (Rose, 1985; Díez et al., 2016). The local food environment is defined as the set of contextual aspects of the local environment that have the potential to influence dietary behaviors (Franco et al., 2016; Swinburn et al., 2011; Story et al., 2008). As a contextual factor, the local food environment affects everyone living in an area and therefore qualifies as a potential upstream determinant of diet. The components of the local food environment include, among other factors, the location and accessibility of food stores and the availability of healthy foods within them (Glanz et al., 2007, 2005). Changes in these factors have the potential to affect population dietary patterns so understanding what causes changes in food stores (and their content) may be a feasible way to understand changes in diet (Story et al., 2008).

Southern European retail food environments are different from those in Anglo-Saxon countries, as they are dominated by small retailers, such as fruit and vegetable stores or fishmongers (Díez et al., 2016; Flavián et al., 2002). The number of outlets per resident is three times higher in Spain, Italy and Portugal compared to the UK, Finland, Denmark and Belgium (Flavián et al., 2002). Compared to Northern and Central Europe, the market share of the top retailers is reduced in Southern European countries (Flavián et al., 2002) as is the average number of supermarkets or shopping malls per resident. In the case of Spain, this is related to two factors: (a) the availability of a transportation network that is especially dense in city centers and other dense areas (as opposed to suburbs where large food retailers may open) (Castillo-Manzano and López-Valpuesta, 2009; Arranz-López et al., 2017); and (b) the presence of small business lobbies that have guaranteed protective regulatory mechanisms related to the opening of large food retailers (Flavián et al., 2002).

The presence of small food retailers in Madrid is abundant and appreciated by neighbors (Bilal et al., 2016), who argue that they place a higher trust on workers in these type of stores (Bilal et al., 2016; Díez et al., 2017). These food retailers (especially fruit and vegetable stores) have a favorable ratio of healthy to unhealthy foods (Díez et al., 2016; Bilal et al., 2016), and surveys have found that on average, people prefer buying fresh produce in them (as compared to supermarkets) (Direccion General de Salud Publica y Alimentacion, 2007). A report from the Spanish Minister of Agriculture showed that small stores ("traditional stores") have the highest market share of fruits and

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https://doi.org/10.1016/j.healthplace.2018.03.004
Received 29 September 2017; Received in revised form 1 March 2018; Accepted 13 March 2018
1353-8292/

vegetables, while supermarkets have the highest share of ultra-processed foods (Ministerio de Agricultura Alimentacion y Medio Ambiente, 2015). Moreover, prices of fresh produce are similar in both types of outlets, while the average price of ultra-processed foods is half in supermarkets (Ministerio de Agricultura Alimentacion y Medio Ambiente, 2015). There is evidence from other countries that supermarkets may contribute to increased caloric intake and increased consumption of ultra-processed foods in particular (Hawkes, 2008). Several studies have also linked the increased presence of supermarkets to an increase in the availability (Cameron et al., 2012; Thornton et al., 2012), and purchases of ultra-processed foods (Rodríguez et al., 2002; Machado et al., 2017), and increased obesity prevalence (Asfaw, 2008, 2011; Courtemanche and Carden, 2011). New research in the US has shown that the previously found dietary benefits of supermarkets (in the US) may be overstated (Cummins et al., 2014).

A report from the early 2000s has studied the longitudinal trends in food retailer types in Spain (without explicitly spatial data) and has noted that small traditional stores were in decline while bigger stores (such as supermarkets) were becoming dominant (Vignali et al., 2001). There is a need for an understanding of where these changes are happening, as it may lead to increased exposure to unhealthy foods and decreased availability of healthy foods. The literature on these effects in Spain is scarce, but there is evidence that children and adolescents living in neighborhoods with worse socioeconomic indicators in Madrid have a higher prevalence of obesity (Villanueva et al., 2015).

Studies of neighborhood social and economic change are scarce in the public health literature. Most studies use the residential mobility of participants as the instrument to study these changes (Jokela, 2014, 2015; White et al., 2016; Ludwig et al., 2011). However, most people that move relocate to similar areas (Glass and Bilal, 2016); moreover, most of the population of an area does not move in a given year (Glass and Bilal, 2016). Only a few recent studies have leveraged long follow-up in cohorts to examine the consequences of neighborhood change (James et al., 2017; Wing et al., 2016; Richardson et al., 2014a, b; Rummo et al., 2017; Lippert et al., 2017). The dearth of studies looking at change in neighborhood characteristics challenges our ability to study contextual characteristics, such as the local food environment, and their effect on health. Cross-sectional studies have shown evidence for a strong patterning of the food environment by socioeconomic and sociodemographic characteristics (Black et al., 2014). There is also evidence for a difference in how food environments change by levels of socioeconomic neighborhood characteristics (Rummo et al., 2017, 2016; Cobb et al., 2015), and how disparities in the retail food environment are either increasing (Warren and Gordon-Larsen, 2017) or even emerging in areas that were relatively equitable (Larsen and Gilliland, 2008). Previous research has shown that socioeconomic trajectories (Richardson et al., 2014a, b) and changes in the disorder of neighborhoods (Mui et al., 2017a, 2017b) are associated with differential patterns of change in the food environment. However, research on longitudinal changes in neighborhood characteristics is usually restricted to socioeconomic factors and race/ethnicity and usually does not consider other factors such as changes in housing (construction or renovation) or residential mobility, which are some of the main drivers of neighborhood change (van Ham et al., 2012).

Few studies have looked at the consequences of specific neighborhood change patterns on the food environment. A study in New York found that two specific gentrifying areas had more 'boutique' stores and large chain-stores (Zukin et al., 2009), as opposed to small locally owned stores. Large chain-stores have a higher capacity to earn profits (due to economies of scale) and can sustain increased property values in the area (Zukin et al., 2009). Another study conducted in 4 areas of the US found that, while the density of supermarkets increased regardless of SES, this increase was stronger in areas with increasing SES. We therefore hypothesize that areas with increasing socioeconomic status will show a decrease in the proportion of small food stores, specifically fruit and vegetable stores, and a relative increase in the number of supermarkets.

1.1. Objective

Our objectives were: (1) to describe retail food environment changes over a 5-year period (2013–2017) in the city of Madrid; and (2) to study the association between neighborhood social and economic change, from 2009 to 2013, and subsequent changes in the distribution of food stores, from 2013 to 2017.

2. Methods

2.1. Study setting

Our study was conducted using data from the municipality of Madrid, Spain. The city is divided into 21 census districts, 128 neighborhoods, and around 2400 census sections. Appendix Table 1.1 describes the structure of these units. Some census sections may have populations as low as 700 or as high as 3500. Their boundaries are updated annually for election purposes and may result in a split or merging of census sections. We constructed a "common" set of census sections (n = 2272) that were consistent during the study period. We conducted all analyses at the common census section level. Data for neighborhood social and economic change spanned from January 2009 to January 2013, while data for food environment changes spanned from June 2013 through January 2017.

2.2. Neighborhood social and economic change

Our primary exposure of interest was neighborhood social and economic change. In a previous study (currently under review, see the Appendix B for more details), we compiled 16 indicators of neighborhood change for every census section of Madrid from 2009 to 2013. These included indicators of change in sociodemographic and socioeconomic characteristics, housing, mobility, and diversity. We then used a finite mixture model to classify all census sections of Madrid (n = 2272) into four types of neighborhood social and economic change. Each census section was assigned a type of change using the method recommended by Bray et al. (2015). Bray has shown how the assignment of type membership (to each observation) is biased unless predictors of type membership are included, including the outcome under study. To implement Bray's method, we included the average number of stores in each category (see below) from 2013–2017 as a predictor of type membership in the finite mixture model. We then used the most likely type (modal class assignment method) for each census section.

2.3. Retail food environment changes

Our primary outcome of interest was the change in the retail food environment. For this, we studied changes in the total number of food stores, and the number of supermarkets, small specialized stores (fruit and vegetable stores, fishmongers, butcheries, and bakeries), and specifically fruit and vegetable stores. This categorization was based on previous studies (Bilal et al., 2016), formative research (Díez et al., 2017a, 2017b), and other research in Spain that highlights the dichotomy between supermarkets and small stores (Achón et al., 2017). Fruit and vegetable stores have lower scores on standard measures of healthy food availability (such as the Healthy Food Availability Index, HFAI (Díez et al., 2016; Bilal et al., 2016)) compared to supermarkets because they lack some healthy foods like whole grain bread or low-fat milk. However, they are a focus here because they are the primary source of fruits and vegetables and generally carry no unhealthy products (Bilal et al., 2016). While other specialty stores may carry less healthy products (meat or baked