THE INFLUENCE OF PERCEIVED ACCESS TO HEALTHY FOOD AND PHYSICAL ACTIVITY ON THE SUBJECTIVE HEALTH OF AFRICAN AMERICANS IN RURAL COMMUNITIES

Jo Ellyn O. Y. Walker
George B. Cunningham PhD

Abstract: The purpose of this study was to examine the presence of food deserts on the subjective health of rural residing African Americans. The authors also examined the potential moderating role of physical activity. Data were part of a larger health assessment project. In this study, African Americans (156 women, 49 men) taking part in this study lived in rural central Texas. Results indicate that whereas participants did not perceive a lack of healthy food, they did perceive financial barriers to obtaining such diet options. Further analyses revealed that the presence of food deserts interacted with physical activity levels to predict subjective health: when activity levels were low, food deserts were negatively associated with subjective health, but these effects were nullified when physical activity levels were high. African Americans living in rural settings face unique challenges to obtaining and consuming healthy food, and as a result, health can suffer. These negative effects can be countered though by engaging in the recommended levels of moderate physical activity.

INTRODUCTION

Health disparities represent “differences in health profiles across major subgroups of the population, including a broad spectrum of physical and mental health outcomes, from self-rated health to mortality, from psychological well-being to major mental disorders” (Schnittker & McLeod, 2005, p. 75). The differences in access to and the quality of healthcare are particularly salient for racial minorities. Illustrative of this point, racial minorities, relative to their white counterparts, are more likely to experience barriers in accessing healthcare (Braveman, Egeter, & Williams, 2010), engaging in leisure time physical activities (Phillip, 1995), and obtaining healthy and affordable food (Smith et al., 2010; Walker, Keane, & Burke, 2010; Dean & Sharkey, 2011a,b), as well as differential treatment during contact with healthcare providers (Braveman et al., 2011).

A lack of access to healthy food also contributes to health disparities (Dean & Sharkey, 2011a; Smith et al., 2010; Walker et al., 2010). Therein lies the importance of food insecurity and food deserts. The former term is generally more encompassing and entails one's retail food environment, household food supplies, financial resources allowing for the purchase of affordable, balanced food items, and the presence or absence of need to skip meals (Dean & Sharkey, 2011a). On the other hand, food deserts materialize when the area in which one lives lacks stores to purchase affordable, healthy food (Cummins & Macintyre, 2002; Walker, Keane, & Burke, 2010). Such disparities play an important role in people's health and well-being, as they result in a failure to consume the recommended levels of vegetables, fruits, and other healthy foods (Liese, Weis, Pluto, Smith, and Lawson, 2007), which in turn, is related to cardiovascular disease (Bazzano et al., 2002; Ness & Powless, 1997), stroke (Joshihura et al., 1999), and certain forms of cancer (Key, Schatzkin, Willett, Allen, Spencer, & Travis, 2004).

The impact of food insecurity and food deserts might be especially salient among persons living in rural communities. Dean and Sharkey (2011b) noted that in these contexts, persons must overcome additional ecological barriers to healthiness (see also McLeroy, Bibeau, Steckler, & Glanz, 1988). Smith et al. (2010) made similar observations. Thus, persons living in rural settings, relative to their urban counterparts, must combat additional barriers to health and well-being that make a lack of access to healthy food particularly taxing.

The effects of food deserts among persons in rural communities might be particularly salient among racial minorities. Indeed, from a critical race theory perspective, racism is embedded within cultures, institutions, and systems, and as such, has the potential to affect all elements of one's life, including health and well-being (Braveman et al., 2011; Hylton, 2008). The deeply embedded, systemic nature of racism means that even in communities of predominantly racial minorities, racism's effects on access to critical services, opportunities, and resources remain truncated, relative to others in the U.S. (Feagin, 2006). This theoretical perspective also recognizes the importance of intersectionality, or the role that multiple identities have on one's lived experiences. This is principally applicable for racial minorities living in rural communities, as they face dual barriers to health and well-being: racism and ecological barriers associated with living in rural communities. As Braveman et al. (2011) note, one's ecological sur-
roundings have the potential to reproduce and amplify the race-based disparities in health that racial minorities already experience.

Building from this literature, the first purpose of this study was to examine the food deserts among African Americans living in rural communities in Texas. We restrict our analyses to African Americans because of the systemic forms of prejudice and discrimination restricting their well-being (Feagin, 2006), evidence of race-related health disparities within the U.S. (Brondolo, Gallo, & Myers, 2009), and the lack of empirical examinations of race-specific health disparities models (Pieterse, Todd, Neville, & Carter, 2011). In drawing from critical race theory, we argue that African Americans, relative to their white counterparts, face racism, discrimination, and systems of oppression that limit their health and well-being. Given that persons in rural communities also face unique health-related challenges (Dean & Sharkey, 2011b; Smith et al., 2010), African Americans living in these communities might be particularly susceptible to having a lack of access to healthy, affordable food. Thus, we predicted:

Hypothesis 1: African Americans living in rural communities will perceive healthy food scarcity.

Hypothesis 2: African Americans living in rural communities will perceive financial barriers to healthy food.

Food Deserts, Physical Activity, and Health

As previously noted, a lack of access to healthy food is associated with low levels of health and well-being (e.g., Bazzano et al., 2002; Joshipura et al., 1999; Key et al., 2004; Liese et al., 2007; Ness & Powell, 1997). We expected a similar relationship in this study, but also examined the role of a potential moderator: physical activity levels. Moderators provide important information about when and under what conditions certain relationships will take place and also represent ways to extend current theoretical understandings (Colquitt & Zapata-Phelan, 2007; Cunningham, 2013).

The benefits of regular physical activity are well documented. For instance, Blair and Brodney (1999) observed that regular physical activity helped to decrease risks of mortality and morbidity—findings that held across groups and even after controlling for various risk factors. Powell, Paluch, and Blair (2011) illustrated that moderate levels of physical activity are associated with a bevy of health benefits, including decreases in certain forms of cancer, Type 2 diabetes, and heart disease, as well as increases in mental well-being and physical functioning. Researchers have observed similar effects when focusing specifically on members of under-represented groups (Edwards & Cunningham, 2013; Lees, Taylor, Hepworth, Feliz, Cassells, & Tobin, 2007). Consequently, public and community health agents have sought to increase physical activity opportunities as a way of improving health (Dishman, Sallis, & Orenstein, 1985; Wilcox, Castro, King, Housemann, & Brownson, 2000).

We drew from these studies in our current work to examine the potential moderating effects of physical activity on the relationship between food deserts and subjective health. That is, if moderate physical activity is associated with increased physical and psychological health, it stands to reason that such activity levels might also help buffer some of the negative effects of food deserts. If this is the case, then the negative relationship between food deserts and subjective health might be less pronounced with people are otherwise physically active. Consistent with this theorizing, we hypothesized:

Hypothesis 3: The negative relationship between food deserts and subjective health will be moderated by physical activity, such that the relationship will be stronger when physical activity levels are low relative to when they are high.

METHOD

Data Source and Participants

We drew from data obtained from a 2010 community health assessment conducted in Texas. The project received the necessary human subjects approvals. The Center for Community Health Development (2010) provides an overview of the data collection and procedures. The larger survey included seven counties (1 urban, 6 rural) located in central Texas, with a combined population approximating 300,000. A working group of representatives from 28 different organizations functioned to assemble the 32-page questionnaire. This instrument contained items from a number of different scales and sources, all of which were included as a way of assessing the participants’ health and its predictors. In our analysis, we focused on the scarcity of healthy food, the cost of healthy food, physical activity levels, and overall health.

In the larger study, researchers randomly selected 15,000 households from a comprehensive list of residential addresses. Consistent with Dillman’s (2000) recommendations for multiple contacts, each participant received a pre-study letter alerting them to the study, and was then contacted by telephone. Of those contacted by phone (10,501), 5,362 agreed to take part in the study, and they were subsequently sent a questionnaire packet. Of this group, 3,965 returned the packet, for a 73.9% response rate.

Given the purpose of the study, we restricted our analyses to responses from African Americans residing in rural communities. The sample included 49 men (23.9%) and 156 women (76.1%). Most of the participants had high school (n = 95, 46.3%) or more than high school (n = 87, 42.4%) for their highest level of education. The mean age was 58.73 years (SD = 14.56) and the mean household income was approximately $32,138 (SD = 30,342.44). As Table 1 shows, participants in the sub-sample, relative to the complete dataset, were more likely to be women, were less educated, of similar age, and had appreciably lower household incomes.
Measures

Participants completed a questionnaire in which they provided their demographic information (as previously outlined) and responded to questions measuring the scarcity and price of healthy food, their physical activity levels, and their subjective health.

**Healthy food scarcity and price.** We measured healthy food scarcity with three items. The stem read: “Thinking about the food resources in your community, please read the following questions carefully and choose one answer for each question.” The three items were: “The availability of fresh fruit is,” “The availability of fresh vegetables is,” and “The availability of a variety of lean (low fat) meat, poultry, and fish is.” A 4-point scale, ranging from 1 (very good) to 4 (poor) anchored each item. The reliability was high (α = .89), and we took the scale mean to represent the final score of that variable.

We then measured food price with three items as well. The stem read: “Thinking about the store where you buy most of your groceries, please answer the following,” and we used the following three items: “the price of fresh fruit is,” “the price of fresh vegetables is,” and “the price of lean (low fat) meat, poultry, and fish is.” The items were anchored by a 4-point scale from 1 (very high) to 4 (very low), and we reverse scored the items so that higher scores reflected high food price. The reliability was high (α = .86), and the scale mean was used to represent the final score for that variable.

Both of these variables informed our treatment of a food desert. Drawing from the literature in this area (Cummins & Macintyre, 2002; Walker et al., 2010), we considered a food desert to be an area where access to healthy food is low and the price of such food is high. In line with this perspective, we first created a food desert variable whereby persons who scored a 3 or greater on the food scarcity and food price items were classified as experiencing food deserts, whereas those with scores below this threshold were considered to not be in this state.

**Physical activity.** We used a version of the Rapid Assessment of Physical Activity to measure PA (Topolski et al., 2006). The introduction to the physical activity portion of the questionnaire read: “Physical activities are activities where you move and increase your heart rate, whether you do them for pleasure, work, or transportation.” Examples were also available, such as fast walking, strength training, and gentle swimming. Participants were instructed that moderate physical activities included those where “your heart beats faster than normal” and “you can talk but not sing.” They were then asked: “In a usual week, how many days per week do you do moderate activities for at least 10 minutes at a time?” and we used this response as the measure of moderate physical activity.

**Subjective health.** We measured subjective health with a single, self-report item: “In general, would you say your health is,” anchored by a 5-point scale from 1 (excellent) to 5 (poor). DeSalvo, Fan, McDonnell, and Fihn (2005) offered validity evidence for the measure. We reverse scored the responses so that higher scores reflected better health.

RESULTS

We present descriptive statistics in Table 2. We include sex, age, and income in the analysis because of their potential links with health. Age (r = -.36), income (r = .36), and food price (r = -.15) were all significantly associated with subjective health. The mean score for days engaged in moderate levels of physical activity was low (M = 3.17, SD = 2.41), and a one-sample t-test showed it was significantly less than the recommended number of days per week to engage in moderate physical activity (5), t (190) = -10.50, p < .001. Finally, the mean score for the subjective health assessment was significantly lower than the midpoint of the scale (3), t (194) = -3.08, p = .002.

Table 1 Characteristics of the Sub-Sample and Overall Sample

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>African Americans in Rural Communities (N = 205)</th>
<th>Overall Sample (N = 3965)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>58.73</td>
<td>58.52</td>
</tr>
<tr>
<td>Percent African American</td>
<td>---</td>
<td>n = 348, 8.8%</td>
</tr>
<tr>
<td>Percent Women</td>
<td>n = 156, 76.1%</td>
<td>n = 2771, 69.9%</td>
</tr>
<tr>
<td>High School Education</td>
<td>n = 95, 46.3%</td>
<td>n = 1404, 35.4%</td>
</tr>
<tr>
<td>More than High School Education</td>
<td>n = 87, 47.2%</td>
<td>n = 2216, 55.9%</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household income</td>
<td>$32,138.72</td>
<td>$55,642.70</td>
</tr>
</tbody>
</table>

with physical activity, as it held direct, positive effects with health and also served to moderate the relationship between food deserts and subjective...
Table 2 Means, Standard Deviations, and Correlations

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sex</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Age</td>
<td>-.04</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Income (log)</td>
<td>-.14</td>
<td>-.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Food scarcity</td>
<td>.04</td>
<td>-.04</td>
<td>.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Food price</td>
<td>.12</td>
<td>.05</td>
<td>-.14</td>
<td>.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Moderate physical activity</td>
<td>-.05</td>
<td>-.10</td>
<td>-.04</td>
<td>-.05</td>
<td>-.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Health</td>
<td>-.02</td>
<td>-.36</td>
<td>.36</td>
<td>-.09</td>
<td>-.15</td>
<td>.08</td>
<td>---</td>
</tr>
</tbody>
</table>

M (%) | 76 | 58.73 | 32138.72 | 2.31 | 2.87 | 3.17 | 2.78 |
SD    | ---| 14.56 | 30342.44 | .90  | .69  | 2.41 | 1.00 |

Notes. Frequency provided for sex, which represents the proportion of women. The M and SD for income represent the values prior to data transformation. r ≥ .14, p < .05.

Hypothesis Testing

The first two hypotheses predicted that African Americans in rural communities would experience healthy food scarcity (H1) and financial barriers to obtaining healthy food (H2). We tested these hypotheses by comparing the mean scores to the midpoint of the scale (2.5) via a one-sample t-test. Results indicate that the food scarcity mean score (M = 2.31, SD = .90) was significantly less than the midpoint of the scale, t(195) = -3.03, p = .003; thus, Hypothesis 1 was rejected. However, Hypothesis 2 was supported, as the mean score for financial barriers to healthy food (M = 2.87, SD = .69) was significantly greater than the midpoint of the scale, t(200) = 7.57, p < .001.

Hypothesis 3 predicted that levels of moderate physical activity would moderate the relationship between food deserts and subjective health. Consistent with the notion that food deserts represent areas where access to healthy food is poor and the price of such food is high, we first created a food desert variable whereby persons why scored a 3 or greater on the food scarcity and food price items were classified as experiencing food deserts (n = 41, 20.9%), and all other participants were classified as not doing so (n = 155, 79.1%). We then computed a moderated regression, following Cohen, Cohen, West, and Aiken’s (2003) guidelines. We controlled for sex, age, and income (transformed using the natural log) in Step 1, the standardized value of days spent engaging in moderate physical activity and the food deserts variable in Step 2, and the food deserts x physical activity product term in Step 3. Subjective health served as the dependent variable.

Table 3 provides the results. The controls accounted for 24% (p < .001) of the variance, with both age (β = -.35, p < .001) and income (β = .27, p < .001) holding a significant association with subjective health. The first order effects then accounted for an additional 4% (p = .02; see Model 2) unique variance. Days spent in moderate physical activity were positively associated with subjective health (β = .15, p = .04), whereas food deserts held a marginally significant, negative association with subjective health (β = -.13, p = .06). Finally, as seen in Model 3, the food deserts x physical activity product term was significant (β = .16, p = .04), accounting for an additional 2% unique variance.

Given these findings, we followed Cohen et al.’s (2003) recommendations and plotted the interaction through simple slopes analysis (Figure 1). Results indicate that when physical activity levels were low, food deserts were significantly and negatively associated with subjective health (β = -.80, p = .005); however, when physical activity levels were high, there was no relationship between food deserts and subjective health (β = .01, p = .99). Thus, Hypothesis 3 was supported.

DISCUSSION

This study examined the relationship among food deserts, physical activity, and subjective health in African Americans living in rural central Texas. Although participants did not perceive a lack of healthy food alternatives, they did perceive price to be a limiting factor. The end result is likely the same as if healthy food was scarce as well. That is, if people cannot afford to purchase fresh fruit, fresh vegetables, and lean meats, the foods’ abundance in the community is of little consequence. These findings are consistent with critical race theory (Braveman et al., 2011; Hylton, 2008) and ecological explanations of health disparities (McLeroy et al., 1988) and suggest that rural-residing African Americans might face multiple barriers, including their location, racism, and financial resources, in accessing healthy food options.

We also examined the interactive effects of food deserts and physical activity on the participants’ subjective health. Consistent with the growing research in this area (Blair & Brodney, 1999; Edwards & Cunningham, 2013; Lees et al., 2007; Powell et al., 2011), we observed health benefits associated
Table 3 Results of Moderated Regression Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>-.03</td>
<td>-.02</td>
<td>-.01</td>
</tr>
<tr>
<td>Age</td>
<td>-.35**</td>
<td>-.35**</td>
<td>-.34**</td>
</tr>
<tr>
<td>Income (log)</td>
<td>.27**</td>
<td>.27**</td>
<td>.29**</td>
</tr>
<tr>
<td>Food desert (FD)</td>
<td></td>
<td>-.13</td>
<td>-.13</td>
</tr>
<tr>
<td>Moderate physical activity (PA)</td>
<td></td>
<td>.15*</td>
<td>.07</td>
</tr>
<tr>
<td>FD × PA</td>
<td></td>
<td></td>
<td>.16*</td>
</tr>
<tr>
<td>R²</td>
<td>.24</td>
<td>.28</td>
<td>.30</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.24**</td>
<td>.04*</td>
<td>.02*</td>
</tr>
</tbody>
</table>

Notes. **p < .001, *p < .05.

Figure 1 Influence of Food Deserts and Levels of Moderate Physical Activity on Subjective Health

Food deserts represent estimates of high food prices and food scarcity (high) or low food prices and food abundance (low). Health assessment ranges from 1 (poor) to 5 (excellent). Food deserts were significantly and negatively associated with subjective health (B = -2.80, p = .005); however, when physical activity levels were high, there was no relationship between food deserts and subjective health (B = .01, p = .99).

health. When activity was low, the presence of food deserts was negatively associated with subjective health; however, when participants engaged in high levels of moderate physical activity, these negative effects disappeared. It is possible that although the lack of fruit, vegetables, and lean meats negatively affect sedentary individuals (e.g., Liese et al., 2007), the many physiological benefits of being physically active (Powell et al., 2011) helped to counteract these detriments.

These results help extend theory in this area and suggest one way of counteracting the negative effects of food deserts is to make opportunities for physical activity more readily available. Unfortunately, participants in the study did not, on average, engage in the recommended levels of moderate physical activity, reporting a mean of 3.17 days per week. This is consistent with research in other areas, showing that adults living in rural communities have low physical activity levels (Brownson et al., 2000). In line with these findings, there is evidence that because of the systemic nature of racism and discrimination in the U.S., African Americans frequently face unique challenges to being active (Edwards & Cunningham, 2013). These include feeling unwelcomed in recreational areas (Phillip, 1995), the racial delineation of leisure spaces (Gobster, 2002), a lack of discretionary income (Cunningham, 2011), and limited physical activity opportunities (Edwards & Cunningham, 2013), among others. Remaining cognizant of critical race theory’s focus on intersectionality (Hylton, 2008), it is important to take into account both the individual’s identity as an African American and that...
of someone who lives in a rural community when identifying and developing opportunities for physical activities.

Frost et al. (2010) offer one potential option. They observed that within rural environments, pleasant aesthetics, the availability of trails, safe settings, and the presence of parks were all associated with increased physical activity; on the other hand, the effects of lighting, sidewalks, and recreational facilities were not reliably associated with activity levels. It is possible these findings would be applicable for African Americans in rural communities, too. Affecting rural communities in these ways might help facilitate the social and structural environments needed to promote regular activity (see also Estabrooks, Fisher, & Hayman, 2008).

Limitations and Future Directions

Whereas the study has several strengths, we are also cognizant of the potential limitations. First, the data are cross-sectional in nature, and thus, the relationships are correlational rather than causal in nature. Second, we relied on a self-report measure of physical activity. It is possible that other objective measures (e.g., actigraphy) might provide different results. Consistent with other household survey research, the overall sample in our study included an over-representation of women and people who were better educated and more affluent than their peers in the general population (Center for Community Health Development, 2010). Related to this point, as the mean age of our sample was near 60, the findings might not be as applicable to younger African Americans. Finally, we did not assess the participant’s likelihood of purchasing or consuming healthy food were it to be available. This is potentially an important element in evaluation of the food deserts and their effects.

Finally, we have also identified a number of areas of future research. First, there is value in continuing to focus on rural populations and specific groups within that setting. As persons in these areas face unique barriers to health and well-being (Dean & Sharkey, 2011b; Smith et al., 2010), efforts to improve understanding of their health and predictors of it are needed. In addition, future researchers should identify the forms of physical activity in which African Americans in rural settings are most likely to engage, and how the different forms of physical activity might differentially buffer the effects of food deserts. Furthermore, our research focused on adults, but there is a need to also examine the barriers and opportunities for healthy eating and physical activity among youth living in rural environments. Finally, from a critical race theory perspective, systemic changes are needed to counter the effects of health disparities. Thus, strategies are needed to build community capacity and engage in system-wide efforts to make healthy foods more affordable while also increasing opportunities to be physically active. Without such systemic efforts, health disparities so frequently observed will only continue.

References


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