



## Barriers to Fresh Fruit and Vegetable intake among African Americans in a Southeastern City: Preventive Implications for Cardiovascular Disease

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### Abstract

**Objective:** This study summarizes the findings of the Centers for Disease Control and Prevention REACH 2010 intervention's impact on reducing risk for cardiovascular disease among racial and ethnic groups living in the Atlanta Empowerment Zone (AEZ). In Fiscal Year 1999, the Centers for Disease Control and Prevention (CDC) funded several health efforts to develop primary prevention programs for the reduction and elimination of racial and ethnic disparities in health targeting cardiovascular disease.

**Methods:** Participants (N=244) were recruited from neighborhoods in the Atlanta Empowerment Zone (AEZ) to take part in an intervention designed to reduce risk to Cardiovascular Disease Risk. Chi-square was used to discern linear associations between categorical measures of barriers at assessment periods and regression analysis was conducted to determine the rates at which the stated barriers to fruit and vegetable consumption varied according to gender at both assessment periods. Adjusted risk ratios (RRs) with 95% confidence intervals (CIs) are presented along with associated probability values.

**Results:** The analysis also revealed that buying fresh fruit every day (RR 1.5; 95% CI .50, 4.8) and that there is too much waste with fresh fruit as being major barriers to consumption (RR 1.5; 95% CI .45, 5.3). Participants were more likely to show that there was too much waste with fresh vegetables (RR 1.3; 95% CI .38, 4.4) or that they did not have the skills required to select fresh vegetables (RR 1.2; 95% CI .35, 4.0).

**Conclusions:** Findings suggest that interventions can affect barriers related to personal beliefs. However, cost and other economic factors remain difficult to change.

the recommendations posited by health organizations [7].

Despite the health benefits of increasing fresh fruit and vegetable consumption, few Americans do it. Many reasons contribute to this outcome and vary by social and situational family factors [8]. Unfortunately, this is even more of a problem among African Americans; in particular, those entrenched in poverty [9]. Among African Americans, this problem gives rise to severe disparities in the occurrence of cardiovascular disease when compared to other ethnic groups [10,11]. African-Americans consume fewer than the recommended F & V servings per day [12,13]. There are also documented ethnic differences with respect to daily intake and variations of consumption patterns [14]. These differences can range from area of the country people reside in as well as how food is prepared [15].

As indicated previously, diets high in fat and low in fiber are associated with higher death rates of coronary heart disease, colon, breast and other cancers, and stroke [16], whereas high fruit and vegetable consumption has been shown to be a protective factor for certain cancers, stroke, and CHD [17-19].

Other factors influence the consumption of fresh fruit and vegetables and often eventuate in the form of barriers. Some common barriers to dietary behavior change in the form of fresh fruit and vegetable consumption subsume availability [9,20] cost [21,22] and that they take time to prepare [22]. Moreland and associates reported that there was a positive correlation between the number of grocery stores in African American and white communities and fruit and vegetable intake and number of supermarkets in African American neighborhoods [23]. In particular, these barriers are more of a problem among low-income families [9,22]. This implies that the children of these families are also at risk and tend to consume less than the daily-required portions of fresh fruit and vegetables [24].

Multitudes of theoretical frameworks examine barriers to fruit and vegetable intake. Cullen and associates made use of the stages of change model to examine fruit and vegetable consumption among

### Introduction

Poor dietary practices are responsible for significant mortality and morbidity in the United States [1]. Poor dietary practices correlate with increased risk to cardiovascular disease [1-4]. Individuals who consume high levels of dietary fat and too little fiber, and limited fresh fruit and vegetables are those most at increased risk of heart disease, stroke, and cancer [5,6]. Thus fruit and vegetable intake in the United States, as well as other developed countries, is well below

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a sample of youth and found differences in both fruit preferences and barriers during pre-contemplation and contemplation stages. Such measures may be used to identify stage of adoption of fruit and vegetable intake and can be used to guide in the development and implementation of dietary interventions [25]. In another study, the authors used social cognitive theory to test parent's fruit, juice, and vegetable practices and concluded that self-efficacy was a strong predictor of children's low fat consumption [26].

Given the aforementioned, it is understandable that the US health goals, as presented both in Healthy People 2010 and REACH 2010, is to place increased attention on reducing risk to CVD via early identification, prevention and treatment of heart attacks, strokes; and other cardiovascular outcomes [27,28]. One way to accomplish this is to examine the extent to which individual barriers to fruit and vegetable consumption impact dietary behavior change among African Americans. By doing this, it may be easier to develop and implement interventions that may increase the consumption of servings of daily fresh fruits and vegetables among African Americans. Clearly, targeted efforts are required to improve the nutritional health of African Americans. Based on this premise, we undertook the current study to assess how the influence of a community-based intervention designed to reduce risk to CVDs could be effective in reducing barriers to fruit and vegetable consumption in a sample of African Americans living in a Southern City.

### Description of the Target Community

The Atlanta Empowerment Zone/Renewal Community is a federally funded program that provides grants and/or loans to

nonprofit or for profit organization to carry out a broad range of human services, safety, housing and economic development programs within target areas in the City of Atlanta. The City of Atlanta's Empowerment Zone is made up of 30 neighborhoods, has a poverty rate of 57.4% and population of 50,000.

### Description of the Intervention

The lifestyle interventions were gender specific and covered several components regarding dietary behavior. These included: diet modification, physical activity, reduced salt intake, increased water consumption, reduced fast food consumption, increased consumption of fresh fruits and vegetables and behavioral strategies including self-monitoring, goal setting and problem solving were stressed. Participants met in small groups weekly for the first 6 months and 3 times per month for the next 6 months. These sessions utilized a standardized protocol and focused on diet, physical activity, or social support and were designed to be administered consistently across multiple locations in the AEZ and to allow maximum flexibility, given the heterogeneity of the participants. In addition, it allowed for the intervention to ensure that all participants were taught the same basic information about nutrition, physical activity, and behavioral self-management. In terms of exercise, the intervention stressed brisk walking and other examples of activity walking, including aerobic dance, bicycle riding, skating, and swimming.

Intervention sessions that targeted behavioral issues focused on the psychological, social, and motivational challenges involved in maintaining these healthy lifestyle behaviors in the long term, inclusive of ongoing identification of personal barriers to CVD

**Table 1:** Socio Demographic Characteristics of Participants (N=258).

Variable	Male N%	Female N%	Total N %	P Value
<b>Gender</b>				
Male			26 10.8%	
Female			214 89.2%	
<b>Marital Status</b>				
Married-spouse in home	9 34.6%	53 25.4%	62 25.2%	.14
Married spouse not in home	0	6 2.9%	7 2.8%	
Living as Married with partner	0	5 2.4%	5 2.0%	
Widowed	3 11.5%	17 8.1%	21 8.5%	
Divorced	7 26.9%	24 11.5%	33 13.4%	
Separated	0	7 3.3%	8 3.3%	
Never Married	7 26.9%	97 46.4%	110 94.7%	
<b>Employment</b>				
Employed for wages	13 54.2%	97 47.1%	110 47.3%	.38
Self-employed	0	12 5.8%	13 5.3%	
Out of work for more than a year	1 4.2%	9 4.4%	10 4.1%	
Out of work for more less than a year	1 4.2%	14 6.8%	15 6.2%	
Retired	7 29.2%	29 14.1%	40 16.5%	
Unable to work	1 4.2%	14 6.8%	16 6.6%	
Student	1 4.2%	13 6.3%	15 6.2%	
Homemaker	0	18 8.7%	19 7.8%	
<b>Income Level</b>				
Under \$5,000	1 4.8%	30 16.9%	33 15.7%	.005
\$5,000-9,000	0	4 2.3%	5 2.0%	
\$10,000-14,999	0	7 4.0%	7 3.5%	
\$15,000-19,999	1 4.8%	18 10.2%	20 9.6%	
\$20,000-24,999	1 4.8%	34 19.2%	39 17.7%	
\$30,000-34,999	0	17 9.6%	17 8.6%	
\$35,000-39,999	2 9.5%	10 5.6%	12 6.1%	
\$40,000-44,999	4 19.0%	8 4.5%	12 6.1%	
\$45,000 and over	8	27 15.3%	7 17.6%	
Don't know/ not sure	4 19.0%	22 12.4%	29 13.1%	
<b>Employment</b>				
Yes	19 82.6%	115 68.9%	134 70.5%	.17
No	4 17.4%	52 31.1%	56 29.5%	

risk reduction and dietary behavior change. Participants were also encouraged to increase their lifestyle activity by methods such as using stairs rather than elevators, and walking rather than riding. Additional life style intervention components included supervised activity classes, integrated in the intervention that were consistent with the overall goals of health empowerment. This included, stress management, meditation/yoga classes, and SPA days for women participants and recognizing anger as a normal human emotion, helping participants identify triggers to their anger, learning healthy verses unhealthy anger management skills for men.

## Method

Data was collected from study participants at two time points: baseline and follow-up upon program implementation and completion. Baseline and follow-up data was collected via survey instrumentation from 258 participants respectively, of which 244 are included in this analysis. The data assessment instrument collected information on participant's demographic characteristics, knowledge of cardiovascular disease risk and health practices regarding physical activity and dietary behavior. Trained interviewers collected data at the intervention sites, after individuals agreed to take part in the intervention and were explained about the purpose of the study. At that time, the interviewer reviewed the data collection instrument with each participant. The instrument was written on a fourth grade reading level and pre-tested prior to actual data collection.

Data were examined with the use of SPSS software version 14.0. Descriptive statistics were employed to present a profile of the participant's demographic characteristics. Chi-square was used to discern linear associations between categorical measures of barriers at both assessment periods. All Chi Square values and associated levels of significance are reported after post-hoc test were conducted to adjust for any possible inflation due to sample size issues (to small

and disparity in group category sample sizes). Specifically, Hommel's method was used because it is considered more powerful than Hochberg's [29].

In addition, regression analysis was conducted to determine the rates at which the stated barriers to fruit and vegetable consumption varied according to gender at both assessment periods. Adjusted risk ratios (RRs) with 95% confidence intervals (CIs) are presented along with associated probability values. Although there are studies that examine barriers associated with efficacious dietary practices among African Americans, none look at gender differences or employ a social cognitive framework for examination. The rationale for the male and female comparisons and the use of RRs is to compare male perceptions with females, rather than to demonstrate statistical significance. This is based on the fact that gender specific groups were employed in the larger intervention portion of this investigation. Specifics pertaining to the male intervention have been reported previously in the scientific literature [30].

## Measures

All Barriers to fruit and vegetable constructs were assessed in terms of consumption prior to intervention and post intervention. Participants were asked the general question; can you please list all the reasons why you do not eat the recommended five servings a day of fresh fruits? Example follow-up probes included Fruits/vegetables cost too much; I do not know how to choose ripe fresh fruit/vegetables; and I cannot get good fruit/vegetables at my local store. Response categories for these variables were dichotomous in the form of 1=yes and 2=no.

## Findings

A detailed profile of study participants is provided in [Table 1](#). Equal proportions of study participants indicated they were either

**Table 2:** Chi-Square Results for Barriers to Fresh Fruit Consumption.

	Baseline %	Post-intervention %	p-value
Fruits cost too much			
Yes	33%	54%	.003
No	67%	46%	
Fresh fruits spoil too quickly			
Yes	46%	57%	.209
No	54%	43%	
Fruits take too much time to prepare			
Yes	23%	42%	.009
No	77%	58%	
Fruit isn't filling enough			
Yes	51%	48%	1.00
No	49%	52%	
My family doesn't like to eat fruit			
Yes	21%	42%	.004
No	79%	58%	
I can't get good fruit at my local store			
Yes	25%	47%	.056
No	75%	53%	
You have to buy fresh fruit every few days			
Yes	36%	57%	.001
No	64%	43%	
Restaurants don't serve fruits			
Yes	17%	28%	.180
No	83%	72%	
You have to plan in order to work fruit into your diet			
Yes	31%	31%	.670
No	69%	69%	
There is too much waste with fresh fruit			
Yes	19%	31%	.201
No	81%	69%	
I don't know how to choose ripe fresh fruit			
Yes	19%	30%	.178
No	81%	70%	
I have trouble digesting fruit			
Yes	15%	29%	.050
No	85%	71%	
My family eats them up to fast			
Yes	29%	42%	.023
No	71%	58%	

(31%) or had never been married (34%) with 93 percent of the sample being female. Most study participants indicated they were either employed with wages (64%). The mean highest level of education completed at baseline was 11.57 years (sd=4.9). Moreover, more than 70 percent reported having health insurance with most of the participants being female (93%). The mean household was comprised of approximately three individuals and the majority of participants indicated that their total income for the last year from all sources for all household members was in the range of \$20,000 to \$29,999 annually. More than 50% indicated they had lived in the target community for five years or more.

Using a chi-square analysis, we found that several barriers were problematic to dietary behavior change related to increasing fresh fruit and vegetable consumption among the target population. Table 2 shows an additional comparison of the distribution of barriers to fresh fruit consumption over the two periods. There was an overall group difference in barriers to fresh fruit intake over the assessment periods for six items. Participants reported increases in barriers that were associated with economic factors including fresh fruits costing too much ( $p<.05$ ) and having to purchase fruits every few days ( $p<.001$ ). Additional barriers that seemed to increase in significance to participants at the follow-up period were the length of time it takes to prepare dishes with fresh fruits ( $p<.009$ ), reporting that their families did not like eating fresh fruits ( $p<.004$ ) and having problems digesting them ( $p<.05$ ).

Similar findings were observed with respect to barriers to fresh vegetable consumption. Cost ( $p<.011$ ), spoiling too quickly ( $p<.019$ ), not being able to get them at their local store ( $p<.011$ ) and having to purchase vegetables every few days were barriers that seemed to become more problematic over the intervention period (Table 3).

Additional personal factors that appeared to be more of a concern after the intervention included not knowing how to select ripe vegetables ( $p<.033$ ), having trouble digesting vegetables ( $p<.016$ ) and families eating fresh vegetables too fast ( $p<.002$ ).

Table 4 presents baseline and post-intervention data regarding self-reported barriers to fruit intake by gender. At baseline Females were 2.3 times more likely than males to indicate that fruits spoiled too quickly (RR 2.3; 95% CI .69, 7.8). Females were 1.2 and 1.3 times more likely than males to state that their families did not like fruit (RR 1.2; 95% CI .31, 4.6) or that they could not get any good fruit at their local store (RR 1.3; 95% CI .38, 4.4). The analysis also revealed that buying fresh fruit every day (RR 1.5; 95% CI .50, 4.8) and that there is too much waste with fresh fruit as being major barriers to consumption (RR 1.5; 95% CI .45, 5.3). Other noted barriers to the consumption of fresh fruit included families consuming fruit too fast (RR 1.4; 95% CI .40, 5.0), not knowing how to select ripe fruit (RR 1.4; 95% CI .40, 4.6).

At post-intervention, the rate of indicating fruits spoil too quickly was reduced but still reflected women being 2.1 times more than men to suggest this as a barrier (RR 2.1; 95% CI .54, 7.9). However, the intervention appeared to have some impact on getting participants to understand that planning may be involved in order to work fresh fruit into their diets (RR 1.9; 95% CI .57, 6.8).

Barriers to fresh vegetable consumption were not as prevalent at baseline assessment as presented in Table 5. In fact participants were more likely to indicate that there was too much waste with fresh vegetables (RR 1.3; 95% CI .38, 4.4) or that they did not have the skills required to select fresh vegetables (RR 1.2; 95% CI .35, 4.0). Post intervention analysis suggests that most barriers were associated with factors aligned with economic circumstances also. For example,

**Table 3:** Chi-Square Results for Barriers to Fresh Vegetable Consumption.

	Baseline %	Post-intervention %	p-value
Vegetables cost too much			
Yes	24%	45%	.011
No	76%	55%	
Vegetables spoil too quickly			
Yes	21%	40%	.019
No	79%	60%	
Vegetables aren't filling enough			
Yes	22%	34%	.384
No	78%	66%	
My family doesn't like to eat vegetables			
Yes	20%	33%	.209
No	80%	67%	
I can't get good vegetables at my local store			
Yes	16%	40%	.011
No	84%	60%	
You have to buy fresh vegetables every few days			
Yes	21%	44%	.003
No	79%	56%	
Restaurants don't serve vegetables			
Yes	17%	34%	.088
No	83%	66%	
You have to plan in order to work vegetables into your diet			
Yes	31%	37%	.683
No	69%	63%	
There is too much waste with fresh vegetables			
Yes	20%	29%	.637
No	80%	71%	
I don't know how to choose ripe fresh vegetables			
Yes	15%	32%	.033
No	85%	68%	
I have trouble digesting vegetables			
Yes	11%	35%	.016
No	89%	65%	
My family eats vegetables too fast			
Yes	14%	40%	.002
No	86%	60%	
I eat only canned or frozen vegetables			
Yes	13%	33%	.103
No	87%	67%	

**Table 4:** Risk Ratios (RR) and 95 Percent Confidence Intervals for Barriers to Fruit Intake based on Gender at Baseline and Post intervention.

	Baseline Q74 Male: Female OR (CI)	Post-intervention Q69 Male: Female OR (CI)
Fruits cost too much.	0.224 (0.048, 1.049)	50% of cells have expected counts <5
Fresh fruits spoil too quickly.	2.323 (0.691, 7.803)	2.074 (0.541, 7.957)
Fruits take too much time to prepare.	0.907 (0.237, 3.477)	0.914 (0.257, 3.256)
Fruit is not filling enough.	0.460 (0.121, 1.752)	0.998 (0.292, 3.406)
My family does not like to eat fruit.	1.202 (0.312, 4.633)	1.576 (0.461, 5.385)
I cannot get good fruit at my local store.	1.288 (0.380, 4.370)	1.143 (0.358, 3.652)
You have to buy fresh fruit every few days.	1.551 (0.503, 4.783)	0.358 (0.106, 1.210)
Restaurants do not serve fruits.	1.296 (0.375, 4.482)	50% of cells have expected counts <5
You have to plan in order to work fruit into your diet.	0.745 (0.222, 2.504)	2.880 (0.836, 9.920)
There is too much waste with fresh fruit.	1.561 (0.458, 5.316)	1.982 (0.575, 6.826)
I do not know how to choose ripe fresh fruit.	1.352 (0.398, 4.589)	0.848 (0.238, 3.019)
I have trouble digesting fruit.	1.258 (0.320, 4.942)	0.805 (0.232, 2.792)
My family eats them up to fast.	1.418 (0.400, 5.036)	1.654 (0.484, 5.652)
I eat only canned fruits.	0.951 (0.095, 9.531)	50% of cells have expected counts <5

**Table 5:** Risk Ratios (RR) and 95 Percent Confidence Intervals for Barriers to Vegetable Intake based on Gender at Baseline and Post intervention.

	Baseline Q76 Male: Female OR (CI)	Post-intervention Q71 Male: Female OR (CI)
<b>Vegetables cost too much</b> Male (1) Female (2)	0.720 (0.188, 2.754)	1.155 (0.391, 3.408)
<b>Vegetables spoil too quickly</b>	0.832 (0.246, 2.810)	1.102 (0.358, 3.392)
<b>Vegetables take too much time to prepare</b>	0.3902 (0.083, 1.837)	1.335 (0.421, 4.238)
<b>Vegetables are not filling enough</b>	0.818 (0.216, 3.090)	0.864 (0.257, 2.903)
<b>My family does not like to eat vegetables</b>	0.255 (0.032, 2.030)	0.844 (0.224, 3.184)
<b>I cannot get good vegetables at my local store</b>	1.125 (0.300, 4.282)	1.828 (0.573, 5.831)
<b>You have to buy fresh vegetables every few days</b>	0.460 (0.099, 2.140)	2.211 (0.712, 6.860)
<b>Restaurants do not serve vegetables</b>	(logit) 0.178 (0.010, 3.068)	2.088 (0.635, 6.863)
<b>You have to plan in order to work vegetables into your diet</b>	0.814 (0.215, 3.072)	1.339 (0.410, 4.370)
<b>There is too much waste with fresh vegetables</b>	1.288 (0.380, 4.370)	0.702 (0.184, 2.679)
<b>I do not know how to choose ripe fresh vegetables</b>	1.188 (0.351, 4.025)	1.364 (0.395, 4.709)
<b>I have trouble digesting vegetables</b>	0.698 (0.147, 3.306)	0.495 (0.105, 2.327)
<b>My family eats vegetables too fast</b>	0.796 (0.211, 3.007)	2.008 (0.611, 6.599)
<b>I eat only canned or frozen vegetables</b>	50% of cells have expected counts <5	Response choices not listed on survey

needing to purchase fresh vegetables every few days (RR 2.2; 95% CI .71, 6.8) and being unable to get fresh vegetables at their local store (RR 1.8; 95% CI .57, 5.8) were determined to be significant barriers to the consumption of fresh vegetables. In addition, female participants were 1.2 and 1.4 times more likely than men to state fresh vegetables cost too much and that they take too long to prepare respectively. Other variables in which females indicated higher proportions when compared to men included their family eat vegetables too fast (RR 2.0; 95% CI .61, 6.6) and that they have to plan to include more fresh vegetables in their diets (RR 1.4; 95% CI .41, 4.4).

## Discussion

Our findings suggest the importance of understanding environmental factors and their impact on fresh fruit and vegetable consumption among African Americans. When asked what prevented them from consuming more fresh fruits and vegetables daily, study participants indicate that several factors associated with economics were the most problematic. In addition, the document the difficulty interventions designed to reduce risk to CVDs have when dealing with behavioral factors that appear to be a function of economics as

with the barriers to fresh fruit and vegetable consumption outlined in this paper. Our findings support the observation of many others how note how financial issues can be major barriers to behavioral change associated with dietary practices, especially among underserved and racial/ethnic populations [31-35].

In our study, cost and having to purchase fresh fruit and vegetables every few days was mentioned consistently as a barrier to healthier eating. In fact, cost came up more often than any other barrier with the exception of skills such as being able to prepare fresh fruits and vegetables and being able to select ripe produce. What is evidenced by this study is that interventions that are designed to increase participants' capacity for behavioral change must account for various preconceptions regarding the efficacy of existing behaviors. As observed from the comparison of the baseline and post-intervention survey results regarding barriers to fruit and vegetable intake, many people living in the AEZ considered their behavior to be appropriate and did not recognize the risk factors associated with them. Participants generally considered their attitudes toward fruit and vegetable intake to be sufficient.

Post-intervention results indicate that the attitudes of the participants began to reflect the presence of significant barriers to fruit and vegetable intake. Implications are that the economic opportunity costs associated with the perish ability of fruits and vegetables compared to foods with longer shelf lives might be a barrier to consumption. There also is an indication of resistance within the household to shift in dietary patterns required for the effective introduction of fruits and vegetables as regular staples. In addition, perceived constraints associated with the amount of preparation time required to incorporate the necessary amount of fruit servings into the household diet too could act as a barrier to their inclusion. Moreover, healthy lifestyle and healthy eating choices are minimally supported through media and culture in African American communities. The success of planned intervention programs toward the adoption of lifestyle modifications is a condition of the ability of the sample population to accept that negative association between current behavior patterns and the risk factors that contribute to the prevailing health disparities.

Even with increased knowledge about risk factors and improved treatment options, heart disease remains the leading cause of death in the U.S. and will likely become an even greater public health concern in the future. However dire the statistics, heart disease is largely preventable and is not an uncontrollable aspect of aging. Because many heart disease risk factors may be managed through lifestyle modification, public education directed at altering personal behaviors remains the most effective strategy for reducing disease risk. Our findings suggest that targeted action can play a key role in enhancing members in the targeted local communities to improve health and reduce risk to CVDs. Aiming at health advocacy through the promotion of skills development by the local population, mostly via the use of community organizations, this approach has proffered to be an effective local level mechanism to tackle the health threats in these communities. REACH efforts not only help jump-start the preventive health activities in the target area but can also play an important part in politically bringing to the table other issues pertaining to health and education. In basic terms, the partners note that improvements need to be made regarding enhancing participants or the target audience's level of interest in correcting problematic health behaviors.

Several limitations of this study should be noted. First, the data are all self-reported measures and not observed behavior. Given this, it is difficult to discern the extent to which statistically significant changes in barriers found in this study represent real changes in consumption patterns. Consequently, more research that uses measures of directly observed behavior would serve to confirm the findings of this study. Another major limitation of our study pertains to sample size, specifically the small sample size of the male group in contrast with the females. Research notes that many behavioral studies may be influenced by the presence of confounding variables [36]. Consequently, larger sample sizes are preferred since

confounding variables must be controlled for in the analysis. Thus a more complex statistical model may have been required, albeit our goal was compare the ranges of males versus females. Moreover, the value of the statistical significance depends on the standard error of the estimator and the power of the study. Therefore, given the smaller male sample size, our level of power is severely decreased, thus our findings may reflect such in the resulting risk ratios and 95% CIs [37]. This has been reported to occur because Logistic regression overestimates odds ratios in studies with small to moderate samples size by inducing systematic bias in a direction away from the null hypothesis away from null (odds ratios shift away from one) [38].

Lastly, this study was not designed to find the relative impact or collect measurable outcome data about the specific trends in the economic environment of the study population, which means we cannot state actual causation with respect to findings.

The consistency of barriers and their impact on fresh fruit and vegetable consumption suggests that it will be very difficult to reduce barriers via health empowerment interventions that target vulnerable populations [30]. It is also possible that another reason for the slight differences noted between men and women in our study may be a function of social roles. It well supported that women are more likely than men to be responsible for both preparing and purchasing food for their households [39,40]. Moreover, some have asserted that among African American and other minority communities that perception that 'eating healthfully' might be understood as giving up part of one's cultural heritage and/or trying to conform to the dominant culture [41].

Our findings also note how economic and situational circumstance can influence health behavioral change even when interventions are designed to do such. For example, during the period of this investigation, gas prices roses in the target community by more than \$1.00. Such an increase will also be incurred at the grocery store and on other necessities required for living including increased cost for bus and rapid transit passes.

Because of the many barriers these patients face, interventions must address how they can improve the socioeconomic status of participants in reference to their environment. This was documented in several recent studies including one examining the extent to which perceived barriers as a construct in Social Cognitive Theory influenced dietary behavior changes among a sample of 1,011 African Americans recruited from 14 churches in Georgia [42].

In closing, disparities in CVD risk and health outcomes in general will continue to prevail if health policy does not focus on the economic impact on the level of disparity in ethnic/racial communities and the barriers they create. This suggest policy focus on expanding the reach of health empowerment interventions that focus on CVD risk reduction via dietary behavior change among racial/ethnically diverse populations as well as economic enhancement and wealth creation.

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