

POLICY, SYSTEM AND ENVIRONMENTAL CORRELATES OF FRUIT AND VEGETABLE CONSUMPTION IN A LOW-INCOME AFRICAN AMERICAN POPULATION IN THE SOUTHEAST

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Objective: The current study seeks to identify policy, system and environmental (PSE) correlates of fruit and vegetable consumption among a sample of low-income African Americans in two counties in Alabama (Jefferson and Mobile) and one county in Mississippi (Forrest).

Design: A modified Behavioral Risk Factor Surveillance System (BRFFS) survey, which included multi-level ecological factors, was used to evaluate nutritional habits at the pre-intervention stage of a multi-state research study. We surveyed a total of 256 participants between May and August 2015. Local community coalitions established in each of the counties were instrumental in the planning and administration of the baseline survey.

Results: Univariate analyses revealed that whether participants met the daily recommendation for fruit/vegetable consumption may be correlated with whether participants had children who attended schools/day care centers with health policies in place, received food assistance, and observed media campaigns related to nutrition. Further, results of multivariate analysis indicated that meeting fruit/vegetable recommendations was correlated with personally participating or having a family member who participated in a health policy meeting in the past two years.

Conclusion: These findings suggest that policy-based interventions have the potential to improve health outcomes among priority populations, such as low-income African Americans, who are at high risk of developing chronic diseases. *Ethn Dis.* 2017;27(Suppl 1):355-362; doi:10.18865/ed.27.S1.355.

Keywords: Policy; System; Environment; Fruit and Vegetable Consumption; Social Determinants; Socioecological Model

INTRODUCTION

Health disparities are widespread in the United States as indicated by higher chronic disease rates and lower life expectancy among racial/ethnic minorities.^{1,2} Further, numerous studies indicate that fruit and vegetable consumption is inversely associated with the risk of coronary artery disease and stroke, and may also decrease the risk for becoming obese and developing type 2 diabetes.^{3,4} This research highlights the importance of focusing on nutrition in obesity prevention interventions as some vulnerable groups may not get the recommended servings of fruits and vegetables on a daily basis.⁴⁻⁶

Over the past two decades, the focus of nutrition interventions has shifted from individual behavioral

approaches for shaping health, to policy, systems and environmental (PSE) strategies designed to improve health outcomes among priority populations, such as low-income African Americans. PSE strategies are important in many ways. For example, an individual's diet quality may be influenced by public policy and the built environment. Urban, low-income and minority neighborhoods have been found to have less access to healthy foods and racial/ethnic minorities are more likely than Whites to live in areas that are classified as food deserts.⁷⁻⁹ The inadequate built environment related to food access is made worse by the fact that transportation options are limited among low-income residents.¹⁰ The lack of access to quality food options may contribute to a poor diet and can lead to higher levels of obesity and other diet-related chronic diseases. Implementing PSE strategies may improve access and thus overall health.

To address the multiple influences on eating behaviors at the individual level, our study utilizes an ecological framework in its design and data analysis. Storey (2008) has posited an ecological framework (Figure 1) to guide both research and interventions related to dietary consumption.¹¹ An

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ecological model emphasizes the connections between people and their environments and how multilevel factors interact to influence health and nutrition. This article reports on the food consumption patterns and multilevel influences on nutrition behavior among a sample of low-income African Americans in three southeastern counties (two in Alabama and one in Mississippi) at the pre-intervention stage of an intervention designed to

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increase fruit and vegetable consumption. The planned intervention will include 50 Community Health Advisors (CHAs) trained to recruit participants from the target communities and encourage them to increase physical activity and fruit and vegetable consumption, in addition to activities at churches, recreation centers and community organizations.

METHODS

We examined data from a baseline survey collected for a regional sub-study, entitled "Policy, System and

Environmental Changes: A Comprehensive Approach to Reduce Obesity," which was funded by the Gulf States Health Policy Center (GSHPC). The GSHPC is a National Institute of Minority Health and Health Disparities funded center that was established in 2013 as a comprehensive community, education, and research center focused on improving health outcomes in the Gulf States region (Alabama, Mississippi, Louisiana, Florida, and Texas). The overall objective of the larger study, taking place between April of 2016 and December of 2017, is to examine the impact of a comprehensive intervention including evidence- and practice-based PSE strategies on improving healthy eating and increasing physical activity in African Americans with the long-term goal of reducing the disparities in chronic diseases between African Americans and Whites. As noted, the goal of our research was to examine data from the baseline survey to assess the influence of multilevel factors on eating behavior before a planned intervention will be implemented.

Study Population

In order to measure the impact of the planned intervention, a modified Behavioral Risk Factor Surveillance System (BRFSS)¹² survey was used to evaluate nutritional habits in the targeted geographic area that includes low-income African Americans in two counties in Alabama (Jefferson and Mobile) and one county in Mississippi (Forrest). As a key part of the GSHPC, local community coalitions were established in each of these counties. The more than 100 coalition members represent various sec-

tors and disciplines, including county and state health departments, non-profits, faith-based groups, schools and universities, health organizations, city and county government, social clubs, the extension system, wellness groups, business groups, chambers of commerce, and regional planning commissions, among others. The coalitions were instrumental in the planning and administration of the baseline survey and the intervention. Each of the coalitions met with investigators regularly to discuss the project, helped recruit participants for both the baseline survey and the planned intervention, and provided locations and meeting space to administer the face-to-face baseline survey.

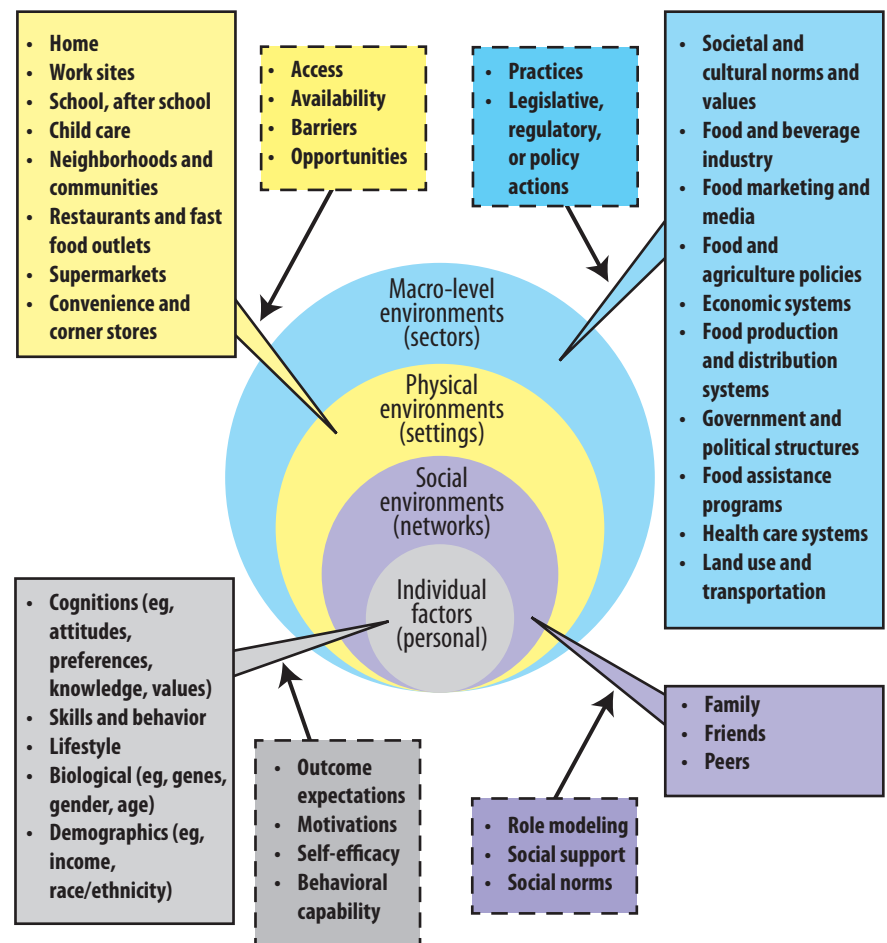
For the parent study, the primary outcomes are defined by the percent of participants who show an increase in fruit/vegetable consumption and in physical activity before and after the intervention. In order to measure the impact of a PSE intervention at the population-level, two mutually exclusive participant groups will be utilized. For example, an individual who participated in the survey at baseline will not be asked to participate in the post-intervention survey. An enrollment of 244 pre-intervention and 244 post-intervention (488 total) was calculated based on 50% of the participants satisfying the study guidelines before the intervention is introduced, assuming a 50% satisfaction rate maximizes the variance of proportions and adjusting for possible inter-correlation within six census tracts (two per county under study).

The sample was drawn from Jefferson (tracts 27 and 39) and Mobile (tracts 40 and 7.02) counties in

Alabama and Forrest County (tracts 5 and 105) in Mississippi. These census tracts were selected based on the large proportion of African American low-income residents as identified by US Census data, as well as the accessibility of the population and the feasibility of conducting the intervention in that particular location. We worked with local GSHPC coalition members to determine which census tracts would be most appropriate in terms of this accessibility and feasibility. Coalition members also identified community groups and organizations that assisted with participant recruitment and provided locations to conduct the onsite interviews. Trained interviewers from the University of Alabama at Birmingham's Recruitment and Retention Shared Facility travelled to the census tracts under study and conducted all interviews in one block of time between May and August 2015. An effort was made to interview all age groups (aged >19 years) with an equal percentage of males and females. Interviewers verified participants' eligibility by asking if they were aged >19 years and if they lived in the targeted neighborhoods represented in the census tracts under study. Participants were provided an incentive of \$15 at the conclusion of the survey. This study was approved by the Institutional Review Board for Human Use at The University of Alabama at Birmingham (UAB), Protocol #X130604008.

Measures

Based on Storey's ecological framework¹¹ (Figure 1), the following items were measured in the survey and examined for our study.



Story M, et al. 2008.
Annu Rev. Public Health. 29:253-72

Figure 1. An ecological framework depicting the multiple influences on what people eat. Reproduced with permission from *Ann Rev Public Health*, 2008;29(1) in Story M et al. *Creating healthy food and eating environments: policy and environmental approaches*.¹¹

Individual/Personal Factors

Individual/Personal measures included the demographic variables of age, race/ethnicity, sex, marital status, income, employment status, occupation, and education. Fruit and vegetable consumption data were collected based on a modified version of the BRFSS,¹² consisting of six questions. Participants were asked how frequently they consumed certain types and forms of fruits and vegetables.

Fruit included fruit juice and whole fruit; vegetables included beans, dark green vegetables, orange-colored vegetables and other vegetables.

Social Environment/Networks

Participants were asked if, "In the past two years have you or anyone in your family engaged in any of the following activities about a policy issue related to health?" such as contacting

an elected official, signing a petition, and/or initiating a discussion in a city, neighborhood, church, or school. They were also asked if, "In the past two years have you or anyone in your family participated in any of the following types of meetings where policy issues related to health were discussed?" including city, neighborhood association, church, and public school meetings. For analysis, responses were collapsed into two categories: participated (yes) or did not participate (no).

Physical Environment/Settings

Factors related to the physical environment were also assessed by self-report. These included: 1) whether children attended child care centers or schools with health policies ("Do your children attend a school or daycare where healthy eating and physical activity is promoted?") and 2) whether participants attended churches with health policies, ("Do you attend a church or other faith-based organization where healthy eating is promoted?") Healthy eating being promoted included: "offering healthy options at church sponsored events; inclusion of nutrition policies in church by-laws; changes in church menus; and/or training of church kitchen staff."

Macro-level Environments/Sectors

Participants were asked whether they were exposed to nutrition campaigns in the media through the question, "In the past 12 months has healthy eating been promoted in your community through media outlets such as print, TV, billboards, radio ads, bus wraps?" They were also asked whether they participated in food assistance programs. Programs included

food stamps, School Breakfast/Lunch, Special Milk Program, WIC, Summer Food Service, Commodity Supplemental Food Program, Community Food and Nutrition Program, TANF, SSI, Assistance from family members, disability, and/or unemployment.

Statistical Analyses

The baseline survey data were coded according to the BRFSS codebook.¹² Fruit and vegetable intake was reported as daily consumption in servings/day. The outcome variable "met the recommendation" for fruit and vegetables was defined as consuming ≥ 2 servings of fruit daily or ≥ 3 servings of vegetables daily (herein referred to as "fruit/vegetable" recommendation). Missing values and non-responses were coded as "Not reported."

In the preliminary analysis of the baseline data, we conducted a descriptive analysis. Mean, standard deviation, median and range were presented for continuous variables, and percentages and counts were presented for categorical variables. The association between outcomes and categorical variables was first assessed with a chi-square statistic. We then used the generalized linear mixed model with PROC GENMOD procedure in SAS to assess the association between "met the recommendation" for fruit and vegetable consumption with the unstructured covariance accounting for variability between clusters (census tracts) and potential intra correlation introduced by the clustering of participants within community.¹³ Binomial distribution was used as the link function. The model included demographic

variables, ie, sex, education, income, marriage status; and covariates with significant associations ($P < .10$) with the outcome in univariate analysis: attends healthy church, child attends healthy daycare, nutrition promotion through media, policy engagement, policy meeting, and received assistance (as defined in the Methods section). The stepwise selection method with type I error at 5% level was applied to select the most predictive variables. Missing values were imputed with the method of West.¹³

RESULTS

A total of 256 participants were recruited to complete a baseline survey; 130 were from Jefferson county, 64 from Mobile county and 62 from Forrest county. Of the 256 participants, 47.3% were female, 93.4% were African American, and the mean age was 51.7 (Table 1). In terms of income, 77.7% of participants stated that they did not know their income level. However, 74% reported receiving some type of financial assistance (Table 3); therefore, we can assume that this is a low-income sample. Fruit and vegetable consumption scores by county are found in Table 2. Median daily fruit intake (servings/day) for the total sample was 1.1 and vegetable intake was 1.3. For the whole sample, 38.7% met the fruit recommendation (2 servings per day) and 14% met the vegetable recommendation (3 servings per day). As seen in Tables 1 and 2, demographics as well as fruit and vegetable consumption between counties were similar. Therefore, we conducted further

Table 1. Participant demographics, by county

	Jefferson, N=130 ^a	Mobile, N=64 ^a	Forrest, N=62 ^a	Total, N=256 ^a
Sex				
Female	60 (46.2)	31 (48.4)	30 (48.4)	121 (47.3)
Male	59 (45.4)	31 (48.4)	32 (51.6)	122 (47.7)
Age, mean (SD)	52.0 (15.1)	45.7 (17.2)	53.4 (18.9)	51.7 (15.5)
Race				
White	2 (1.54)	0 (0)	0 (0)	2 (.8)
Black or African American	116 (89.2)	61 (95.3)	62 (100)	239 (93.4)
Other	2 (1.5)	1 (1.6)	0 (0)	3 (1.2)
Ethnicity				
Hispanic	1 (.8)	0 (0)	0 (0)	1 (.4)
Non-Hispanic	119 (91.5)	62 (96.9)	62 (100)	243 (94.9)
Education, highest level completed				
< High school	21 (16.2)	13 (20.3)	8 (12.9)	42 (16.4)
High school grad or GED	50 (38.5)	35 (54.7)	27 (43.6)	112 (43.8)
Income				
< \$19,999	17 (13.1)	7 (11.0)	9 (14.5)	33 (12.9)
\$20,000 to \$69,000	8 (6.1)	5 (7.9)	9 (14.5)	23 (9.1)
Don't know/not sure	104 (80.0)	51 (80.0)	42 (67.7)	197 (77.0)

Data are n (%) unless noted otherwise.

a. Numbers do not add up to total N or 100% due to missing data.

analysis on the sample as a whole.

As seen in Table 3, we conducted univariate analysis to explore the relationship between various ecological factors from the model and whether these factors correlated with participants meeting daily fruit/vegetable recommendations. Chi-square statistics indicated that while sex and education did not influence whether dietary recommendations were met, social engagement factors were significantly associated with fruit/vegetable

consumption (Table 3). Meeting the daily fruit/vegetable recommendation was associated with having a child who attended a school or daycare center where healthy eating and physical activity was promoted ($P < .05$), observing nutrition promotion through the media ($P < .05$), engaging in activities related to health policy in the past two years (the participant or a family member) ($P < .05$), attending a meeting where health policy was discussed (the participant or a family member)

($P < .001$), and receiving some type of financial assistance ($P < .05$). Additionally, we found the factor of attending a church with health policies to be trending toward significance ($P < .10$).

Upon further analysis using a multivariate logistic regression model to select factors to predict fruit/vegetable consumption, the only factor that remained significant was related to attending a meeting where health policy was discussed. Participants or those with family members who at-

Table 2. Participants' fruit and vegetable consumption, by county

	Jefferson, N=130	Mobile, N=64	Forrest, N=62	Total, N=256
Total servings of fruit consumed per day				
Median	1.1	1.1	1.2	1.1
Mean \pm SD	1.8 \pm 2.0	1.8 \pm 1.8	1.7 \pm 1.6	1.8 \pm 1.8
Min-max	0-9	0-11	0.1-9	0-11
Consumed \geq 2 fruits daily, n (%)	46 (35.4)	29 (45.3)	24 (38.7)	99 (38.7)
Total servings of vegetables consumed per day				
Mean \pm SD	1.6 \pm 1.7	2.3 \pm 2.8	1.8 \pm 1.6	1.8 \pm 2.0
Median	1.2	1.3	1.4	1.3
Min-max	0-10	0-12	0-8	0-12
Consumed \geq 3 vegetables daily, n (%)	13 (10.0)	12 (18.8)	12 (19.4)	37 (14.5)

Table 3. Univariate analysis examining factors correlated to whether participants met the daily fruit and vegetable recommendation

	Did not meet the daily recommendation, N=147	Met the daily recommendation, N=109 ^e	Total, N=256
Attends healthy church ^a			
No	74 (50.3)	42 (38.5)	116 (45.3)
Yes	73 (49.7)	67 (61.5)	140 (54.7)
Child attends healthy daycare ^b			
No	102 (69.4)	60 (55.0)	162 (63.3)
Yes	45 (30.6)	49 (45.0)	94 (36.7)
Policy engagement ^c			
No	128 (87.1)	78 (71.6)	206 (80.5)
Yes	19 (12.9)	31 (28.4)	50 (19.8)
Policy meeting ^d			
No	95 (64.6)	47 (43.1)	142 (55.5)
Yes	52 (35.4)	62 (56.9)	114 (44.5)
Nutrition promotion through media ^b			
No	79 (53.7)	45 (41.3)	124 (48.4)
Yes	68 (46.3)	64 (58.7)	132 (51.6)
Receive assistance ^b			
No	46 (31.3)	19 (17.4)	65 (25.4)
Yes	101 (68.7)	90 (82.6)	191 (74.6)
Sex			
Male	66 (48.9)	57 (52.3)	123 (48.0)
Female	69 (51.1)	52 (47.7)	121 (47.2)
Education			
< High school	25 (18.7)	17 (15.6)	42 (16.4)
High school grad/GED	60 (44.8)	52 (47.7)	112 (43.8)
Some college/higher	49 (36.6)	40 (36.7)	89 (34.8)

Data are n (%).

a. P<.10.

b. P<.05.

c. P<.01.

d. P<.001 (two-tailed tests).

e. Met the daily recommendation means: daily fruit consumption ≥2 OR vegetable consumption ≥3.

tended a meeting in the past two years where health policy was discussed had 2.18 times the odds of meeting the fruit/vegetable recommendation compared with those who did not attend such a meeting (OR=2.18, 95% CI 1.29,3.67).

DISCUSSION

The study population, three low-income African American communities in the Southeast, was found to be consuming amounts of fruits

(1.1 servings/day) comparable with national data, but fewer servings of vegetables (1.3 vs 1.6 servings/day).¹⁴ Since we found multi-level factors were correlated with fruit/vegetable consumption in our population, these results shed light on the conceptual framework we used to guide our research (Figure 1).

In terms of individual factors, we were not able to examine the correlation of fruit/vegetable intake with race/ethnicity due to the homogeneity of the sample. Although sex and educational attainment were not cor-

related with fruit/vegetable consumption, interestingly, if an individual or their family members attended a meeting where health policy was discussed or engaged in a health policy issue, they were more likely to meet the daily fruit/vegetable recommendation. This suggests a relationship between health-related policy awareness and engagement and dietary practices. These findings are compelling because there is little research linking policy engagement of any kind and health outcomes in individuals. However, recent research indi-

cates that engaging youth in advocacy to promote health may be effective in obesity prevention.^{15,16} Therefore, the connection between health policy engagement and meeting healthy living guidelines would be an important area to pursue in further studies.

Related to the Physical Environment, meeting the fruit/vegetable recommendation was significantly correlated to participants reporting that they had a child who attended a school or daycare where healthy eating and physical activity were promoted.

...if an individual or their family members attended a meeting where health policy was discussed or engaged in a health policy issue, they were more likely to meet the daily fruit/vegetable recommendation.

These and other findings provide support for examining the impact that institutional nutrition policies of both schools and daycare centers may have on children as well as their families.¹¹

For macro-level environments, we explored the impact of food assistance programs and nutrition promotion campaigns. We found that participants who reported receiving some form of food assistance were more likely to meet the fruit/vegetable recommendation. Our findings sub-

stantiate other research that has established the link between food insecurity and lower quality diets;¹⁷ therefore, fruit and/vegetable consumption may increase if more resources are made available to vulnerable populations.

Finally, observing the promotion of healthy eating through media outlets was significantly correlated to participants meeting the fruit/vegetable recommendation. Our findings are plausible as research has indicated that fruit/vegetable communication media campaigns can affect intervention communities by about 5%.¹⁸ Successful campaigns use several strategies to reach the target population multiple times and carefully design the intervention to each community's needs.¹⁸ The types of media campaigns existing in the areas under study are not known. However, the next phase of this study is to implement a community engaged PSE intervention, including a media campaign, in the three communities and conduct a post-intervention survey in 2018.

Limitations

This study has several strengths including the population studied and range of questions that cover the ecological model, which provides a more complete analysis of the complex factors that contribute to health outcomes among the targeted population. One notable limitation is that we were unable to determine the extent to which participants actually engaged in policy activities or meetings due to the framing of the research question. Still, the findings remain valuable for the consideration of future studies. Also, as with any homogeneous sample, generalizability is lim-

ited. Finally, because our census tracts were not randomly chosen, the design of this study precludes an evaluation of PSE factors as causal mechanisms.

CONCLUSION

This article reports findings from a baseline survey, implemented with the help of GSHPC community coalitions, at the pre-intervention stage of a PSE intervention among a low-income, African American population in the southeastern United States. Results indicate that multilevel factors contribute to fruit and vegetable consumption among the sample. Macro-level factors such as food assistance programs and nutrition marketing and physical environmental factors such as school policies may play a more significant role in fruit and vegetable consumption than individual factors. However, one individual/social factor that seems to be significant in meeting the fruit/vegetable recommendation is policy involvement in the form of attending health policy-related meetings. Future research should seek to disentangle the link between macro-level and environmental factors as well as policy involvement and dietary intake, so that effective interventions can be developed to improve dietary quality and ultimately improve population health.

ACKNOWLEDGMENT

Research reported in this publication was supported by the National Institute of Minority Health and Health Disparities of the National Institutes of Health under award number U54MD008602. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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CONFLICT OF INTEREST

No conflicts of interest to report.

AUTHOR CONTRIBUTIONS

Research concept and design: Bateman, Wynn, Fouad; Acquisition of data: Bateman, Smith, Fouad; Data analysis and interpretation: Bateman, O'Neal, Li, Dai, Fouad; Manuscript draft: Bateman, O'Neal, Smith, Li, Wynn, Fouad; Statistical expertise: Li, Dai; Acquisition of funding: Fouad; Administrative: Bateman, O'Neal, Smith, Wynn; Supervision: Fouad

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