



Disparities and access to healthy food in the United States: A review of food deserts literature

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ABSTRACT

Increasingly, studies are focusing on the role the local food environment plays in residents' ability to purchase affordable, healthy and nutritious foods. In a food desert, an area devoid of a supermarket, access to healthy food is limited. We conducted a systematic review of studies that focused on food access and food desert research in the United States. The 31 studies identified utilized 9 measures to assess food access. Results from these studies can be summarized primarily into four major statements. Findings from other countries offer insight into ways, in which future research, policy development and program implementation in the U.S. may continue to be explored.

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1. Background

Environmental conditions have been extensively explored as contributing factors in promoting health disparities (Lee, 2002; Sexton, 2000). It is widely accepted that racial/ethnic minority neighborhoods are disproportionately affected by increased rates of morbidity, mortality and adverse health outcomes (Cubbin et al., 2001; Deaton and Lubotsky, 2003). These disparities are believed to be associated with factors, including residential segregation, poverty and neighborhood deprivation (Gee and Payne-Sturges, 2004), which can lead to adverse health outcomes. Previous studies focused on the ill-effects of neighborhood deprivation have reported the tendency of poor and minority neighborhoods to have an increased exposure to unhealthy advertisements for tobacco and alcohol (Morello-Frosch et al., 2002), fewer pharmacies with fewer medications (Morrison et al., 2000), and fewer supermarkets which offer a larger variety of affordable and healthy foods compared to smaller convenience stores (Morland et al., 2002b). The latter is of importance due to the emergence of “food deserts” in many low-income and minority neighborhoods that result from the absence of a supermarket.

The phrase “food desert” was first used in the early 1990s in Scotland by a resident of a public housing sector scheme (Cummins and Macintyre, 2002). Since that time, the phrase has been used

differently by different researchers. For example, in a study by Hendrickson et al. (2006) food deserts were defined as “urban areas with 10 or fewer stores and no stores with more than 20 employees” (2006: 372). Cummins and Macintyre (2002) define food deserts as “poor urban areas, where residents cannot buy affordable, healthy food” (Cummins and Macintyre, 2002). The latter definition focuses on the type and quality of foods rather than the number, type and size of food stores available to residents. Beyond these descriptions, there is a lack of consensus on the definition of food deserts (Hendrickson et al., 2006), and what measures are required for identifying food deserts, thereby contributing to the debate about their actual existence (Cummins and Macintyre, 2002; Cummins, 2003; Reisig and Hobbiss, 2000; Shaw, 2006).

In the U.S., several theories to how food deserts formed have been postulated. One theory has been associated with both the development and closure of stores (Curtis and McClellan, 1995; Guy et al., 2004). It is believed that the growth of large chain supermarkets on the outskirts of inner-cities in more affluent areas offer consumers a better quality, variety and price for food options. Additionally, these venues tend to have longer business hours and better parking options that are attractive to consumers (Alwitt and Donley, 1997; Guy et al., 2004). The expansion of these supermarkets have forced the smaller, independent, neighborhood grocery stores to close, thereby creating areas where affordable, varied food is accessible to those who have access to a car, or those able to pay public transportation costs (Guy et al., 2004). This theory has led one independent retailer to define a food desert as ‘an area where high competition from the multiples [large chain supermarkets] has created a void’ (Furey et al., 2001).

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Another theory of how food deserts formed in the inner-cities pertain to changes in demographics in larger U.S. cities between 1970 and 1988. It is speculated that during this period, economic segregation became more prominent with more affluent households emigrating from inner-cities to suburban areas (Bianchi et al., 1982; Nyden et al., 1998; Wienk et al., 1979). This shift caused the median income in the inner-cities to decrease and forced nearly one-half of the supermarkets in the three largest U.S. cities to close (Alwitt and Donley, 1997; Diesenhouse, 1993; Miller, 1994).

Other factors that make the establishment of businesses in inner-cities less desirable are inaccurate perceptions of these areas, declining demand for low-skilled workers, low-wage competition from international markets and zoning laws (Gittel and Thompson, 1999). For instance, in urban areas, it is difficult for large supermarkets to find land that is appropriate for the size of the supermarket, due to fragmentation of property that results from the ease of selling smaller pieces of land (Alwitt and Donley, 1997). It is plausible that urban food deserts would have a competitive advantage as sites for a supermarket, due to its prime location near the city center, ability to address an unmet demand and access to a large labor force. However, financial gain is often an underlying factor that tends to override these characteristics and deter retailers from establishing in the urban areas (Gittel and Thompson, 1999).

A consequence of poor supermarket access is that residents have increased exposure to energy-dense food (“empty calorie” food) readily available at convenience stores and fast-food restaurants (Drewnowski and Specter, 2004). It is documented that a diet filled with processed foods, frequently containing high contents of fat, sugar and sodium, often leading to poorer health outcomes compared to a diet high in complex carbohydrates and fiber (Block et al., 2004; Mari Gallagher Research & Consulting Group, 2006; Lewis et al., 2005; Swinburn et al., 2004). For those who are low-income, maintaining a healthy diet can be difficult to achieve due to various factors (Chung and Myers, 1999; Freedman, 1991; Hendrickson et al., 2006). First, the lack of financial resources present a barrier to healthy eating, due to the increased cost associated with healthy eating. Second, many urban areas lack a supermarket, thereby, limiting access to healthy foods for residents. For residents without access to a personal vehicle for transport to food stores outside the immediate neighborhood, residing in a food desert can be even more deleterious (Kirkup et al., 2004; Lake and Townshend, 2006).

People tend to make food choices based on the food outlets that are available in their immediate neighborhood (Furey et al., 2001). This can pose problems since many low-income, urban areas have a higher density of fast-food restaurants and corner stores that offer prepared foods compared to higher income areas (Hendrickson et al., 2006). Increasingly, environmental factors including where people live have been considered when studying food access (Rose and Richards, 2004). The impact of focusing on the neighborhood food environment is two-fold. First, increased attention is brought to the local food environment given the important role these environments play in providing food for residents within their immediate vicinities. Second, the uneven distribution of food stores can be observed and disadvantaged neighborhoods that lack supermarket access, or food deserts, can be noted.

The goal of this paper is to explore the current state of research on food deserts in the United States and to identify areas in need of future research. To date, there is a relatively limited amount of research on food deserts conducted in the U.S. One explanation for this finding is that food security, a household measure of hunger, is assessed in the U.S. annually, and forms the basis of numerous research studies. However, research on food deserts and food-related policy in the United States has become an increasing

priority for the United States Department of Agriculture (USDA). The Food, Conservation, and Energy Act of 2008, implemented by the USDA, provides legislation for Federal agriculture programs (The Food, Conservation, and Energy Act of 2008, The United States Department of Agriculture, June 18, 2008). Enacted into law in June 2008, this bill will remain in effect until 2013. In addition to international provisions outlined in the bill, the importance of addressing domestic food distribution and nutrition is highlighted. Section 7527 of the bill (2008: 389) outlines the responsibilities of the Secretary as they pertain to addressing food deserts in the U.S. These activities include researching the prevalence and causes of food deserts; effects of food deserts on populations; recommendations for reducing and eliminating food deserts; community development initiatives; incentives for food stores to establish in food deserts; and partnerships to address food deserts (The Food, Conservation, and Energy Act of 2008, The United States Department of Agriculture, June 18, 2008).

Restricting this review to studies conducted in the U.S. will parallel the USDA's efforts in researching food deserts in the U.S., and will bring attention to research looking at neighborhood-level access to food in a specific geographic region that is poorly studied and poorly understood. This paper will identify measures that have traditionally been used to assess food access in the U.S. and summarize the articles into major statements, or major research findings. Gaps in the literature will be identified. Lastly, the breadth of knowledge that exists within other countries will be discussed to offer insight into work that has been done pertaining to food deserts and food access within an international context.

2. Methods

The articles included in this review were identified from January 2008 to January 2010 by two mechanisms: keyword searches in the PubMed, Agricola, Anthropology, Environmental Studies, Geography, Public Affairs, and Sociology databases, and by reviewing the references of the articles identified from these databases. Combinations of the keywords “food desert” and “food access” were used to identify relevant articles. Only articles written in English were included in the review. No constraints were made for the year of article publication. The rationale for not limiting the year of article publication is due to the relatively recent nature of the topic. Abstracts were then reviewed to ensure that articles that did not meet certain criteria were excluded from the review. Abstracts excluded were: (1) editorials, (2) non-empirical papers, including review articles and book reviews, (3) articles with outcomes that did not focus on food deserts, and (4) letters to the editor. Fifty-two abstracts were identified in the initial review. After reading the articles, it was determined that only 31 would be included in the review after 5 were excluded based on the first exclusion criterion, 10 for the second criterion, 5 for the third criterion and 1 excluded for the fourth criterion. The articles were read with particular attention to the measures used in the studies. These measures were noted and designated as categories.

3. Results

The 31 selected articles represent a variety of work that has been done in the U.S. related to food access. Nine measures have been used to assess food access. For example, articles that used business directories/lists include yellow pages, business addresses on food stores, food store data including consumer spending, geographic location and store openings and closings. The food use

inventory included in the review was used to assess food used within the home (regardless if eaten at home or somewhere else). Food store assessments were objective assessments of the food environment. Studies that used GIS technology used geocoding to map resources or density maps to make comparisons between different locations. Interviews used in the studies were either in-depth or one-on-one. Food frequency assessments were grouped with questionnaires. These measures are presented in Table 1. The most frequently used measures to assess food access are GIS technology (9 articles), food store assessments (8 articles) and surveys (7 articles). The findings from the 31 included articles can be divided into 11 categories representing the variables that have been explored in food desert research (Table 2). For example, articles that focused on the racial/ethnic differences in the neighborhood food environment were grouped under the category “Race/Ethnicity”. Similarly, articles that compared food stores between urban areas versus rural and/or suburban were grouped under the category “Location”.

4. Major findings in the literature

Results of the review of the literature produced 31 empirical studies that focus on food deserts in the U.S. It is worthwhile to

Table 1
Measures used to explore food access by author(s).

Measures used to assess food access Author	
Business lists/directories and census data	Alwitt and Donley, 1997 Chung and Myers, 1999 Cotterill and Franklin, 1995 Moore and Diez-Roux, 2006 Powell et al., 2007
Focus groups	Hendrickson et al., 2006 Smith and Morton, 2009
Food store assessments	Chung and Myers, 1999 Freedman, 2009 Freedman and Bell, 2009 Glanz et al., 2007 Hendrickson et al., 2006 Lewis et al., 2005 Morland and Filomena, 2007 Morris et al., 1990 Morris et al., 1992 Zenk et al., 2006
Food use inventory GIS technology and census data	Rose and Richards, 2004 Block et al., 2004 Mari Gallagher Research & Consulting Group, 2006 Giang et al., 2008 Kaufman, 1999 Morland et al., 2002a Morland et al., 2002b Morland and Filomena, 2007 Raja et al., 2008 Schafft et al., 2009 Zenk et al., 2005
Interviews	Freedman, 2009 Rose and Richards, 2004 Richards and Smith, 2007
Inventory for measuring perceptions of food access Questionnaires	Freedman and Bell, 2009 Garasky et al., 2004 Morland et al., 2002a
Surveys	Block and Kouba, 2006 Chung and Myers, 1999 Hendrickson et al., 2006 Inagami et al., 2006 Kaufman et al., 1997 Lopez, 2007 Rose and Richards, 2004

note that most of the research in this area has focused on exploring racial/ethnic and income disparities within food deserts. This can partly be attributed to increased attention focusing on reducing and eliminating health disparities, including racial/ethnic and income disparities. Four major statements emerged from summarizing the research findings of the included articles. These statements are: (1) access to supermarkets (10 articles); (2) racial/ethnic disparities in food deserts (11 articles); (3) income/socioeconomic status in food deserts (11 articles); and (4) differences in chain versus non-chain stores (14 articles). The fourth statement encompasses factors associated with cost (6 articles), availability of food items (4 articles) and store type (4 articles).

4.1. Access to supermarkets

Increasingly, studies are focusing on the availability of healthy and nutritious foods within communities across the country, and suggest that factors within the built environment play a critical role in a person's diet (Morland et al., 2002b; Rose and Richards, 2004). A widely cited example of the lack of access to supermarkets is in Philadelphia, PA (Giang et al., 2008). Results from the University of Connecticut's Food Marketing Policy Center study showed that Philadelphia had the second lowest number of supermarkets per capita among major cities in the U.S. during the 1990s (Cotterill and Franklin, 1995).

To illustrate this further, consider the number of supermarkets on the national level. It is believed that the lowest income neighborhoods had nearly 30% less supermarkets than the highest income neighborhoods (Weinberg, 1995). Compare this to the food environment in Philadelphia, where the highest income neighborhoods had 156% more supermarkets than the lowest income neighborhoods (Weinberg, 1995). Access-related concerns are even more compounded by the lack of transportation. Low-income residents may have difficulty affording transportation costs to the supermarket located outside of their immediate vicinity, thereby limiting access to food options (Rose and Richards, 2004; Weinberg, 1995). Transportation is not the only barrier to accessing healthy foods. Rose and Richards (2004) suggest that access to food goes beyond the food environment and incorporates the built environment and individual characteristics. For example, unsafe neighborhoods for walking, and the lack of time due to work schedules, being a single parent, or the lack of time required to prepare meals, can result in difficulty accessing supermarkets (Rose and Richards, 2004).

A related finding in the aforementioned University of Connecticut study was that residents in many of the neighborhoods that lack access to supermarkets in low-income neighborhoods of Philadelphia had greater prevalence of health challenges with diet as a risk factor. These challenges include diabetes, heart disease and cancer (Cotterill and Franklin, 1995). Studies suggest that disparities in supermarket access exist with racial/ethnic minority communities and low-income communities being disproportionately affected (Chung and Myers, 1999; Hendrickson et al., 2006; Powell et al., 2007; Zenk et al., 2005). While many of these studies address access-related concerns, they focus on the racial/ethnic and income disparities that exist within food deserts. Findings from these studies will be discussed in the subsequent sections.

4.2. Racial/ethnic disparities in food deserts

Previous studies found that predominantly Black neighborhoods have fewer supermarkets compared to predominantly White neighborhoods (Metro Chicago Information Center, 2008; Morland et al., 2002b). In an examination of the associations

Table 2
Summary of publications included in the review by food desert category.

Categories	Article results
Access to stores	<p>Alwitt and Donley, 1997—poor residents travel a greater distance to access the same resources as non-poor residents.</p> <p>Chung and Myers, 1999—poor residents have less access to chain stores.</p> <p>Cotterill and Franklin, 1995—more low-income residents lack transportation which limits access to food outlets.</p> <p>Mari Gallagher Research & Consulting Group, 2006—African Americans have the lowest access to grocery stores and greatest access to fast-food outlets. A decrease in grocery store access is associated with an increase in obesity.</p> <p>Giang et al., 2008—access to food is unevenly distributed in Philadelphia. In areas where access is limited the most, residents suffer greater health challenges with diet as a risk factor.</p> <p>Inagami et al., 2006—residents who shopped in more disadvantaged neighborhoods had higher BMIs than those who did not shop in a more disadvantaged neighborhood, suggesting that neighborhood SES of the grocery store is a proxy for quality of the grocery store.</p> <p>Kaufman, 1999—more than 70% of the total low-income population in the catchment area had accessibility challenges.</p> <p>Morland et al., 2002a—fewer supermarkets were observed for neighborhoods, where both black study participants and white study participants resided. However, there were five times as many supermarkets in the areas, where white participants resided compared to blacks.</p> <p>Raja et al., 2008—there are no food deserts in Erie County, New York</p> <p>Rose and Richards, 2004—easy access to supermarkets was associated with increased household fruit intake.</p>
Income/SES	<p>Alwitt and Donley, 1997—poor areas have fewer and smaller food outlets than non-poor areas.</p> <p>Chung and Myers, 1999—residents of poor neighborhoods pay more for shopping locally</p> <p>Cotterill and Franklin, 1995—low#-income areas have 30% fewer supermarkets compared to higher income areas.</p> <p>Giang et al., 2008—low#-income residents have limited access to supermarkets.</p> <p>Glanz et al., 2007—non-poor neighborhoods were more likely to have healthier food options than poor neighborhoods</p> <p>Kaufman et al., 1997—there is little evidence that food prices are higher in poor areas compared to non-poor areas.</p> <p>Lewis et al., 2005—poorer neighborhoods have fewer healthy food options compared to non-poor neighborhoods</p> <p>Moore and Diez-Roux, 2006—low-income neighborhoods had four times as many grocery stores (non-chain stores) and half as many supermarkets (chain stores) compared to more affluent neighborhoods.</p> <p>Morland et al., 2002b—there were three times as many supermarkets in non-poor neighborhoods compared to poor neighborhoods. Non-poor neighborhoods were less likely to have smaller grocery stores (non-chain), convenience stores (without a gas station), and specialty stores compared to poor neighborhoods.</p> <p>Powell et al., 2007—poor neighborhoods have fewer supermarkets, only 75%, of that in middle-income neighborhoods</p> <p>Zenk et al., 2005—supermarket access was similar among the least impoverished neighborhoods regardless of race/ethnicity.</p>
Race/ethnicity	<p>Block et al., 2004—predominantly black neighborhoods have six times more fast-food restaurants than predominantly white neighborhoods.</p> <p>Block and Kouba, 2006—the predominantly black neighborhood had fewer supermarkets and more grocery stores. Store prices were comparable to supermarket prices, but of poorer quality.</p> <p>Mari Gallagher Research & Consulting Group, 2006—African Americans travel the greatest distance to any type of grocery store.</p> <p>Lewis et al., 2005—predominantly African American neighborhoods have fewer healthy food options compared to areas with a lower percentage of African American residents.</p> <p>Moore and Diez-Roux, 2006—predominantly minority and racially mixed neighborhoods had more than twice as many grocery stores (non-chain stores) and half the number of supermarkets (chain stores) than predominantly white neighborhoods.</p> <p>Morland et al., 2002a—the presence of one supermarket was associated with a 32% increase in fruit and vegetable consumption among blacks and 11% increase in fruit and vegetable consumption among whites.</p> <p>Morland et al., 2002b—supermarkets were four times more likely to be found in predominantly white neighborhoods compared to predominantly black neighborhoods.</p> <p>Morland and Filomena, 2007—predominantly white areas had greater supermarket access compared to racially mixed areas. Predominantly black areas did not have a supermarket. A lower proportion of stores in predominantly black areas carried fresh produce compared to predominantly white and racially mixed areas.</p> <p>Powell et al., 2007—predominantly African American neighborhoods have 52% of the supermarkets that are available in predominantly white neighborhoods. Hispanic neighborhoods have only 32% of the supermarkets that are available in non-Hispanic neighborhoods.</p> <p>Raja et al., 2008—there is a lack of supermarkets in neighborhoods of color compared to white neighborhoods</p> <p>Zenk et al. 2005—compared to the most impoverished white neighborhoods, African American neighborhoods were 1.1 mile farther from the nearest supermarket.</p>
Food store density	<p>Block et al., 2004—neighborhoods with 80% black residents have 2.4 fast-food restaurants/mile² compared to 1.5 fast-food restaurants/mile² in neighborhoods with only 20% black residents.</p> <p>Lewis et al., 2005—the comparison group for the study (more affluent, smaller percentage of African American residents) contained 50% more full-service restaurants than the target area.</p> <p>Morland et al., 2002b—with the exception of bars and taverns, all food outlets were more common in racially mixed and predominantly white neighborhoods than predominantly black neighborhoods. Full-service restaurants were two times more common in white neighborhoods. Carryout food outlets serving specialty food items are 9–11 times more common in racially mixed and predominantly white areas.</p>
Cost	<p>Chung and Myers, 1999—prices at chain stores are lower than smaller convenience stores.</p> <p>Glanz et al., 2007—the prices for most healthy options (low fat, low calorie) were not significantly different from the comparable regular item. The greatest cost difference found in the cost of lean ground beef, low-fat hot dogs, baked chips and 100% fruit juice compared to the regular items ($p < 0.01$).</p> <p>Hendrickson et al., 2006—food prices were higher in both rural and urban food deserts compared to non-food deserts</p> <p>Kaufman et al., 1997—food items in supermarkets offer greater variety and quality at a lower cost.</p> <p>Morris et al., 1990—the average cost of one week's worth of thrifty food plan groceries was 36% higher than the maximum weekly food stamp allotment of \$75 for a family of four.</p> <p>Morris et al., 1992—the average thrifty food plan cost for small/medium stores was \$102 compared to \$81 in supermarkets.</p>
Location	<p>Chung and Myers, 1999—more chain stores are located outside inner-cities, where there is low poverty.</p> <p>Hendrickson et al., 2006—food prices in the urban food desert were more expensive than the market basket price.</p> <p>Kaufman, 1997—supermarkets in inner-cities have somewhat higher prices than those in suburban areas.</p> <p>Kaufman, 1999—poor residents of rural areas depend on smaller convenience stores than residents in metropolitan cities.</p> <p>Morris et al., 1990—rural poor depend on limited, more expensive food outlets.</p> <p>Morris et al., 1992—in 1988, the number of supermarkets per county in rural America versus urban America was 3.8 and 2.9, respectively.</p> <p>Powell et al., 2007—food outlets are more common in urban areas compared to suburban, rural and farm areas.</p>

Table 2 (continued)

Categories	Article results
Store type	<p>Chung and Myers, 1999—for specific food items, chain stores offer prices that are 10–40% less than non-chain stores.</p> <p>Glanz et al., 2007—convenience stores were found to have lower food price compared to grocery stores.</p> <p>Moore and Diez-Roux, 2006—poorer areas were less likely to have fruit and vegetable markets, bakeries, specialty stores and natural food stores compared to affluent areas. These areas were more likely than affluent areas to have liquor stores.</p> <p>Raja et al., 2008—smaller grocery stores (non-chain) are more prevalent in neighborhoods of color compared to white neighborhoods.</p>
Availability	<p>Glanz et al., 2007—grocery stores were found to have greater availability of healthier food options compared to convenience stores.</p> <p>Hendrickson et al., 2006—foods within rural and urban food deserts are more limited in type and in number compared to non-food deserts.</p> <p>Morris et al., 1990—many rural food outlets contained poorly stocked shelves and lacked healthy and nutritious foods.</p> <p>Morris et al., 1992—small/medium stores carried a small amount of fresh foods.</p>
Perception	<p>Garasky et al., 2004—rural clients were more likely than urban or suburban to perceive their food environment as having an inadequate number of supermarkets (50% compared to 22% and 13%, respectively). Suburban clients' perceived local food as being more affordable compared to urban and rural clients. Transportation concerns were the greatest among suburban and rural clients.</p> <p>Freedman, 2009—participants did not perceive convenience stores and non-chain stores as “real” food stores.</p> <p>Freedman and Bell, 2009—participants' perceptions of access to healthy food was supported by objective food store assessments.</p> <p>Hendrickson et al., 2006—residents identified lack of affordable healthy food options within their communities and food insecurity as concerns.</p> <p>Richards and Smith, 2007—participants perceived environmental (rules and regulations established at the homeless shelter), parental, and personal factors as influencing food access and food choice.</p> <p>Smith and Morton, 2009—perceptions of factors influencing food choice and food access among rural residents include household, social and cultural and environmental factors.</p>
Quality of available foods	<p>Glanz et al., 2007—grocery stores were found to have greater quality of healthier food options compared to convenience stores.</p> <p>Hendrickson et al., 2006—foods within the urban and rural food desert were of fair or poorer quality compared to a non-food desert.</p> <p>Zenk et al., 2006—the quality of fresh produce was significantly lower in predominantly African American, low socioeconomic position communities compared to racially mixed, middle socioeconomic position communities.</p>
Impact	<p>Hendrickson et al., 2006—the lack of affordable, quality foods diminishes the ability to access healthy foods needed to maintain a healthy diet.</p> <p>Lewis et al., 2005—the neighborhood food environment in the low-income neighborhoods in the study provides challenges to healthy eating for residents. Restaurants in the less affluent target area promoted unhealthy food options to residents.</p> <p>Lopez, 2007—zip code level variables, including median household income and the presence of a supermarket were associated with obesity risk.</p> <p>Schafft et al., 2009—there is a positive association between increased rates of child overweight and percentage of children in the school district residing in a food desert.</p>

between the availability of food stores in the US and race, ethnicity and socioeconomic status, Powell et al. (2007) found that the availability of chain supermarkets in Black neighborhoods was only 52% that of their White counterpart (Powell et al., 2007). These differences still existed after controlling for relevant covariates, including neighborhood income.

In a similar study using geographic information system (GIS) to measure spatial accessibility of chain supermarkets with respect to neighborhood racial composition and poverty in Detroit, Michigan, Zenk et al., 2005 found that the most impoverished neighborhoods in which African Americans resided were 1.1 mile farther from the closest supermarket compared to the most impoverished White neighborhoods (Zenk et al., 2005). Additional findings show that 28% of the residents in the most impoverished Black neighborhoods did not own a car in 2000, that these neighborhoods had 2.7 fewer supermarkets within a three-mile radius compared to the most impoverished White neighborhoods, and that among the most impoverished neighborhoods in Detroit, 76% of these areas had a high proportion of African Americans (Zenk et al., 2005). Understanding the social and racial history has helped frame the present-day issue of racial segregation and consumer purchasing power. Looking at the history in Detroit, Michigan, Zenk et al., 2005 surprisingly found that among the least impoverished neighborhoods studied, all but one of the predominantly Black neighborhoods that had access to a supermarket equivalent to their White counterparts, was located in the inner city. The interpretation of this finding is two-fold. First, this suggests that supermarkets will stay invested in a neighborhood as long as the residents have the purchasing power to make their commitment to the area profitable. Second, supermarkets that remain in these urban areas are remnants from when these areas

were predominantly White, again implying that it is profitable for these retailers to remain in the area (Zenk et al., 2005).

4.3. Socioeconomic status in food deserts

The majority of smaller stores located in urban areas are in low-income areas (Alwitt and Donley, 1997; Hendrickson et al., 2006). The consequence is that the issue of poverty plays out in economic barriers in accessing food in low-income areas. Hendrickson et al. (2006) found that food prices are higher and food quality is poorer, often inedible, in areas where poverty is the highest, compared to more affluent areas. Furthermore, results from the same study show that there is a smaller quantity and variety offered at stores in impoverished areas. These findings are consistent with other studies that show that residents living in areas that do not have a supermarket pay more for their food (Chung and Myers, 1999; Freedman, 1991; Hendrickson et al., 2006; Kaufman et al., 1997; U.S. House of Representatives Select Committee on Hunger, 1990). In a similar report by the New York's Consumer Affairs Department in 1991, results from price surveys in 60 stores and 140 interviews with consumers and retailers showed that the poor residing in urban areas paid more for groceries, and received poorer quality foods (Chung and Myers, 1999; Freedman, 1991).

One explanation for the higher costs of food in urban areas has to do with increased crime in these areas. Theft within stores in urban areas, where the cost is already high tends to drive up the cost of food items even more. The unfortunate result is that a vicious cycle may form, where the high cost of food makes stealing an attractive option, thereby forcing store owners to

increase the price of food for consumers that already have a difficult time paying for food (Hendrickson et al., 2006).

Additionally, the issue of lack of transportation is echoed throughout the literature citing that many low-income households do not have access to a car and cannot afford the costs associated with getting to a supermarket outside of their immediate neighborhood. (Alwitt and Donley, 1997; Guy et al., 2004; Hendrickson et al., 2006; Kaufman, 1999; “U.S. House of Representatives Select Committee on Hunger”, 1990). As a result of the lack of transportation, low-income households are less likely to travel the distance to a supermarket outside of their neighborhood and will purchase food items from the stores that are nearby, thereby sacrificing cost and quality for convenience.

4.4. Differences in chain versus non-chain stores

A report by the Economic Research Services (ERS) of the United States Department of Agriculture (USDA) found that urban supermarket prices are higher than the suburban ones (Kaufman et al., 1997; Powell et al., 2007). The fewer supermarkets and the prevalence of smaller grocery stores that are located in urban areas may account for the higher food prices. The ERS report also explained that smaller grocery stores tend to stock leading brand items and smaller package sizes, which can drive the cost of food prices up. Larger supermarkets are able to stock both leading brand and generic items, both offered in larger and smaller packages. The variety, in brands and package size, that larger supermarkets are able to offer helps offset the higher priced items, thereby keeping the cost lower (Chung and Myers, 1999; Kaufman, 1999).

In an examination of food items in approximately 55 stores within the Minneapolis and St. Paul metropolitan areas, Chung and Myers (1999) found that only 22% ($n=256$) of chain supermarkets were located in urban areas. However, nearly one-half of the non-chain stores were located there. Results also showed that non-chain stores were more likely to be located in poor areas, whereas chain supermarkets were more likely to be located in more affluent areas (Chung and Myers, 1999). To identify differences between two markets, chain versus non-chain, Chung and Myers (1999) compared market basket prices. These prices reflect the cost of a fixed list of items and provide information regarding inflation within the larger economy as well as within a specific market.

The biggest disparity in price between chain and non-chain venues was in the price of dry goods, including flour and oatmeal. Consumers who shop at chain supermarkets paid between 10% and 40% less for these items (Chung and Myers, 1999). In terms of market basket prices, there was a \$16.62 price gap between non-chains and chains, \$1.18 price gap between urban and suburban retailers, and a \$5.15 price gap between poor and non-poor areas (Chung and Myers, 1999). This means that consumers who shopped at non-chain stores, in urban and poorer areas paid more per unit of measurement than chain, suburban and non-poor areas.

5. Discussion

This review focused on food desert literature in the US. The specific focus on food deserts opposed to including articles pertaining to areas that have supermarkets, or food oases, was to highlight the issues surrounding poor access to healthy and nutritious foods characteristic of food deserts. Furthermore, the focus allowed for better understanding of the challenges in obtaining healthy and affordable foods faced by residents of these areas. This review highlights measures traditionally used in food desert research in the U.S. and identified areas, where additional work is needed. To gain insight and knowledge into potential

ways, in which gaps in the literature can be addressed in the U.S., the existing literature related to food access was sought from other countries. While studies conducted in other countries may not be translatable entirely to the U.S. context, pertinent findings can be gleaned and expounded upon.

5.1. Increased access to food

One of these areas, where additional research is needed, is exploring the impact of residing in a food desert. Specifically, there is debate about whether living in a food desert is associated with unhealthy eating and food buying practices. It is unknown to what extent additional factors, including personal preferences are better indicators for healthy eating than the actual presence or absence of a supermarket. However, one noteworthy before/after study, the Seacroft intervention study offers insight into how increased access to a supermarket influences factors, including food consumption and perception (Wrigley et al., 2003, 2004). Using food diaries and household questionnaires, Wrigley et al. (2003) explored a host of factors including attitudes towards healthy eating, food store choice and travel options to stores pre-intervention (before the opening of a new store). Surveys and focus group discussions assessed changes in usage of primary food store and changes in travel behavior post intervention (nearly two years after the new store opened). Results showed that nearly half of the respondents switched their main food store location to the new store. Additionally, distance travelled to the primary food store decreased from 2.25 km (approximately 1.4 mile) before the switch to the new store to 0.98 km (approximately 0.60 mile) after the switch to the new store (Wrigley et al., 2003). Access-related reasons including convenience and proximity were expressed by the majority of respondents as being instrumental in the switch to the new store (Wrigley et al., 2004). Modest improvements in diet and nutrition were noted. Only a small percentage of respondents utilized savings associated with increased access to purchase fresh food.

What can be gleaned from this study are unintentional consequences. For instance, with the opening of a larger store, residents had a larger variety of foods, including prepared foods to choose from and reported feeling “tempted” to overspend small food budgets by purchasing large quantities of needed items or purchasing “luxury” items (Wrigley et al., 2004). This finding has major public health implications for improving diet, nutrition and for obesity prevention. Some respondents in this intervention study did not switch to the new store. Reasons for not switching included cheaper prices and familiarity with the current store. These reasons are underscore the importance for considering issues of poverty and financial constraints when food shopping. In other words, increasing access to healthy and nutritious foods does not necessarily increase consumption, especially for low-income households. Furthermore, a sense of loyalty to owners of neighborhood convenience stores is a real concern for residents. One of the theories to how food deserts formed in many urban cities have to do with the opening of a supermarket that introduced competition to small business owners and forced many to close their doors. The presence of a supermarket can have detrimental effects on these smaller stores and their ties to and roles within the community.

5.2. Policy implications

Another area for future research is exploring the impact of policy on food access. The few studies that mention policy-related concerns in the U.S. discuss reducing the racial/ethnic and related income disparities that exist in accessing food, and working to

attract supermarkets to economically disadvantaged neighborhoods (Chung and Myers, 1999; Lang and Caraher, 1998; Zenk et al., 2005). This underscores the need for policymakers and stakeholders to begin determining food-related policies and practices. These policies can have a major impact in addressing the limited access to affordable healthy and nutritious foods for low-income residents of urban areas that lack access to these foods.

An example of how cities are addressing the lack of access to supermarkets are found in Pittsburgh, Boston and New York, where many communities have relied on local leadership and policy development to alleviate these disparities (Pothukuchi, 2000). These cities have developed public/private partnerships, agreements between government and private sector organizations, to build and maintain infrastructure and necessary community facilities (Nayga and Weinberg, 1999; Widdus et al., 2001). Specifically, partnerships between local government and supermarket leaders have been developed to bring supermarkets into underserved areas. Ultimately, these partnerships seek to increase supermarket access within neighborhoods that have been overlooked by food retailers.

Findings from Western Australia identified similar partnerships between government and non-government sectors that were established with the goal of developing strategies aimed at increasing fruit and vegetable consumption. In an iterative process that involved discussing priority areas for policy and program interventions and the required infrastructure support, activities were identified. These policies included developing and supporting nutrition policies to increase fruit and vegetable consumption within the schools, restricting food advertising targeted to children, support of a fruit and vegetable mass media campaign and support the efforts of local organizations to develop and implement policies geared towards increasing fruit and vegetable access and improving overall nutrition (Pollard et al., 2008).

Recommendations from this working group included developing policies and strategies that support and complement each other. For example, a social marketing campaign was established to support a school canteen program introduced to recognize and reward schools operating healthy canteens. This initiative was a partnership between the Western Australia School Canteen Association, the Heart Foundation of Australia and the Department of Health. As of 2009, 21.4% of the schools in Western Australia that operated school canteens committed to the program. Recent findings show that schools have increased promotion and sales of healthy food and drinks as identified under the Government Healthy Food and Drink Policy, which mirrors the Australian Dietary Guidelines for Children and Adolescents (Western Australia School Canteen Association, Inc., 2010). The intersectoral collaborations established in Western Australia to improve diet and nutrition quality among children in schools and child care have been successful, in part, due to the collaborations established, willingness and readiness for organizational change, resources available and incentives for improving food service standards (Pollard et al., 2001).

5.3. An Ecological approach

While many studies focus on the presence or absence of supermarkets, few examine the dynamic interaction between other food venues (restaurants, corner stores, gas stations, etc.) as places, where residents purchase food. This is another area where additional research is needed in the U.S. This is important because these venues, in addition to local grocery stores, comprise the food environment and offer food items for residents, despite

the nutritional value of these foods. The importance of identifying these types of food stores within a neighborhood is two-fold. First, identifying these stores offers a complete picture of the entire food environment within a neighborhood. Second, researchers will have a better understanding of the food options that are available to residents. While it is important to identify places that offer healthy foods within a neighborhood, it is equally important to identify the places within a neighborhood that can offset these locations. Research is needed to better understand additional factors involved in food buying practices among the residents of food deserts. These factors are important for developing and implementing individual and community-level interventions that increase access to healthy foods, influence food buying practices, and facilitate healthy eating.

In the U.K., Reisig and Hobbiss (2000) identified key stakeholders involved in food poverty initiatives. Semi-structured questionnaires and in-depth interviews were used to identify causes of food poverty and ways to combat food poverty in Leeds (Reisig and Hobbiss, 2000). Causes included personal factors such as lack of education, poor eating habits, poverty, income inequalities, lack of transportation and limited availability of foods offered at the local convenience store (Reisig and Hobbiss, 2000). Program initiatives aimed at improving food access on the individual-level included a health education and health promotion component for residents to encourage them to eat healthier foods. A secondary goal was then to empower residents to demand store owners stock healthier food options that are not available in the store. A community-level initiative included providing better transportation options for residents to get to supermarkets as part of the retailers responsibility, or within the context of a larger transportation program sponsored by the city (Reisig and Hobbiss, 2000). The lack of transportation is a real concern in accessing food, especially among low-income residents who do not own a car or cannot afford costs associated with taking public transportation. Strategies taken in other countries to address transportation-related issues in food access will be helpful when thinking about ways to bridge the gap between food access and healthy eating.

5.4. Future areas of research in the U.S.

This review identified aspects of food desert research that have been thoroughly studied in the U.S. Further research on this topic is warranted. Research studies utilizing a mixed-methods approach to assess both objective and subjective measures would be beneficial. We recommend an innovative method such as concept mapping, a participatory research method that allows hypotheses to be generated and integrates the results in a way that multivariate analyses can be used to make comparisons between groups. Comparisons can be made between participants with differential supermarket access such as those who reside in a food desert compared to a food oasis. Additional comparisons can be made between participants from food secure versus food secure households, and even those who own a personal car or have access to transportation compared to those who lack transportation options. These analyses will provide data for understanding factors involved with food buying practices and healthy eating. While the studies included in this review improve our understanding of the measures and major findings of food access research in the practices. These data will provide an understanding of the complexity of food access and the food environment, while providing a basis for program planning and policy development aimed at addressing access to healthy and affordable foods.

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