



GLOBAL JOURNAL OF HUMAN-SOCIAL SCIENCE: H
INTERDISCIPLINARY

Volume 18 Issue 1 Version 1.0 Year 2018

Type: Double Blind Peer Reviewed International Research Journal

Publisher: Global Journals Inc. (USA)

Online ISSN: 2249-460X & Print ISSN: 0975-587X

Towards an Interdisciplinary Approach to Food Accessibility Research

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GJHSS-H Classification: *FOR Code: 130205*



Strictly as per the compliance and regulations of:



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1. BACKGROUND ON FOOD ACCESSIBILITY

In recent years, there has been a rise in public and scholarly interest in food accessibility and food deserts in the United States. While food accessibility refers to the ability of individuals to access food stores physically, a food desert represents a low-income neighborhood where residents do not have access to nutritious food outlets within a walk able distance or over a mile to 10miles distances, and also, faced with inadequate access to vehicles (Hublely, 2011; McKenzie, 2014; USDA 2017). Residents of food deserts often rely on food outlets which do not offer healthy choices, (such as fresh fruits and vegetables), and may be at a higher risk of experiencing food-related health complications than high-income residents within the country (Caspi, Kawachi, Subramanian, Adamkiewicz, & Sorensen, 2012; Eckert& Shetty, 2011; Hubley, 2011; Inagami, Cohen, Finch, & Asch, 2006; Lee, 2012; Morland, Diez Roux, & Wing, 2006). Approximately 39.4 million people reside in areas classified as food deserts

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in the United States, and about half of such residents (19million people) have difficulty in accessing nutritious food outlets within a range of 1 mile to 10 miles. At a reduced range of 0.5 to 10 miles, about 83.5 million people live in areas with low access to a vehicle and nutritious food outlets. Within the same range, 54.4million people or 17.7% of the U.S population have challenges accessing nutritious food outlets and may rely on innutritious food outlets, which can be detrimental to their health (Lee, 2012; USDA, 2017).

Studies that attempt to compare food accessibility between neighborhoods of different socio-economic characteristics have varying conclusions. Whereas the majority of the studies suggest low-access to nutritious food outlets for low-income neighborhoods compared to high-income neighborhoods, some studies indicate inexistence of disparities in the level of access to nutritious food outlets between communities of different socio-economic characteristics. (Adeigbe, Baldwin, Gallion, Grier, & Ramirez, 2015; Cannuscio et al., 2013; Eckert & Shetty, 2011; Gustafson, Lewis, Wilson, & Jilcott-Pitts, 2012; Hubley, 2011; Lee, 2012; McKenzie, 2014; Meltzer & Schuetz, 2012; O'Connell, Buchwald, & Duncan, 2011). Irrespective of the outcomes of such comparisons, the problem still exists for some residents and is notably worse for residents of minority concentrated inner-city neighborhoods and Native American communities because of segregation and economic forces that consider such neighborhoods detrimental to profit maximization (Dawson, 2012; Meltzer & Schuetz, 2012; O'Connell et al., 2011; Slocum & Saldanha, 2016). Also, low-income residents of rural communities who do not have cars and grocery stores nearby, remain extremely challenged with the problem of food inaccessibility due to limited or inexistence of public transportation (Hublely, 2011; McKenzie, 2014; USDA, 2009).

Furthermore, neighborhood food environments and food affordability influence peoples' choices of food; people may utilize food options closer to their residence instead of traveling long distances (Lin, Ver-Ploeg, Kasteridis, & Yen, 2014; Rahkovsky & Snyder, 2015; Vaughan, Cohen, Ghosh-Dastidar, Hunter, & Dubowitz, 2016). Therefore, residents of food deserts who do not have adequate access to vehicles may rely on innutritious food outlets such as convenience stores and fast food chains or travel longer distances for nutritious food compared to residents with nutritious

food outlets nearby (Auchincloss, Riolo, Brown, Cook, & Diez Roux, 2011; Black, Moon, & Baird, 2014; Hilmers, & Dave, 2012; Inderbir Sohi, 2014; Sohi, Bell, Liu, Battersby, & Liese, 2014). Convenience stores and fast food chains primarily sell processed or canned foods with high fat, sugar, etc., which are not considered healthy choices. (Black et al., 2014; Handbury, Rahkovsky, & Schnell, 2015; Morland et al., 2006; Vaughan et al., 2016). Where convenience stores have some nutritious food, the food is often more expensive compared to same food sold in grocery stores or supermarkets within the same area (Liese, 2007). Indeed, health issues such as obesity are more prevalent among residents of low-income neighborhoods, Black people, and Latinos with poor access to grocery stores compared to Whites and residents of high-income areas with adequate access to grocery stores. (Auchincloss et al., 2011; Inagami et al., 2006; Caspi et al., 2012; Rutten, Yaroch, Patrick, & Story, 2012).

Not with standing research efforts by scholars of varying disciplines such as geography, planning, public health, community sustainability, social work, and sociology to unravel and surmount the challenge of food deserts or accessibility, the problem persists in several communities across the country (Abubakari, 2017; USDA, 2009, 2017). The attempts of planning authorities at local, regional and national levels to solve the problem have yielded modest successes as several neighborhoods remain classified as food deserts in the USDA food desert atlas. (Abubakari, 2017; USDA, 2009, 2015, 2017). Efforts of public health and nutrition professionals in educating the public on food choices have proven futile due to lack of food options within some low-income neighborhoods. Specific interventions include the 2008 Farm Bill that aims at supporting the provision of nutritious food through rural farming with the leadership of the United States Department of Agriculture and food pantries by nonprofits across the country (Abubakari, 2017; USDA, 2009; Karpyn, Young, & Weiss, 2012). Even politicians like the Former first lady, Michele Obama called for, and supported initiatives that provided grocery stores for some neighborhoods in the country through her non-profit focused on food accessibility (Karpyn et al., 2012). Apart, some investors still shy away from some communities because of high poverty rates and fear for recurrent supply cost, without inherent profit organization (Dawson, 2012; Diao, 2015). In a nutshell, these interventions and research have been piecemeal and may partly contribute to the persistent existence of food deserts across the United States. When a complex problem such as food accessibility is studied in piecemeal function (disciplinary, or multidisciplinary), various components of the issues are left unaddressed (CohenMiller, Faucher, Hernández-Torrano, & Brown-Hajdukova, 2017; Choi & Pak, 2006).

Whereas disciplinary studies view issues and inform research in a singular perspective or approach, multi-disciplinary research involves little interactions, contrasting or sharing of knowledge between two or more disciplines, or drawing insight from two or more disciplines without fully integrating them (Choi & Pak, 2006; CohenMiller et al., 2017; Repko & Szostak, 2017). The inadequate and piecemeal assessment of the problem of food accessibility limits the understanding of the causes and even the impacts of the problem as well as interventions to improve food access. An interdisciplinary approach, therefore, would help address the challenges associated with the disciplinary and multidisciplinary approaches by synthesizing and integrating existing knowledge to form a complete picture of food accessibility in the country. With an interdisciplinary approach, researchers and institutions would be able to probe this complex subject of a food desert and accessibility, draw and integrate insights from multiple disciplines to comprehensively understand and choose the best approach in solving the problem sustainably.

Therefore, this paper offers a critical review of research transcending two significant disciplines and provides an integrated understanding of the issue of food accessibility in the United States. Research from geography and public health are reviewed in this paper. These two fields are selected because they have taken center stages in the research and discussion of food deserts, food accessibility, and food-related health complications and remain the parent disciplines of most of the other disciplines that study and attempt to solve the problem of food accessibility. As a paradigm shift from the existing single disciplinary research, however, this paper provides a direction towards an interdisciplinary research approach that could expand perspectives and approaches in a food desert, food accessibility, or food-health related research. Specifically, the study integrates perspectives, theories and approaches to food accessibility research from the disciplines of geography and public health to form a new and more comprehensive perspective and approach for food accessibility research.

II. A COMPARISON OF INSIGHTS ON FOOD ACCESSIBILITY BETWEEN GEOGRAPHY AND PUBLIC HEALTH

Geographers and public health researchers and practitioners view the problem of food accessibility in two distinct perspectives; whereas geographers mainly consider food access as a physical location issue, public health academics and professionals largely view it as a factor that can affect the health and well-being of individuals. These distinct views are implicated in the way the disciplines conceptualize and approach studies on food desert or food accessibility. Here, research from

geography and public health is reviewed. Specific emphasis is placed on the perspectives, fundamental theories, and approaches employed by the two disciplines in investigating the issue of food accessibility in the United States.

III. CONCEPTUALIZATION OF FOOD ACCESSIBILITY STUDIES

The term food desert by definition is devised from geographic perspectives and reflects some underlining themes of studies in geography such as location, place, human-environmental interaction and movement (Chen, 2017; Dawson 2012; Ron Johnson, 2016; Widener et al., 2017). Geographers view food accessibility as a location factor and assume that the absolute and relative location of nutritious food outlets and residential neighborhoods affect peoples' level of access to nutritious food (Abubakari, 2017; Chen, 2017; Dawson, 2012; Ghosh-Dastidar et al., 2017; Slocum & Saldanha, 2016; Thatcher, Johnson, Zenk, & Kulbok, 2017). An absolute location, in this context, reflects the exact point on earth's surface where a place is positioned, and relative location defines the setting of a place relative to its surroundings (Dempsey Caitlin, 2017). Geographers view access to nutritious food as a matter of place and human-environment interaction, whereby the physical and socioeconomic characteristics of a place determines the kind of food stores available for the residents of that place. (Abubakari, 2017; Chen, 2017; Parece, Serrano, & Campbell, 2017; Shannon, 2016; Slocum & Saldanha, 2016).

Crucial to this perspective is the central place theory compounded by Walter Christaller in 1933. The theory assumes that the concept of a 'threshold' is the determinant of the location of services such as food stores. The threshold concept suggests that services such as grocery stores will be situated in neighborhoods with the local capacity to support profit maximization, hence the existence of food deserts (Dawson, 2012; Ghosh-Dastidar et al., 2017; Ron Johnson, 2016; Widener & Shannon, 2014). Furthermore, in line with the geographic theme of movement, it is assumed that consumers shop within ranges of stores and would travel to the nearest market closest to their residence because individuals have interest in reducing travel cost and time (Dawson, 2012; Johnson, 2016; Ghosh-Dastidar et al., 2017; Shannon J., 2014; Thatcher et al., 2017; Widener & Shannon, 2014; Widener et al., 2017). The focus of geographers therefore, is on the relationship between the location of food stores, travel distance and neighborhood socioeconomic characteristics when measuring food accessibility. (Abubakari, 2017; Chen, 2017; Parece et al., 2017; Shannon, 2016; Slocum & Saldanha, 2016; Widener et al., 2017; Widener & Shannon, 2014). Also, geographic studies on food access remain focused on spatial

accessibility and the concept of food desert, which are defined by areal divisions such as census tracts and block groups, with USDA food desert map forming the basis of identifying existing food deserts at any city or county level for geographers (Abubakari, 2017; Chen, 2017; Ghosh-Dastidar et al., 2017; Parece et al., 2017; USDA, 2015, 2017; Widener & Shannon, 2014). Geography-based papers examining food deserts indicate several dimensions to the issue, ranging from neighborhood or individual socioeconomic characteristics to type of settlement (Abubakari, 2017; Chen, 2017; Shannon J., 2014; Slocum & Saldanha, 2016; Thatcher et al., 2017; Widener & Shannon, 2014).

At the neighborhood level, studies suggest that low-income neighborhoods and communities of color often have restricted access to supermarkets and grocery stores, which are considered nutritious food outlets (Ghosh-Dastidar et al., 2017; Parece et al., 2017; Shannon, 2016; Widener & Shannon, 2014). Comparably, there have been different directions on the disparities in food accessibility; while many indicate that low-income and communities of color have less access to nutritious food outlets compared to white and high-income neighborhoods, others indicate no difference in the level of access to nutritious food outlets between White communities and communities of color. (Abubakari, 2017; Dutko, Ploeg, & Farigan, 2012; Parece et al., 2017; Shannon J., 2014; Widener & Shannon, 2014). Convenience stores and fast food outlets which are categorized as innutritious food sources remain the dominant food outlets in low-income and minority neighborhoods compared to White and high-income neighborhoods (Abubakari, 2017; Dutko et al., 2012; Widener & Shannon, 2014). The dynamics change when considering rural and urban communities in the country, although rural areas are predominantly White occupied, several studies have indicated that low-income rural settlements have very restricted access to grocery stores compared to equally poor urban settlements (Dutko et al., 2012; Thatcher et al., 2017; USDA 2009,2015).

At the individual level, individual choices amidst transportation systems or travel distance as a factor of accessibility play a significant role in discussing the dynamics of food accessibility among geographers (Shannon, 2014, 2016; Widener & Shannon, 2014). Individuals with access to vehicles, and/or live within walkable distance to nutritious food outlets turn to have more access to fresh fruits and vegetables compared to individuals with limited access to healthy food outlets or vehicles (Dutko et al., 2012; Widener & Shannon, 2014). Therefore, individuals with lower socioeconomic statuses are most likely to be affected by the problem of food accessibility compared to individuals with higher socio-economic statuses (Abubakari, 2017; Dutko et al., 2012; Shannon J., 2014; Thatcher et al., 2017).

On the other hand, public health research on food accessibility primarily focuses on epidemiology (distribution, patterns, and determinants of diseases) and the etiology (causes) of individual health conditions related to food (Halpern et al., 2017; Heval et al., 2016; Kolodinsky, Battista, Roche, Lee, & Johnson, 2017). Embedded in food accessibility research of scholars in the public health discipline is the perspective that there is an underlining cause of health conditions affecting individuals (Deller, Canto, & Brown, 2017; Halpern et al., 2017). Researchers in this field assume that certain health conditions such as obesity and diabetes have causal and preventative elements that may occur differently among people of different places (Heval et al., 2016; Kolodinsky et al., 2017). Moreover, based on the ecological theory of health, it is assumed that the causes of health issues are confounding and includes both individual and environmental factors, where an individual's food choices remain influenced by the individual's food environment, which then leads to individual health or ill-health (Deller et al., 2017; Heval et al., 2016; Kolodinsky et al., 2017; Leung, Laraia, Tester, & Yen, 2017). Therefore, studies on food access by public health scholars and professionals largely focus on the distribution or patterns of health conditions such as obesity, and the visible differences in the distribution of these conditions in relation to place and availability of nutritious food sources for residents (Deller et al., 2017; Kolodinsky et al., 2017). Also, extensively studied is the food-retail environment of neighborhoods and how they might influence peoples' decisions on nutrition, with emphasis consigned on the availability of fruits and vegetables in the food outlets within the neighborhoods (Campbell et al., 2017; Kolodinsky et al., 2017; Leung et al., 2017; MacNell, Elliott, Hardison-Moody, & Bowen, 2017).

Public health studies suggest a relationship between health issues (obesity, diabetes, cardiovascular disease) and individual socioeconomic characteristics (such as income, race, educational level, age, and sex), which stand influenced by the individual's food environment (Deller et al., 2017; Drewnowski & Darmon, 2005; Heval et al., 2016). Underprivileged persons have a higher risk of being overweight or obese compared to persons of high-income status due to lesser consumption of nutritious food among the disadvantaged (Halpern et al., 2017; Heval et al., 2016; Drewnowski & Darmon, 2005). Individuals of minority racial/ethnic categories such as Blacks and Hispanics have lower access to nutritious food and also have a higher probability of being obese compared to other races, especially White (Halpern et al., 2017; Drewnowski & Darmon, 2005; Romano et al., 2017). Furthermore, individuals with lower levels of educational attainment utilize minimal amounts of nutritious food and are at higher risk of being obese compared to individuals with

higher educational attainment. (Halpern et al., 2017; Drewnowski & Darmon, 2005).

At the neighborhood level, public health researchers suggest that neighborhood socio-economic contexts (racial/ethnic and income composition and education) correlate with the presence of nutritious food outlets (Bonica & Story, 2017; Deller et al., 2017; Heval et al., 2016). Specifically, areas with a concentration of people with lower socioeconomic characteristics have less available nutritious food outlets compared to areas with a concentration of people of higher socioeconomic characteristics (MacNell et al., 2017; Romano et al., 2017; Rummo et al., 2017; Williamson, McGregor-Shenton, Brumble, Wright, & Pettinger, 2017). An unavailability of a healthy food outlet within a neighborhood may also translate to higher rates of health concerns within that neighborhood (Cooksey-Stowers, Schwartz, & Brownell, 2017; Deller et al., 2017; Kolodinsky et al., 2017).

Public health scholars recognize the confounding nature of the causes of health concerns, therefore, explains that other social factors such as workplace and lifestyle may contribute to obesity either than food choices or accessibility. (Deller et al., 2017; Heval et al., 2016; Kolodinsky et al., 2017). Nonetheless, attempts to measure the relationship between obesity and other factors such as workplace while controlling for neighborhood socioeconomic factors have shown varying results and have continued to be an issue investigated in the field. Whereas some results question the validity of the notion that neighborhood socioeconomic characteristics determine the rate of health issues, several studies have established a relationship between neighborhood socioeconomic characteristics and health concerns, hence guiding the research of neighborhood food accessibility in the public health field (Bonica & Story, 2017; Cooksey-Stowers et al., 2017; Deller et al., 2017; Heval et al., 2016; Kolodinsky et al., 2017; Wright, Gerassimakis, Bygrave, & Waldstein, 2017).

Furthermore, some indicate that gender plays an important role in health issues such as obesity as it relates to neighborhood context. Most of the studies suggests a higher prevalence of eating disorders and obesity among women compared to men and others suggest a high prevalence of obesity and eating disorders among men compared to women (Chao et al., 2017; Flegal, Kruszon-Moran, Carroll, Fryar, & Ogden, 2016; Hudson, Hiripi, Pope, & Kessler, 2007; Kolodinsky et al., 2017; Ledikwe et al., 2005). Apart, sections of public health researchers also believe that peoples knowledge or perception about nutritious food as it relates to the environment in which they reside is a contributing factor to their food choices that could affect their body mass index. In this regard, individuals with adequate knowledge of the significance and availability of nutritious foods such as fruits and vegetables are

most likely to consume them compared to individuals without a proper understanding of the existence of these nutritious food sources (Drewnowski & Darmon, 2005; Halpern et al., 2017; MacNell et al., 2017; Nutbeam, 2000). The consumption of fresh fruits and vegetables are considered highly relevant by public health researchers and practitioners because an increase in the consumption of fresh fruits and vegetables together with proper dieting may result to a reduction in body mass index among individuals (MacNell et al., 2017; Romano et al., 2017; Williamson et al., 2017; Wright et al., 2017).

IV. APPROACHES OF FOOD ACCESSIBILITY RESEARCH

There exist some differences between the approaches employed by public health scholars and geographers in studying food desert as a geographic issue or as a health concern. The geography-based research employs geographic information systems in measuring food accessibility. These approaches can be categorized into two types; individual-based and place-based approaches. Studies that apply the individual-based approach examine the relationship between socio-economic characteristics of persons such as income, vehicle ownership, race, etc. and distance or access to food stores (Shannon, 2014, 2016). The place-based approach, which appears as the commonly used approach in measuring food accessibility among geographers focuses on neighborhood socioeconomic characteristics and how they are related to access to food for residents (Abubakari, 2017; Chen, 2017; Parece et al., 2017). Often considered variables under the place-based approaches which reflect the geographic themes of place and movement include distances to food stores, transportation or walkability, travel time, neighborhood poverty, and racial composition (Abubakari, 2017; Chen, 2017; Ghosh-Dastidar et al., 2017; Parece et al., 2017).

On the contrary, public health researchers mainly employ epidemiological and ecological approaches to understanding food access and its relationship to health conditions (Deller et al., 2017; Wright et al., 2017). The distribution of health conditions remains measured based on two categories; individual or neighborhood socioeconomic characteristics and food environment. The primary variables studied include obesity, income levels and racial composition of individuals, number of healthy or unhealthy food stores within neighborhoods, and the content of food stores (Bonica & Story, 2017; Campbell et al., 2017; Cooksey-Stowers et al., 2017; Deller et al., 2017; Leung et al., 2017; Heval et al., 2016). Ecological studies mainly focus on the food environment and how it affects individual choices of food. Studies here are mostly qualitative in nature and seek answers from consumers

on their food choices in relation to lack of access to nutritious food stores or quantitatively measuring store contents (Campbell et al., 2017; Heval et al., 2016; Leung et al., 2017; MacNell et al., 2017; Williamson et al., 2017). Bonica & Story, (2017) pursued a unique approach by using an experiment; they restricted a subject to eating from only convenience stores to test how eating from convenience stores can affect individual health.

Several studies also look at the neighborhood socioeconomic characteristics (income, race, gender, age, etc.) distinctly and how they relate to the prevailing health conditions among neighborhoods (Cooksey-Stowers et al., 2017; Heval et al., 2016; Wright et al., 2017). In measuring the socio-economic characteristics in relation to health, some researchers use GIS methods as well, showing some level of mixed method approach in public health (Halpern et al., 2017; Romano et al., 2017; Rummo et al., 2017; Kolodinsky et al., 2017). Areas with higher rates of a condition such as obesity and higher concentrations of individuals with lower-socio economic characteristics are mainly the targets of the research questions of such studies (Campbell et al., 2017; Cooksey-Stowers et al., 2017; Halpern et al., 2017; Heval et al., 2016; Romano et al., 2017; Wright et al., 2017). The neighborhood approaches appear geared towards identifying racial or economic disparities or injustices in food environments of people based on socio-economic status (Romano et al., 2017; Rummo et al., 2017; Wright et al., 2017).

V. COMMON GROUND: FOOD ACCESSIBILITY RESEARCH BETWEEN GEOGRAPHY AND PUBLIC HEALTH

The fields of geography and public health have no specific counter-arguments regarding food accessibility and how it affects people across the country. The perspectives, theories, and approaches, however, that guide their studies on food accessibility demonstrate certain dissimilarities between the disciplines. Geographers mainly focus on travel distances, location characteristics, transportation options and other factors that define the level of accessibility to food stores (Abubakari, 2017; Chen, 2017; Shannon, 2016; Slocum & Saldanha, 2016; Parece et al., 2017; Widener & Shannon, 2014; Widener et al., 2017). On the other hand, Public health professionals pay more attention to the content of food stores (fresh fruits and vegetables), individual diet choices and how they relate to obesity and other health concerns among people in a place (Bonica & Story, 2017; Campbell et al., 2017; Cooksey-Stowers et al., 2017; Deller et al., 2017; Heval et al., 2016; Leung et al., 2017; MacNell et al., 2017; Romano et al., 2017; Williamson et al., 2017; Wright et al., 2017). These

difference in focus is explained by the theories guiding the studies.

Geographers primarily use retail geographical theories such as the central place theory and perspectives that mostly delve into understanding places and how they shape location of services or contribute to decisions on food store locations (Dawson, 2012; Ghosh-Dastidar et al., 2017; Johnson, 2016; Widener & Shannon, 2014). Such perspectives significantly inform their concentrations of studies on location and distance to food stores. In the same context, geographers concern has been on consumer travel origin and destinations, thus, where consumers shop, and how far they are willing to travel from their homes to access services such as fruits and vegetables. The focus on place and travel patterns mainly generate studies on proximities and densities of food stores within certain kinds of neighborhoods among geographers (Abubakari (2017; Shannon, 2014,2016; Widener & Shannon, 2014).

Unlike geographers, public health researchers principally utilize ecological and behavioral theories and perspectives in understanding how individual circumstances and residential neighborhood environments relate to health conditions (Deller et al., 2017; MacNell et al., 2017; Romano et al., 2017; Williamson et al., 2017; Wright et al., 2017). Accordingly, studies from this field ought to unravel the content of food stores within convenient locations to residents and how the food environment affect eating patterns among people with the anticipation of comprehending the problems that contribute to health complications such as obesity among a defined population (Halpern et al., 2017; Kolodinsky et al., 2017; Romano et al., 2017; Rummo et al., 2017).

Apart from the existing differences in perspectives and approaches, some researchers from geography and public health undertake to some extent, studies that transcend their main disciplines to incorporate some worldviews from the other discipline (Abubakari, 2017; Dai & Wang, 2011; Halpern et al., 2017; Kolodinsky et al., 2017; Romano et al., 2017; Rummo et al., 2017; Shannon J., 2014). The inclusion of perspectives from different disciplines, however, is largely piecemeal and is best described as multidisciplinary studies instead of interdisciplinary (Choi & Pak, 2006). They are multidisciplinary because insights expended remain partial or unintegrated; they are often employed in providing an explanation or support for certain fragments of the problem or inquiry (Choi & Pak, 2006; Repko & Szostak, 2017). For instance, geographers often feature research findings from public health studies that establish a link between access to nutritious food outlets to obesity, to purposively construct a background and rationale for measuring travel distances to food stores, and or densities of food stores within neighborhoods

(Abubakari, 2017; Chen, 2017; Parece et al., 2017; Shannon, 2016; Widener & Shannon, 2014). Likewise, public health researchers utilize geographic findings on food deserts, food store density and travel distances to build a context and justify the need for research into neighborhood food contents, the kind of food people consume and how it relates to body mass index and other health concerns of the field (Bonica & Story, 2017; Cooksey-Stowers et al., 2017; Halpern et al., 2017; Heval et al., 2016; Kolodinsky et al., 2017; Wright, Gerassimakis, Bygrave, & Waldstein, 2017).

Furthermore, inferencing from the studies reviewed above, there exist some eminent mutual cognitive factors that drive food accessibility research between geographers and public health scholars or practitioners (Figure 1). Primarily, the concept of 'place' appears as a cross-cutting factor between both disciplines. Place is significant in ecological theories, and perspectives, thus, guide public health research. As stated in the earlier part of this inquiry, public health professionals view the etiology of health concerns such as obesity to contain both individual and environmental factors, and where (places) people live, and the kind of food they have access to within these spaces could have an effect on their health. Hence, the constant research on the link between food environment and obesity rates of neighborhoods among public health scholars and practitioners. Again, place is one of the fundamental themes of geography and virtually defines the perspectives and approaches of research in that field. Primary retail geographic theories such as the central place theory are place-based, and remain one of the guiding pillars of research into locations of food stores in relation to where people live and shop in food accessibility studies. Therefore, both geographic and public health perspectives, theories, and approaches of research expressively recognize the importance of place in people lives and agree on the importance of locating nutritious food outlets within places people live.

Entrenched in both public health and geography works on food accessibility and population health is socio-economic characteristic of individuals and neighborhoods (Figure 1). Both fields examine elements such as income, race, age, gender, etc., except that geographers mainly focus on physical access and density of food outlets and health researchers primarily focus on health concerns such as obesity. Specifically, both fields extensively attempt to examine disparities in food accessibility between individuals of lower socioeconomic status and individuals of higher socioeconomic status; the focus of both fields in that regard is on income and race. As examined earlier, both geographers and public health scholars and practitioners suggest that people of low socioeconomic characteristics are unduly disadvantaged when considering the location of nutritious food stores and distribution of health

complications such as obesity. Hence, the existence of an additive inclusion of perspectives from each other on the issue of food access and obesity.

Moreover, per the literature, minorities, especially Blacks and Latinos remain the most disadvantaged regarding access to nutritious food outlets compared to White and non-Black/Latino populations. Similarly, obesity rates are higher among minorities (Blacks and Latinos) than among White and non-Black/Latino populations in the US. With regards to income, low-income residents of any type of settlement (rural/urban) have disproportionate lack of access to nutritious food outlets compared to high-income residents of any community (rural/urban). Underprivileged residents also have higher rates of obesity than high-income residents. Therefore, both geographers and public health researchers agree on an intersectionality of poverty and race when discussing food deserts or access to nutritious food and health complications such as obesity. These agreement forms the common ground between both disciplines in this paper, and stand as the bedrock for integration of the disciplinary perspectives and approaches in examining food accessibility.

Even regarding the scope or scale of the studies, both geographers and public health researchers measure food accessibility; be it by distance, density, food contents, or health complications based on socio-economic characteristics at the individual and neighborhood levels. Essentially, geographic perspectives and approaches combined with that of public health will provide a complete framework of food accessibility research that will ensure a more comprehensive understanding of the problem spanning from place to health. Therefore, the proposal advanced further in the following sections of this paper and illustrated in Figure 1, is an interdisciplinary outlook that combines geographic theory and public health theories, or perspectives to form a new form of perspective that would implement both views in a complete study on food accessibility. In the context of this paper, as illustrated in Figure 1 below, central place theory and ecological model combined would provide a more comprehensive framework and understanding of food accessibility; spanning from individual and neighborhood socioeconomic characteristics, location, place, and movement, to food choices and health consequences.

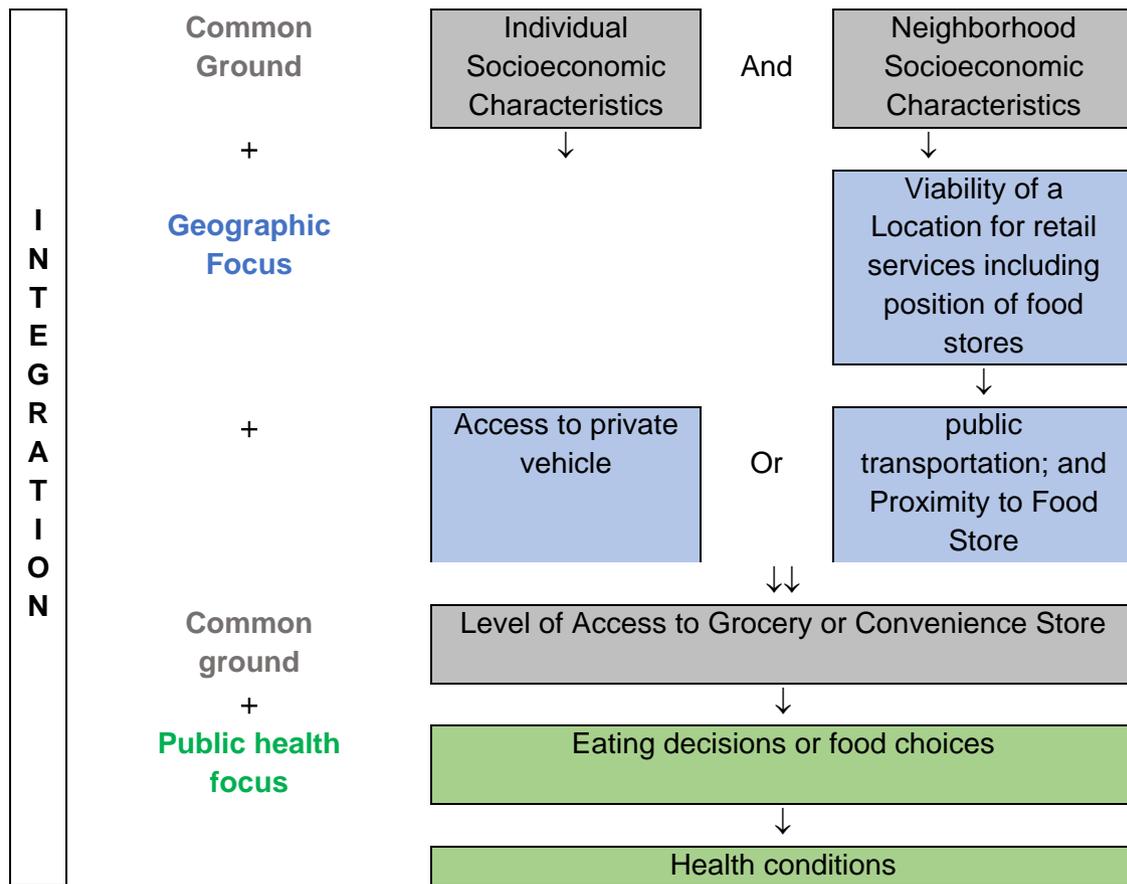


Figure 1: Interdisciplinary Food Accessibility Framework

VI. AN INTERDISCIPLINARY APPROACH IN EXAMINING FOOD ACCESSIBILITY

The issue of inadequate access to nutritious food stores within neighborhoods affects several people in the US, and as indicated by both geographers and public health researchers, low-income residents in both urban and rural settlements are affected the most. There is also a common knowledge about research findings that indicate that low-income residents across the country often rely on food outlets without healthy options and that utilization of unhealthy food also relates to health concerns such as obesity. Therefore, Figure 1 defines the problem wholly, with all the components and perspectives such as place, socio-economic characteristics, and health included, it explicitly illustrates the complexities of food inaccessibility and the need to view it with interdisciplinary lenses. This approach will also mean integrating perspectives, and some fundamental theories and procedures of the disciplines of geography and public health to enable a comprehensive understanding and solution to the problem. In a more precise way; the following are suggestions regarding an integration between geography and public health for the interdisciplinary study of food accessibility expended in Figure 1.

The geographic central place theory and the ecological model that guides research in public health appear useful in fully understanding the problem of food accessibility as it relates to poverty and health. In combining those two perspectives, Figure 1 illustrates that food accessibility is an issue that includes business decisions with regards to the location of food stores, individual and neighborhoods socio-economic characteristics, transportation, personal food choices and a health factor. Therefore, an individual's socioeconomic characteristics including income and race determine where the individual resides. People with low incomes are most likely to settle in areas with low housing values due to their inability to live in high-income areas. The neighborhood in which a person resides may play a significant role in determining the person's food-retail environment. The food-retail environments of poor residents are often without nutritious food options because retailers usually place grocery stores within neighborhoods or in proximity to communities, which can yield higher dividends or support profit maximization. As a consequence, low-income residents with adequate access to a vehicle, and understanding of the importance of healthy eating can travel farther distances to access nutritious food. Residents unable to access nutritious food stores are most likely to rely on neighborhood convenience stores, which do not provide nutritious food like fresh fruits and vegetables, hence maybe at a higher risk of developing food-related health complications such as obesity and diabetes. Thus, a complete definition that mathe-

matically incorporates all perspectives from geography and public health, and essential for researchers to consider it entirely when designing research on food accessibility.

Based on the comprehensive problem definition provided and illustrated in Figure 1, researchers should consider incorporating both geographic and public health perspectives more comprehensively when designing studies. That is, adopting the description of the problem provided and also integrating both aspects from the review of the literature, research questions, methods, results, and conclusions. For instance, instead of just asking a question that intends to measure only physical access to food stores by distance, researchers should have follow-up questions that probe the individual level factors that define accessibility, including transportation availability and shopping decisions as well as health conditions in relation to the eating choices. This approach will reveal the various facets of the problem defined above and would help researchers to unravel the issues bordering food accessibility completely. This approach also implies that researchers should go beyond using geographic information systems, statistics, or qualitative research to a more community-based interdisciplinary mixed method approach that will incorporate several of these methods. Whereas Geographic Information System technologies can measure the questions on physical distance, statistics will be useful in measuring availability and density, and qualitative methods such as focus group discussions are appropriate for gathering insights from individuals about health issues and food access.

VII. DISCUSSION AND CONCLUSION

The problem of food accessibility appears very complicated and attempts by various disciplines especially geography and public health to unravel it has been piecemeal. Despite growing public interest in food deserts, the fragmented approaches of research do not stimulate a complete assessment of, or even a holistic approach in solving the problem, hence the unending nature of the problem in the country. A geographic or public health based study with additive insights from other disciplines cannot fully unpack the issue, hence the need for an interdisciplinary approach. Synthesis and integration of knowledge from different disciplines, which forms the bedrock of an interdisciplinary study are essential for probing a convoluted issue such as food desert or food accessibility. This approach as shown in Figure 1, amalgamates the various perspectives of the problem of food access and helps to create a new and more comprehensive understanding of the problem.

The reviewed literature demonstrates that the lack of food accessibility indeed falls within the confines of research in geography and public health as it is both

a geographic concern and public health concern. Whereas geography is concerned with place and how people within such spaces live and move around their day to day activities, and for that matter grocery shopping, public health finds it essential that the food people eat affect their wellbeing. Studies by researchers from these distinct disciplines, however, barely take into consideration perspectives and even approaches from the other discipline when studying either part of the problem. Meanwhile, there is a common population of interest; low-income and minority residents who reside within food deserts. In order to comprehensively understand the problem and possibly identify solutions to solve the problem entirely, this study calls for an interdisciplinary approach in examining food accessibility. Here an amalgamation of geographic perspectives and approaches with public health perspectives and methods in studying food accessibility is encouraged. By so doing, researchers can comprehensively address the issue by using geographic theories in understanding location, places and how people circulate within places to access food, and extensively utilize public health perspectives and approaches in measuring people's decisions and eating habits and their health implications on the people.

Although piecemeal multidisciplinary studies exist on food accessibility, they do not comprehensively unpack the issue, as several neighborhoods remain food deserts in the country. This interdisciplinary approach, therefore, is a complete system of merger where both disciplinary approaches stand utilized from conceptualization of the problem, literature review, methodologies, to interpretation and application of results of the study. An adoption of this approach will hopefully translate into viable information not just for academia but information that will be useful for decision-making bodies and institutions such as the United States Department of Agriculture. The information will also contribute to a full understanding of the complexities of the issue of food accessibility in a particular community and yield possible direction for sustainable solutions to surmount the problem in the United States and World Over.

ACKNOWLEDGEMENT

I wish to thank Professor Elizabeth Mellin, Director, Community Research and Action Phd Program for her guidance and input in understanding interdisciplinary and integration of different perspectives in research.

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