Health & Place 30 (2014) 1–3

Contents lists available at ScienceDirect

Health & Place

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

Viewpoint

When are food deserts? Integrating time into research on food accessibility

Michael J. Widener [a,*], Jerry Shannon [b,1]

[a] Department of Geography, University of Cincinnati, PO Box 210131, Cincinnati, OH 45221-0131, USA
[b] Department of Geography, University of Georgia, 210 Field St., Rm. 204, Athens, GA 30602, USA

ARTICLE INFO

Article history:
Received 27 May 2014
Received in revised form
15 July 2014
Accepted 24 July 2014
Available online 21 August 2014

Keywords:
Food deserts
Food accessibility
Spatio-temporal analysis
Space-time accessibility
Health geography

ABSTRACT

The food desert concept is used as a means for defining regions as having inadequate spatial and socioeconomic access to vendors selling nutritious foods. This primarily aggregate-level and static method for understanding the food environment is commonly used by researchers and policy makers seeking to improve health outcomes of those affected by reduced access. However, recent research findings have brought the association between living in a food desert and adverse health outcomes into question. In this viewpoint, we put forward the idea that the food desert concept, and food accessibility research more generally, should be expanded to include a temporal component, and note potential avenues for future research.

1. Introduction

Food deserts are commonly defined as regions lacking (spatial) access to healthy foods, like fruits and vegetables, as well as a range of other nutritious options (Beaumont et al., 1995; USDA, 2013). The "desert" component of the term is inherently spatial, and emphasizes the physical absence of food vendors that provide healthy options in low-income neighborhoods (Cummins and Macintyre, 1999). The spatial nature of food deserts is highlighted by the common practice of defining them through pre-existing areal units, like U.S. census tracts. A common thread between all of these food desert identification methods is the use of aggregate-level and atemporal data. The US Department of Agriculture's (USDA) Food Accessibility Mapper – which identifies census tracts as lacking food access – epitomizes this concept of food access (USDA, 2013). This tool provides a national map of low-income, low-access areas using only two primary criteria: the population's poverty rate and distance to the nearest supermarket (For examples using this methodology see: Dai and Wang, 2011; Eckert and Shetty, 2011; Pearce et al., 2006).

While these aggregate-level and static measures of food accessibility provide an efficient method for understanding the healthy food environment, researchers testing the relationship between objective health outcomes and static spatial access have found mixed evidence supporting an association between these two measures (Holsten, 2009). In many urban areas, though certainly not in all cases, low-income neighborhoods and communities of color have limited geographic access to large supermarkets (Apparicio et al., 2007; Block and Kouba, 2006). However, the association between residence in these areas and health outcomes has been shaky at best (An and Sturm, 2012; Lee, 2012).

Given this information, it is problematic that national and local governments, alongside charitable foundations, have relied on the food desert concept to inform and fund policy decisions in a range of cities, including Chicago, San Diego, Baltimore, and New York City (Couzin-Franke, 2012; Gallagher, 2009; Gary, 2012). Consider the recent case in Philadelphia, PA, where the Pennsylvania Fresh Food Financing Initiative helped fund the construction of a new supermarket in a low accessibility census tract. The rationale for this intervention largely relied on the spatial component of the food desert concept—namely that increased physical access would improve the nutrition in nearby residents' diets, and subsequently their health and well-being. However, a follow up survey conducted a half-year after the store opening found the new supermarket had no significant impact on food shopping behavior or health (Cummins et al., 2014).

While distance to retail locations may play a significant role in food consumption decisions, qualitative work has shown that it is just one of a number of factors, alongside existing mobility

* Corresponding author. Tel.: +1 513 556 2849.
E-mail addresses: michael.widener@uc.edu (M.J. Widener), jshannon@uga.edu (J. Shannon).
[1] Tel.: +1 706 542 1656

http://dx.doi.org/10.1016/j.healthplace.2014.07.011
1353-8292/

patterns, dynamic social ties, and changing demands upon the household budget (Shaw, 2006; Whelan et al., 2002). Indeed, several studies have shown that individuals do not always use stores closest to their homes for numerous reasons (LeDoux and Vojnovic, 2013; Shannon, 2014; Zenk et al., 2011). The overreliance on measures of geographic proximity in many studies may thus account for inconsistent findings. Additionally, a rich literature exists in the field of geography documenting the utility of spatiotemporal approaches to measuring accessibility (Miller, 2007; Kwan, 2013). With this in mind, we argue that future research measuring healthy food accessibility would benefit from increased attention to a crucial and understudied component to understanding why and how people access healthy foods: time.

Kwan (2012b) has described the importance of spatiotemporal analysis through what she terms the uncertain geographic context problem. In the case of food deserts, previous research may be limited by its atemporal nature and reliance on place of residence as a proxy for individual location. While some have integrated space-time conceptualizations of the food environment into their work (Chen and Clark, 2013; Horner and Wood, 2014; Widener et al., 2013; Zenk et al., 2011) the practice is both recent and rare in the healthy food environment literature. The integration of a spatiotemporal framework into future food environment studies is critical if the linkages between our lived spaces, shopping behavior, food consumption, and health outcomes are to become clear. We outline below two important dimensions in which an integration of temporal data might strengthen research into food deserts and their effects on health.

2. Temporality of the food system

Most research on the food environment is cross sectional in focus, analyzing all food sources without reference to operating hours or, in the case of food trucks and mobile markets, changes in location. Supermarkets, convenience stores, specialty markets, farmers' markets and mobile food trucks open and close at various times throughout the day (Chen and Clark, 2013). Additionally, mobile food vendors, such as New York City's Green Carts, move across space, providing temporary food accessibility to new populations at different hours of the day (Leggat et al., 2012).

Beyond these issues, the makeup of the food system itself changes over time. The rise of the supermarket did not occur until the middle of the 20th century, and over a matter of decades this "disruptive" model completely transformed how people interact with and purchase food (Seth and Randall, 2001). Early research on food deserts was often situated in a broader discussion of retail restructuring in urban neighborhoods (Cummins and Macintyre, 1999). This focus has faded over time, with few current studies analyzing changes in store locations and food accessibility over time (two notable exceptions are Burgoine et al. (2009) and Larsen and Gilliland (2008)). Two interrelated processes may be of interest to future work in this area. First, "supermarket redlining" is perhaps the most common scenario; cases where supermarkets followed white, middle class residents to the suburbs during the height of suburbanization (Eisenhauer, 2001). Second, given the interest of upscale retailers such as Whole Foods in relocating to urban food deserts, it is also worth examining the connection between neighborhood gentrification and changes to the urban foodscape (Bomey, 2013). Research on both of these processes involves collection of longitudinal data, a time consuming task and one not easily available through existing data sources such as InfoUSA's or Dun and Bradstreet's databases. Yet, a better understanding of these processes would strengthen initiatives seeking to increase food access in low-income areas by identifying the connections between food access and broader neighborhood restructuring.

Another key issue relates to the cycles of food purchasing in low-income neighborhoods. In the United States specifically, food assistance through the SNAP and WIC programs arrives once a month, and many individuals spend the majority of these benefits soon after receiving them, largely at large retailers. As the month ends, these individuals rely more heavily on the emergency food system for support or may spend money out of pocket at smaller retailers. More research is needed on the implications of this monthly pattern for food purchasing behaviors and how stores and food shelves adapt to it.

Lastly, seasonality may matter to the food system in a literal sense, with access to alternative food sites such as farmers' markets greatly curtailed during cold weather months, and with transportation to retailers more generally difficult during this time. Farmers' markets themselves are subject to changing weather conditions, generally selling healthy produce that also changes based on the timing of different crops' harvests (Widener et al., 2011). Analyzing how access to retailers may change during times of extreme heat or cold might be another productive direction for future research.

3. The mobile person

In almost all cases, research on food deserts has used place of residence as a proxy for individual location. For low-income groups, whose actual place of residence, and thus foodways, may change more frequently than the general population, this is inherently problematic. In addition, an increasing amount of evidence, primarily relying on GPS tracking and commuting data, confirms that individuals are highly mobile and that this mobility significantly affects their exposure to various food sources (LeDoux and Vojnovic, 2013; Shannon, 2014; Widener et al., 2013). The factors shaping individual mobility vary from person to person. They include travel for work, but also visits to friends or family and trip chaining—the act of combining food shopping with other daily errands or activities.

Mode of travel also affects neighborhood mobility. While past studies have accounted for road and public transit networks (Burgoine and Monsivais, 2013), these most often employ buffered spaces a set distance from home. Data on commuting provides a more valid measure of daily activity, but neglects other destinations and may not be useful for populations with high rates of unemployment or non-standard work hours. Attention to various modes of transportation is useful, but again these are measured most often from place of residence and as mentioned above, may not account for changes in congestion or transit schedules throughout the day.

The changing conditions and efficiencies of urban transportation networks also play a significant role in shaping this mobility. For automobile users, traffic congestion during rush hours could impose a time cost to grocery shopping much larger than what would be experienced at less busy times of day. Likewise, the frequency of service, reliability, and spatial extent of a city's public transportation system can greatly impact the amount of time a transit rider needs to get to a food vendor. While some researchers have included distances to transit stops in their analyses (Burgoine and Monsivais, 2013), this approach fails to account for the sometimes complex nature of navigating a transit system (e.g. route frequency and transfers, willingness to trade shorter walking distances for greater distances via transit) (Widener et al., 2014). Finally, walking and biking to healthy food opportunities bring their own time related dynamics, with factors like safety and weather conditions playing different but still significant roles.

A more robust set of "mobile methodologies" may thus be needed, including but not limited to increasingly sophisticated techniques for analyzing spatiotemporal data (Hein et al., 2008). Broader research on mobility in the social sciences has provided multiple options, including space-time prisms, the walking interview, and geoethnography (Evans and Jones, 2011; Kwan, 2012a; Matthews et al., 2005). Transportation diaries are another underused source of data on daily mobility and interactions with the food system. Rather than simply analyzing all the potential exposures to food sources, these approaches would identify nodes in the network of daily mobility where individuals are mostly likely to obtain food and articulate how and why these may differ across subpopulations.

4. Where and when are food deserts?

A vast literature has documented numerous ways for identifying and defining food access in spatial terms (Walker et al., 2010). However, as documented above, there are many opportunities to incorporate the temporal dimension into research on accessibility to nutritious food. With an increasing amount of attention being focused on food environment research to inform policy decisions, and follow up studies showing static spatial measures of access not consistently linked to health outcomes, it is important that geographers and geographically inclined health researchers begin to ask not just where we might find food deserts, but when.

References

An, R., Sturm, R., 2012. School and residential neighborhood food environment and diet among California Youth. Am. J. Prev. Med. 42, 129–135.

Apparicio, P., Cloutier, M.-S., Shearmur, R., 2007. The case of Montreal's missing food deserts: evaluation of accessibility to food supermarkets. Int. J. Health Geogr. 6, 4.

Beaumont, J., Lang, T., Leather, S., Mucklow, C., 1995. Report from the Policy Subgroup to the Nutrition Task Force Low Income Project Team. Institute of Grocery Distribution.

Block, D., Kouba, J., 2006. A comparison of the availability and affordability of a market basket in two communities in the Chicago area. Public Health Nutr. 9, 837–845.

Bomey, N., 2013. Whole Foods sets June opening for Detroit store, Detroit Free Press. [1 March 2013]. Gannett, Detroit.

Burgoine, T., Lake, A.A., Stamp, E., Alvanides, S., Mathers, J.C., Adamson, A.J., 2009. Changing foodscapes 1980–2000, using the ASH30 study. Appetite 53, 157–165.

Burgoine, T., Monsivais, P., 2013. Characterising food environment exposure at home, at work, and along commuting journeys using data on adults in the UK. Int. J. Behav. Nutr. Phys. Act. 10, 85.

Chen, X., Clark, J., 2013. Interactive three-dimensional geovisualization of space–time access to food. Appl. Geogr. 43, 81–86.

Couzin-Franke, J., 2012. Tackling America's eating habits, one store at a time. Science 337, 1473–1475.

Cummins, S., Flint, E., Matthews, S.A., 2014. New neighborhood grocery store increased awareness of food access but did not alter dietary habits or obesity. Health Aff. 33, 283–291.

Cummins, S., Macintyre, S., 1999. The location of food stores in urban areas: a case study in Glasgow. Br. Food J. 101, 545–553.

Dai, D., Wang, F., 2011. Geographic disparities in accessibility to food stores in southwest Mississippi. Environ. Plann.—Part B 38, 659.

Eckert, J., Shetty, S., 2011. Food systems, planning and quantifying access: using GIS to plan for food retail. Appl. Geogr. 31, 1216–1223.

Eisenhauer, E., 2001. In poor health: supermarket redlining and urban nutrition. GeoJournal 53, 125–133.

Evans, J., Jones, P., 2011. The walking interview: methodology, mobility and place. Appl. Geogr. 31, 849–858.

Gallagher, M., 2009. The Chicago Food Desert Update Report, Mari Gallagher Research & Consulting Group.

Gary, M., 2012. N.Y. food desert fund distributes 6 million. Supermarket News, Available from: ⟨http://supermarketnews.com/retail-amp-financial/ny-food-desert-fund-distributes-6-million⟩. [18 April 2012].

Hein, J.R., Evans, J., Jones, P., 2008. Mobile methodologies: theory, technology and practice. Geogr. Compass 2, 1266–1285.

Holsten, J.E., 2009. Obesity and the community food environment: a systematic review. Public Health Nutr. 12, 397–405.

Horner, M.W., Wood, B.S., 2014. Capturing individuals' food environments using flexible space-time accessibility measures. Appl. Geogr. 51, 99–107.

Kwan, M.-P., 2012a. How GIS can help address the uncertain geographic context problem in social science research. Ann. GIS 18, 245–255.

Kwan, M.-P., 2012b. The uncertain geographic context problem. Ann. Assoc. Am. Geogr. 102, 958–968.

Kwan, M.-P., 2013. Beyond space (as we knew it). Ann. Assoc. Am. Geogr. 103, 1078–1086.

Larsen, K., Gilliland, J., 2008. Mapping the evolution of 'food deserts' in a Canadian city: supermarket accessibility in London, Ontario, 1961–2005. Int. J. Health Geogr. 7, 1–16.

LeDoux, T.F., Vojnovic, I., 2013. Going outside the neighborhood: the shopping patterns and adaptations of disadvantaged consumers living in the lower eastside neighborhoods of Detroit, Michigan. Health Place 19, 1–14.

Lee, H., 2012. The role of local food availability in explaining obesity risk among young school-aged children. Soc. Sci. Med. 74, 1193–1203.

Leggat, M., Kerker, B., Nonas, C., Marcus, E., 2012. Pushing produce: the New York City Green Carts initiative. J. Urban Health Bulletin of the New York Academy of Medicine 89, 937.

Matthews, S.A., Detwiler, J.E., Burton, L.M., 2005. Geo-ethnography: coupling geographic information analysis techniques with ethnographic methods in urban research. Cartographica: The International Journal for Geographic Information and Geovisualization 40, 75–90.

Miller, H., 2007. Place-based versus people-based geographic information science. Geogr. Compass 1, 503–535.

Pearce, J., Witten, K., Bartie, P., 2006. Neighbourhoods and health: a GIS approach to measuring community resource accessibility. J. Epidemiol. Community Health 60, 389–395.

Seth, A., Randall, G., 2001. The Grocers: The Rise and Rise of the Supermarket Chains. Kogan Page Publishers, Dover, New Hampshire.

Shannon, J., 2014. What does SNAP benefit usage tell us about food access in low-income neighborhoods? Soc. Sci. Med. 107, 89–99.

Shaw, H.J., 2006. Food deserts: towards the development of a classification. Geogr. Ann. Ser. B 88, 231–247.

USDA ERS, 2013. Food Access Research Atlas. Available from:⟨http://www.ers.usda.gov/data-products/food-access-research-atlas.aspx⟩. [20 October 2013].

Walker, R.E., Keane, C.R., Burke, J.G., 2010. Disparities and access to healthy food in the United States: a review of food deserts literature. Health Place 16, 876–884.

Whelan, A., Wrigley, N., Warm, D., Cannings, E., 2002. Life in a 'food desert'. Urban Stud. 39, 2083–2100.

Widener, M., Farber, S., Neutens, T., Horner, M., 2014. Spatiotemporal accessibility to supermarkets using public transit: an interaction potential approach in Cincinnati, Ohio. In: 93rd Annual Meeting of the Transportation Research Board. Washington DC.

Widener, M.J., Farber, S., Neutens, T., Horner, M.W., 2013. Using urban commuting data to calculate a spatiotemporal accessibility measure for food environment studies. Health Place 21, 1–9.

Widener, M.J., Metcalf, S.S., Bar-Yam, Y., 2011. Dynamic urban food environments: a temporal analysis of access to healthy foods. Am. J. Prev. Med. 41, 439–441.

Zenk, S.N., Schulz, A.J., Matthews, S.A., Odoms-Young, A., Wilbur, J., Wegrzyn, L., Gibbs, K., Braunschweig, C., Stokes, C., 2011. Activity space environment and dietary and physical activity behaviors: a pilot study. Health Place 17, 1150–1161.