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Spatial access to food: Retiring the food desert metaphor

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A B S T R A C T

The food desert metaphor has been widely used over the past few decades as a way to identify regions as being at risk for having little or no access to healthy food. While the simplicity of the metaphor is attractive, this article argues that its usefulness to researchers interested in understanding the relationship between the geography of healthy food opportunities and dietary behaviours is limited. More nuanced approaches to incorporating geography into food access studies, like including transportation, economic factors, and time use, in addition to considering other dimensions of accessibility, are warranted.

1. Introduction

Researchers, politicians, community groups, and activists have been increasingly interested in how the built environment impacts the health of individuals in a range of geographic and social contexts. This "spatial turn" in health research [1] has resulted in many health-related disciplines explicitly considering spatial variations in the distribution of positive and negative influences and outcomes. One recent area where geographic thinking was applied was the study of spatial access to healthy food, a necessary but not sufficient component to maintaining a healthy diet.

"Food deserts," a term reported to have arisen from the United Kingdom in the early 1990s [2], are generally reported to be regions in which access to food retailers that stock fresh, affordable, and healthy food options are lacking or nonexistent. While there is no universally agreed upon definition, early definitions included those put forward by government ministers, like the UK's health minister Tessa Jowell in 1997, who identified food deserts as areas "where people do not have easy access to healthy, fresh foods, particularly if they are poor and have limited mobility" [3,4]. The lack of geographic access is a problem, the reasoning goes, because those without the ability to physically acquire healthy foods will be less likely to incorporate such foods into their diets, leading to the consumption of food from readily available retailers (e.g. fast food restaurants and convenience stores) that typically supply options with lower nutrient and higher energy densities [5]. This ultimately can result in a range of health issues like hypertension, diabetes, and other obesity-related comorbidities [6].

The use of the word desert is appealing, as it lends an explicit spatiality to the concept of food inaccessibility, evoking a barren landscape, devoid of food for the people within. In practice, it also simplifies the issue of food accessibility to a binary – regions where people are in food deserts, and regions where people are not in food deserts. Early on, Cummins and Macintyre critiqued this simplification, noting that the food desert concept is a factoid – an assumption or speculation "reported and repeated so often that" it is "popularly considered true; they are simulated or imagined facts" [2]. The authors go on to discuss the social and political context that can propel a factoid into government health policy, and emphasize that, despite the term's popularity, there is a lack of empirical evidence.

A clear example of the reliance on this simplification was found in early iterations of the US Department of Agriculture's Food Access Research Atlas, originally called the "Food Desert Locator" [7]. This mapping tool presented the locations of census tracts they defined to be food deserts because a sufficient number of residents are considered low-income and live more than one mile away (in urban areas) from the nearest grocery store. In a press release in 2011, the then Agriculture Secretary Tom Vilsack is quoted as saying the mapping tool "…will help policy makers, community planners, researchers, and other professionals identify communities where public-private intervention can help make fresh, healthy, and affordable food more readily available to residents." The tool's purpose was to pinpoint discrete regions for spatially targeted interventions intended to improve diets of residents.

This rough approach disregarded the evidence that food shopping and urban mobility are complex. Research has shown that many people do not shop at the closest food retailer [8,9] and transportation mode can drastically change levels of spatial accessibility to supermarkets [10,11]. Later iterations of the USDA's atlas have taken a more careful and general approach by, for example, including a census tract-level food access measure that incorporated car ownership, and also moved away from the term "food desert." However, the USDA's platform still

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takes an all or nothing approach, designating the people within tracts that meet specified criteria as residing in a region with low levels of spatial access to healthy food options [12].

This simplification gets to the fundamental problem with the food desert metaphor: it overemphasizes space in a multidimensional problem, where its role varies depending on a range of other factors like income, household characteristics, transportation options, and time use, to name only a few. For the low-income parent working two jobs, living within walking distance to an affordably priced supermarket may not matter because of constraints on their time and activity space. Conversely, a high-income couple where only one partner works may live a great distance from the nearest healthy food retail option, but have no issues accessing and consuming healthy food because the non-working partner has the time and resources to make the trip. The food desert concept, an inherently spatial representation of healthy food access, implicitly leads those developing targeted interventions aimed at improving the nutritional content of diets to focus on the geographic characteristics of food retail and discard the many other important factors linked to dietary behaviours.

This is not to say that the geography of food retail and spatial accessibility has no marginal effect on diets and nutrition. Much good work has been done on measuring the food retail environment by researchers in geography, planning, nutrition, and public health [13–15], and a review of the literature does find that there are inequities in spatial access to food retail in the United States, if not in other high-income nations [16]. Rather, it is important to retire the food desert metaphor and consider spatial access as one component of a more holistic accessibility framework. For example, work by Penchansky and Thomas from 1981, more than a decade before the rise of the food desert, describes overall access to health services as a function of availability (the number of opportunities), accessibility (the spatial configuration of opportunities), accommodation (how clients are accepted), affordability (the cost of the service or product), and acceptability (clients' attitudes about the characteristics of providers) [17]. While their focus was on patients' interaction with the healthcare system, their generalized framework maps nicely to access to healthy food, without overemphasizing any one component. For example:

- Availability: the quantity of retailers stocking healthy food options,
- Accessibility: the spatial configuration of food retailers with healthy food,
- Accommodation: the ability of food retailers to accept alternative payments (e.g. WIC),
- Affordability: the price of healthy food options, and
- Acceptability: the stock of culturally appropriate foods.

From this list, it is apparent that the food desert metaphor emphasizes one of the five aforementioned dimensions ([spatial] accessibility), and can only generally account for the others through simplifying characteristics about aggregated populations and retail within some region.

In the next two sections of this piece, the cartographic limitations of relying on the food desert metaphor to identify regions with little or no access to healthy food and alternative practices for measuring the geography of food retail access are briefly presented. The geography of access to food is an important topic to study, but to achieve the desired outcome of identifying populations with a need for improved dietary outcomes, the food desert concept's utility is questionable. As a tool designed to identify the geography of populations who face barriers to maintaining a healthy diet, a more comprehensive approach is needed, and a more nuanced treatment of space is required.

2. Cartographic limitations to the food desert metaphor

There are a range of challenges faced by researchers and policy makers trying to.

understand and communicate the spatial distribution of any phenomena via mapping. For centuries, geographers and cartographers have struggled with the limitations of maps and sought ways to overcome them; maps are models and should be interpreted as such. In regard to food deserts, the fallacy of division [18], the modifiable areal unit problem [19], and boundary effects [20] must all be accounted for if an accurate representation of spatial access to healthy food for at risk populations is to be achieved.

More recently, advances in geographic information systems (GIS) have allowed for representations of food deserts to become less rigid. In particular, interactive maps let users shift time frames, choose different political boundaries (e.g. census blocks to census tracts), and dynamically select the criteria that determine categorization as a food desert (for example, see work by Chen and Clark [21]). While these new abilities provide increased flexibility in selecting regions as food deserts, the fundamental issue of generalizing arbitrarily defined zones remains.

In addition, it is difficult for any food desert measure to capture the importance of the dynamics of everyday life. For example, shifts in the distribution of the population as they move through their activity spaces, the opening and closing of food retail options, and broader seasonal and annual trends in availability [22–24] all contribute to a moving target when it comes to pin pointing discrete spatial units (typically only focussing on residential locations) with lower levels of access. It is important to note again that it is not necessarily a problem that food deserts are simplifications of access. However, because they are intended to serve as a means for identifying populations inside of areas where there is an increased risk for maintaining unhealthy diets, it is expected that this could be achieved somewhat reliably. Nevertheless, in multiple review articles [25,26] and a cross-sectional study [27] that have examined exactly this issue, this has not been the case. For example, Caspi et al. [26] point out that the reason for some of these inconsistent findings could be related to an overreliance on GIS-based measures that fail to account for the many non-spatial variables that explain the relationship between the food environment and diet.

3. Alternative means for measuring the spatial access to food

Where do the limitations of the food desert metaphor leave researchers interested in spatial patterns of inaccessibility to healthy food retailers? Given the increase in spatial and temporal data availability on a range of topics, from food retail locations to transit networks, and widely available and easy to use GIS software packages, it is becoming easier to incorporate some of the complexities that may be responsible for the weak relationships found when studying the links between food deserts and nutrition. A number of potential approaches, all focused on a more comprehensive accounting of exposure and access to food retail across space, are described here.

Beginning in the later 2000s, numerous academics have integrated some of the aforementioned spatial dynamics into their studies of spatial access to healthy food. In some cases, this involved the use of data collected on travel patterns [10,28–31]. With these data it was possible for researchers to map routine trips (e.g. daily commutes) as a way to provide a more complete approach to understanding what food retailers were spatially available to populations in various study areas. While these studies do provide more information about various populations' space-time paths, they are limited by the data's focus on a limited set of activity spaces (e.g. only work and home), which discounts other commonly travelled places or over emphasizes those with fulltime employment.

Similar to this work, there has been an increase in the number of food environment studies that utilize global positioning system (GPS) devices [32–34]. The ubiquity of smart phones with GPS technology has made it much easier to collect large amounts of spatial trajectory data alongside other types of potentially useful information (e.g. pictures of receipts) on-the-fly. This data collection method provides more