DIETARY INTAKE TO REDUCE CANCER RISK AMONG AFRICAN AMERICAN WOMEN IN PUBLIC HOUSING: DO SOCIODEMOGRAPHIC FACTORS MAKE A DIFFERENCE?

Objectives: This study investigates the dietary intake of African American women in public housing as related to cancer risk and explores the sociodemographic factors that hinder healthy dietary intake in this population.

Design: Demographic and dietary data for this cross-sectional study were collected as part of a Breast Health Education Study. Trained interviewers conducted face-to-face interviews with study participants to assess the frequency of consumption of specified food items.

Setting and Participants: Study participants included 202 women 35–79 years old residing in six public housing facilities in Atlanta, Georgia.

Outcome Measures: Univariate analyses were performed to report age, marital status, education level, employment status, income level, and frequencies of food items consumed. Correlation coefficients and multivariate logistic regression were used to analyze the association between the frequency of food item consumption and selected sociodemographic characteristics.

Results: Overall, only 33.7% and 17.9% of the women consumed fruit and vegetables on a daily basis, respectively. Almost two thirds consumed meat daily, while less than a third consumed whole wheat bread and bran cereals daily. A significant proportion of women had a daily consumption of fats, oils, and sweets (13.4%–49.5%). Three sociodemographic factors - young age, low income, and low education - were associated with unhealthy dietary intake.

Conclusions: Strategies to promote healthy dietary intake should be implemented for women in public housing communities to help reduce cancer morbidity and mortality in this population. These strategies should address the barriers to healthy dietary consumption that are faced by women in this setting. (*Ethn Dis.* 2006;16:963–970)

Key Words: African American, Dietary Intake, Public Housing

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INTRODUCTION

African Americans have the highest cancer incidence and mortality of all races in the United States today.¹ Dietary factors, such as high consumption of fruits, vegetables, and fiber and low consumption of fat and red meat, may be protective against many cancers.²⁻⁴ Despite this, adherence rates to healthy dietary intake recommendations among African Americans are low. Studies have shown that African Americans have low rates of fruit,⁵⁻⁷ vegetable,^{5–7} and fiber⁸ consumption and high rates of fat consumption.^{7,9} Enhancing overall dietary quality among African Americans may help reduce the significant morbidity and mortality from cancer in this population.

In order to develop and implement interventions to appropriately increase healthy dietary intake among African Americans, we must identify barriers that hinder healthy intake. Various

BDT, LC), Department of Family Medicine (LB), National Black Leadership Initiative on Cancer III: Community Networks Program (JS), and the Clinical Research Center (FM), Morehouse School of Medicine, Atlanta, Georgia; Institute of Environmental Health, China Medical University, Shenyang, China (JFS).

Address correspondence to Sherry R. Crump, MD, MPH; Morehouse School of Medicine; 720 Westview Dr, SW; NCPC Room 213; Atlanta, GA 30310; 404-752-1541; 404-752-1198 (fax); scrump@msm. edu Few studies have focused on factors affecting the dietary habits of low-income African Americans living in public housing.^{14,15}

sociodemographic factors are associated with inadequate dietary intake, such as low income,^{10,11} low education,^{10,12,13} and younger age.¹⁰ Few studies have focused on factors affecting the dietary habits of low-income African Americans living in public housing.^{14,15}

To better understand the dietary intake of African Americans in public housing and to investigate sociodemographic barriers to healthy eating in this population, we collected data on dietary habits from 202 African American women living in public housing in Atlanta, Georgia.

METHODS

We randomly selected study participants from the Atlanta Housing Authority's tenant occupancy list of six public housing facilities, including four high-rise facilities and two low-rise facilities. High-rise facilities housed individuals who were disabled or who were ≥ 62 years of age, and low-rise facilities housed individuals under the age of 62. We included women in the study if they were aged 35–79 and had no personal history of breast cancer.

Using an 84-item questionnaire, trained interviewers conducted face-toface interviews (20-30 minutes) with individuals who agreed to participate. The variables on the questionnaire included: 1) sociodemographic characteristics; 2) medical and family history; 3) preventive health practices; 4) alcohol and tobacco use; 5) knowledge, attitudes, and beliefs pertaining to breast cancer; 6) breast cancer screening practices; and 7) diet. The diet section of the questionnaire asked participants to report the frequency of consumption of 15 food items. We selected foods for the questionnaire based on American Cancer Society (ACS) nutrition guidelines for cancer prevention.¹⁶ Response options were based on a modified version of the Health Habits and History Questionnaire: Diet History and Other Risk Factors made available through the National Cancer Institute.¹⁷ and included: never, less than one time per month, one time per month, two to three times per month, one time per week, two to four times per week, five to six times per week, one time per day, two to four times per day, and greater than four times per day.We did not take portion sizes into account when soliciting food frequency information. We pilot tested the questionnaire with Cronbach's alpha, which ranged from .755 to .85.

For the present report, we performed univariate analyses to determine the distribution of participants by age, marital status, education level, employment status, and income level. The frequency distribution of food items consumed was collapsed as follows: 1) less than one time per month; 2) one time per month; 3) two to three times per month; 4) one time per week; 5) two to six times per week; 6) one time per day; 7) two to four times per day; 8) five times per day or more; and 9) unknown. To examine balance or variety in the participants' diets, we grouped foods according to the Food Guide Pyramid¹⁸ as follows: 1) group 1 - bread, cereal, rice, and pasta; 2) group 2 - fruit; 3) group 3 - vegetables; 4)group 4 - meat, poultry, fish, dry beans, eggs, and nuts; 5) group 5 - milk and dairy products; and 6) group 6 - fats, oils, and sweets. French fries, potato chips, bacon, fatback, cakes, pies, and cookies were placed in group 6 based on the typical fat content of these food items. Using Pearson's correlation analysis, we measured the association between the consumption of each food item and selected sociodemographic characteristics, including age, marital status, education level, employment status, and income level. We conducted data analysis with SAS statistical package, version 8 (SAS Institute, Inc., Cary, NC).

RESULTS

Two hundred and two women participated in the study. Slightly more than half of the study participants were aged \geq 50 years, and 56.8% had <12 years of education (Table 1). Most of the participants were retired or unemployed (89.1%), not married (81.5%), and had an annual household income <\$10,000 (82.5%).

Table 2 shows the frequencies of food items consumed by the participants. Almost 27% of the participants reported a daily consumption of whole wheat bread (19.3% once a day, 7.4% two to four times per day), and 10.4% reported a daily consumption of bran cereal (7.9% once a day, 2.5% two to four times per day). Eleven percent (11.4%) of the participants reported that they consumed fruit two to four times per day, and 1.0% reported that they consumed fruit five or more times per day. In terms of vegetables, 2.5% of the participants reported consumption two to four times per day, and 1.0% reported consumption five or more times per day. Sixty-five percent

Table 1. Sociodemographic characteristics of the study participants (N=202)

Characteristics	n (%)
Age (years)	
<50	97 (48.0)
≥50	105 (52.0)
Married/living together	
Yes	37 (18.5)
No	165 (81.5)
School education (years)*	
<12	113 (56.8)
12	58 (29.1)
≥13	28 (14.1)
Employment	
Currently employed	22 (10.9)
Retired	69 (34.2)
Unemployed	111 (54.9)
Income†	
<\$5,000	85 (42.5)
\$5,000-\$10,000	80 (40.0)
≥\$10,000	14 (7.0)
Linknown	21 (10.5)

(64.9%) of the participants reported that they consumed meat one or more times per day, and 24.3% reported that they consumed this food item two to six times per week. Seven percent (7.4%) reported the consumption of beans one or more times per day and 35.6% reported consumption two to six times per week. Other food items consumed one or more times per day included whole milk products (25.7%), French fries and potato chips (13.4%), margarine and oil (49.5%), fatback, bacon, butter, and lard (15.8%), cakes, pies, and cookies (20.3%), and mayonnaise (13.4%). Between 20%-30% participants reported consuming these food items two-six times per week.

The intake of some food items by the participants correlated with age, education, and income. Younger age was associated with greater consumption of pastas, potatoes, meat, luncheon meats, and French fries, while older age was associated with greater consumption of whole wheat bread (Table 3).

	Frequency (Number of Times Per Month, Week, or Day)								
	<1/month <i>n</i> (%)	1/month n (%)	2–3/month n (%)	1/week n (%)	2-6/week n (%)	1/day n (%)	2-4/day n (%)	≥5/day n (%)	Unknown n (%)
Group 1: Bread, cereal, rice,	and pasta								
Whole wheat bread	85 (42.1)	7 (3.5)	14 (6.9)	7 (3.5)	31 (15.3)	39 (19.3)	15 (7.4)	0 (.0)	4 (2.0)
Bran cereal	112 (55.4)	7 (3.5)	11 (5.4)	14 (6.9)	33 (16.3)	16 (7.9)	5 (2.5)	0 (.0)	4 (2.0)
Pastas	8 (4.0)	23 (11.4)	26 (12.9)	32 (15.8)	86 (42.6)	15 (7.4)	6 (3.0)	1 (.5)	5 (2.5)
Group 2: Fruit									
Fruit	10 (5.0)	10 (5.0)	17 (8.4)	22 (10.9)	70 (34.7)	43 (21.3)	23 (11.4)	2 (1.0)	5 (2.5)
Group 3: Vegetables									
Vegetables	13 (6.4)	10 (5.0)	24 (11.9)	41 (20.3)	75 (37.1)	29 (14.4)	5 (2.5)	2 (1.0)	3 (1.5)
Group 4: Meat, poultry, fish,	dry beans, egg	s, and nuts							
Meats	1 (.5)	1 (.5)	5 (2.5)	12 (5.9)	49 (24.3)	69 (34.2)	57 (28.2)	5 (2.5)	3 (1.5)
Beans/peas	21 (10.4)	19 (9.4)	33 (16.3)	39 (19.3)	72 (35.6)	12 (5.9)	2 (1.0)	1 (.5)	3 (1.5)
Luncheon meats	52 (25.7)	11 (5.4)	19 (9.4)	19 (9.4)	65 (32.2)	23 (11.4)	9 (4.5)	1 (.5)	3 (1.5)
Group 5: Milk and dairy proc	ducts								
Whole milk products	30 (14.9)	16 (7.9)	20 (9.9)	25 (12.4)	55 (27.2)	36 (17.8)	12 (5.9)	4 (2.0)	4 (2.0)
Group 6: Fats, oils and sweet	S								
French fries, chips	66 (32.7)	11 (5.4)	22 (10.9)	20 (9.9)	53 (26.2)	22 (10.9)	3 (1.5)	2 (1.0)	3 (1.5)
Margarine, oil	27 (13.4)	4 (2.0)	7 (3.5)	12 (5.9)	46 (22.8)	85 (42.1)	14 (6.9)	1 (.5)	6 (3.0)
Fatback, bacon, butter, lard	60 (29.7)	9 (4.5)	14 (6.9)	24 (11.9)	60 (29.7)	28 (13.9)	4 (2.0)	0 (.0)	3 (1.5)
Cake, pie, cookies	51 (25.2)	17 (8.4)	21 (10.4)	26 (12.9)	42 (20.8)	26 (12.9)	14 (6.9)	1 (.5)	4 (2.0)
Mayonnaise	44 (21.8)	17 (8.4)	15 (7.4)	46 (22.8)	49 (24.3)	24 (11.9)	3 (1.5)	0 (.0)	4 (2.0)

Table 2. Food consumption frequency by food items, based on the Food Guide Pyramid

Consumption of pastas, meat, luncheon meats, and French fries was significantly associated with more education, while consumption of fatback, bacon, butter, and lard was associated with lower levels of education. Income was positively correlated with the consumption of pastas, vegetables, margarine, and oil. No significant association was seen between age, education, or income and the consumption of fruit and whole milk products.

DISCUSSION

African American women in our study population exhibited unhealthy dietary habits. Less than a third of the women reported consuming whole wheat bread and bran cereal daily. In addition, only one third of the women consumed fruit, and less than one third consumed vegetables on a daily basis. Almost two thirds of the women reported a daily intake of meat, and another quarter repored eating meat two to six times per week. A significant proportion of women ate items that typically contain fats, oils, and sugar on a daily and weekly basis. Our results are consistent with those of other studies that show that African Americans tend to have diets of poor quality. In particular, studies have shown African Americans to have a low intake of fruits and vegetables⁵⁻⁷ and fiber⁸ and a high intake of fat.^{7,9} Statistics from the Behavioral Risk Factor Surveillance System (BRFSS) reveal that >90% of African Americans in Georgia consume fruits and vegetables daily,¹⁹ which is significantly higher than that consumed by women in our population. Since data for the BRFSS are collected by telephone survey, our study results may more closely reflect the dietary habits of low-income African Americans who do not have access to telephones. Another explanation for this difference is that our study participants are solely inhabitants of public housing. Individuals who

Less than a third of the women reported consuming whole wheat bread and bran cereal daily. In addition, only one third of the women consumed fruit, and less than one third consumed vegetables on a daily basis.

live in public housing may face sociodemographic barriers that hinder healthy eating patterns.

One sociodemographic barrier faced by individuals living in public housing is limited transportation. In a study by Shankar and Klassen,¹⁵ only 50% of African American women living in public housing used a car to shop, and 22% walked to the market at times. A

Table 3.	Pearson correlation coefficients	between food item	consumption and age,
education	, and income		

Food Item	Age	Education	Income			
Group 1: Bread, cereal, rice, and pasta						
Whole wheat bread	.177‡	.082	.024			
Bran cereal	.036	.051	021			
Pastas	226†	.152*	.178*			
Group 2: Fruit						
Fruit	.019	.133	.040			
Group 3: Vegetables						
Vegetables	116	.089	.179*			
Group 4: Meat, poultry, fish, dry bea	ns, eggs, and nuts					
Meats	163*	.226†	004			
Beans/peas	041	059	.108			
Luncheon meats	317§	.227†	.020			
Group 5: Milk and dairy products						
Whole milk product	067	025	03			
Group 6: Fats, oils, and sweets						
French fries, chips	489§	.271‡	.002			
Margarine, oil	.016	115	.155*			
Fatback, bacon, butter, lard	101	159*	017			
Cake, pie, cookies	039	049	083			
Mayonnaise	084	.068	.043			

* *P*≤.05.

†*P*≤.01.

‡ *P*≤.001. § *P*≤.0001.

The association between food item consumption, marital status, and employment level is not significant – data not shown.

study by Malmgren et al²⁰ revealed that 20% of older individuals living in public housing reported lack of transportation and distance to the doctor as barriers to assessing health care. In addition, 29% reported needing more help with transportation. Not having adequate transportation can potentially limit access to healthier food stores, such as supermarkets. Supermarkets are more likely to offer a variety of healthier foods than grocery stores and convenience stores,²¹ but they are not highly available in under-served areas. For example, a study by Morland et al²² revealed that supermarkets are prevalent in White and wealthy neighborhoods, while smaller grocery stores and convenience stores are prevalent in Black and poor neighborhoods. In public housing communities, if supermarkets are not available and individuals have limited transportation, they are resigned to

shopping at the stores in their neighborhoods that offer less healthy foods. Another study by Morland et al²³ revealed that African Americans' consumption of fruit and vegetables increased and the consumption of fats decreased with an increase in the number of available supermarkets. In this study, African Americans living in areas with one supermarket were 1.54 times more likely to meet dietary guidelines for fruit and vegetable intake, and 1.22 times more likely to meet dietary guidelines for total fat intake than African Americans living in areas without supermarkets. Although not explored with the women residing in public housing in our study, limited access to healthier food stores should be considered a potential barrier to eating a healthy diet.

Another sociodemographic factor that may influence eating patterns

among inhabitants of public housing is limited social support. Female inhabitants of public housing in the study by Shankar and Klassen¹⁵ reported a lack of social support for shopping and meal preparation. Lacey et al²⁴ found that physical and social isolation was a barrier to smoking cessation among Black women residents of Chicago public housing. Studies have shown that having social support is associated with healthy behaviors. In a study by Nollen et al,²⁵ African American women reporting greater social support at week four of a smoking cessation intervention were 41% more likely to quit smoking at week four. Levy-Storms and Wallace²⁶ revealed that Samoan women who were the most well-connected to other Samoan women within their church-based health communication networks were more likely to be in the stages of planning to have a mammogram and of having had a recent mammogram. In a study by Suarez et al,27 Hispanic women who had high social integration were more likely to have had a recent pap smear compared to the women with lower social integration. Specifically, having friends, family, or associates who are practicing similar healthy behaviors or who encourage healthy habits could foster healthy behaviors in individuals. In a study by Addy et al²⁸ among residents of a southeastern county of the United States, having physically active neighbors was associated with walking 30 or more minutes a day for five or more days per week. Latkin et al²⁹ revealed that condom use among study participants in Baltimore Maryland was associated with having friends who encouraged or used condoms. Participants in a study by Eyler et al³⁰ were less likely to be sedentary if they had high physical activity social support. The literature demonstrates that social support is an important reinforcing factor in enhancing healthy behaviors. It is important to consider that women in our study, because they live in public housing,

may not have an adequate social support system. This factor may have contributed to their unhealthy dietary habits.

A third barrier to healthy eating could be inadequate access to services that are important for daily living. In their assessment of the effects of the Moving to Opportunity program in Chicago, Rosenbaum and Harris³¹ found that families living in public assisted housing in high-poverty areas had limited access to specific services. Their baseline survey revealed that fewer than one third of these families reported having their usual place of worship, grocery store, and healthcare provider within 15 minutes of their residence. Having adequate access to social resources can be an enabling factor for positive dietary behaviors. For example, healthcare providers are a conduit for encouraging dietary change among their patients and providing them with the technical skills to translate dietary recommendations into daily meal planning.³² As another example, one study among elderly individuals living in subsidized housing revealed that most of those on food stamps reported that this benefit of receiving dietary advice. allowed them to purchase more needed foods.³³ Although we did not determine women's access to specific resources in our study, it is a potential barrier to consider when looking at factors that could hinder African American women in public housing from eating healthy diets.

Sociodemographic Factors Associated With Poor Dietary Quality

To further understand the potential barriers to healthy dietary intake among African American women in public housing, we explored the association between specific sociodemographic factors and the consumption of selected food items from the Food Guide Pyramid. Three sociodemographic factors were associated with unhealthy dietary intake in our population of women - young age, low income, and low education. Young age was associated with a low intake of whole wheat bread and a high intake of meat, French fries, and potato chips. This finding is consistent with the results of other studies that have shown that younger individuals are more likely to have unhealthy eating habits than do older individuals.^{10,34} Although not assessed in our study, younger women may be more likely to have children to care for than older women. As such, these women may shop for foods based on the preferences of their children, as opposed to choosing healthier food items. One study showed that the choice of breads and cereals purchased by women included the preferences of their children.³⁵ In our study, half the women were of childbearing age. This factor may have influenced their relatively low consumption of whole wheat bread and bran cereals, since these food items are probably not favorites of children. The high intake of French fries and potato chips could also reflect preferences of children. The study by Shankar and Klassen¹⁵ revealed that women with children in their households are more likely to eat fast food at least once a week than are women without children.

Our study revealed that low income was associated with a low intake of vegetables, and low education was associated with a high intake of fatback, bacon, lard, and butter. Income and education can serve as two indicators of socioeconomic status.^{36,37} Our findings are consistent with those of other studies that have shown that individuals of low socioeconomic status are more likely to have unhealthy dietary intake than those of higher socioeconomic status. 10,34,38 One way that low socioeconomic status can impact dietary consumption is by limiting one's capability to purchase healthier food items. A study by Treiman et al³⁹ has shown that cost is a barrier to consuming fruit and vegetables. Similarly, cost may have

been a barrier to consuming healthier foods for women in our population, as most had incomes <\$10,000 a year.

In order to improve the quality of diet among women in public housing, interventions should be individualized and tailored to the specific needs of women in this population. Educational messages that are tailored have been shown to have a significant positive impact on behavior.³² These tailored interventions should address potential barriers to healthy dietary intake faced by these women, such as low socioeconomic status and factors associated with young age and living in public housing. In addition, they should teach ways to overcome these barriers or to eat as healthy as possible despite them. Particular components of dietary interventions should enhance food shopping skills at grocery stores and food selection skills when eating out to promote healthier food choices,^{32,40} and provide guidance on preparing nutritious meals and snacks at home in order to minimize the consumption of nutrientdilute, energy-dense food items.⁴⁰

Recommending a healthy diet is only one part of the equation; it is equally important to ensure the availability of appropriate foods. Access to healthy food items is imperative if dietary change is to take place among individuals in public housing. Public policy should be developed and enforced to assure that a variety of healthy and affordable foods are available in smaller grocery and convenience stores in low-income neighborhoods, and that supermarkets are established in these areas. In addition, policies should be enforced to minimize the number of fast-food restaurants in low income areas, and to replace them with food establishments offering varied and healthier menu options.

Dietary Risk Factors for Cancer

The findings of our study have significant implications for the prevention of cancer in African American

women, a population that is already at high risk for cancer morbidity and mortality.1 Cancer risk is associated with the consumption of fruits^{4,41} and vegetables.^{4,41,42} For example, the risk of colon cancer has been shown to be inversely associated with the consumption of fruit⁴³ and vegetables,⁴⁴ and lycopene found in tomatoes may be protective against breast cancer. 45,46 In terms of other foods, studies have also shown that a lower risk of colon cancer may be associated with the consumption of fiber^{47,48} and dairy products,⁴⁹ and breast cancer risk may be inversely associated with the consumption of dairy products.⁴⁹ Also, dietary fats may be associated with the risk of certain cancers such as colon⁵⁰ and breast.^{51,52} In addition to the dietary fat in foods such as butter, cakes, and cookies, the high intake of total energy as reflected in the caloric content of these foods is associated with cancer risk.⁵³ The high consumption of these food items can also replace the consumption of healthier foods and can lead to obesity, a risk factor for the development of cancer.⁵⁴ Women in our study population are at risk for various cancers because of their inadequate consumption of fruits, vegetables, fiber, and dairy products and their high consumption of meats and nutrient-dilute, energy-dense foods.

In order to prevent cancer, the American Cancer Society recommends that individuals eat five or more servings of a variety of vegetables and fruits each day, choose whole grains in preference to processed grains and sugars, limit the consumption of red meats, especially high fat and processed meats, and choose foods that help maintain a healthful weight.55 Specifically for fiber intake, the US Department of Health and Human Services (HHS) and the US Department of Agriculture (USDA) recommends the consumption of three or more ounce-equivalents of whole-grain products per day.⁵⁶ The dietary intake of women in our study did not meet the recommendations by

the ACS, or by HHS and USDA. These women had limited intake of whole grain products, fruits, and vegetables, and consumed foods high in fat content and calories. Strategies need to be undertaken to educate African American women in public housing on the role of diet in the prevention of cancer and to encourage healthy eating habits to reduce their risk of cancer. Efforts need to focus on increasing the consumption of fruits and vegetables to at least five a day, incorporating fiber in the diet at least daily, and substituting food items that are high in fat and calories but low in nutritious value with those that are healthier. Although we did not determine the type of meats that were consumed by women in our study, the fact that the majority eat meat at least daily and few consume beans or peas warrants education. African American women in public housing should be encouraged to comply with ACS dietary recommendations to prevent cancer by: limiting the intake of red meat; selecting fish, poultry or beans as opposed to beef, pork and lamb; choosing lean cuts of meat and smaller portions; and preparing meats by baking or broiling instead of frying or charbroiling.55

LIMITATIONS

Our study was limited by the fact that a non-quantitative food frequency questionnaire was used, and therefore portion sizes of food items were not assessed. The ACS guidelines on diet and cancer prevention recommend that meat consumption be limited, especially high-fat meats; however, our survey did not distinguish between types of meats. In addition, we did not assess the manner in which foods were prepared but instead inquired about the consumption of added fats. Study participants' ability to accurately recall their intake of food items may have limited the results of our study, leading to either

an overestimate or underestimate of actual food consumption. Because the surveys were conducted through face-toface interviews, participants may have been prone to giving responses that they perceived to be acceptable, thus potentially leading to an inaccurate portrayal of food consumption. Despite these limitations, the results of our study reflect a pattern of food intake among African American women in public housing that is suboptimal.

CONCLUSIONS

Our study suggests that African American women in public housing consume diets that place them at risk for cancer. Specific sociodemographic factors, such as age, income, and education, may hinder these women from initiating and maintaining healthy dietary habits for themselves and their families. Tailored interventions to improve dietary quality should be implemented to help reduce the significant morbidity and mortality from cancer in African American women. These interventions need to explore and address the barriers that hinder healthy eating among these women, especially those barriers that are specific to living in public housing.

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REFERENCES

- Ries LAG, Eisner MP, Kosary CL, et al. SEER Cancer Statistics Review, 1975–2001. Bethesda, Md: National Cancer Institute; 2004.
- Cummings JH, Bingham SA. Diet and the prevention of cancer [see comment]. *BMJ*. 1998;317(7173):1636–1640.
- Greenwald P, Clifford CK, Milner JA. Diet and cancer prevention. *Eur J Cancer.* 2001; 37(8):948–965.

- Riboli E, Norat T. Epidemiologic evidence of the protective effect of fruit and vegetables on cancer risk. *Am J Clin Nutr.* 2003;78(suppl 3):559S–569S.
- Resnicow K, Jackson A, Wang T, et al. A motivational interviewing intervention to increase fruit and vegetable intake through Black churches: results of the Eat for Life trial. *Am J Public Health.* 2001;91(10):1686–1693.
- Gorin SS, Jacobson J. Diet and breast cancer surveillance behaviors among Harlem women. *Ann N Y Acad Sci.* 2001;952:153–160.
- Vitolins MZ, Quandt SA, Bell RA, Arcury TA, Case LD. Quality of diets consumed by older rural adults. *J Rural Health.* 2002;18(1): 49–56.
- Robinson ME, Hunter PH. Nutritional assessment of a predominately African American inner-city clinic population. WMJ. 2001; 100(9):32–38.
- Croft JB, Temple SP, Lankenau B, et al. Community intervention and trends in dietary fat consumption among Black and White adults. J Am Diet Assoc. 1994;94(11): 1284–1290.
- Gary TL, Baptiste-Roberts K, Gregg EW, et al. Fruit, vegetable and fat intake in a populationbased sample of African Americans. *J Natl Med Assoc.* 2004;96(12):1599–1605.
- Guthrie JF, Lin BH. Overview of the diets of lower- and higher-income elderly and their food assistance options. *J Nutr Educ Behav.* 2002;34(suppl 1):S31–S41.
- McClelland JW, Demark-Wahnefried W, Mustian RD, Cowan AT, Campbell MK. Fruit and vegetable consumption of rural African Americans: baseline survey results of the Black Churches United for Better Health 5 A Day Project. *Nutr Cancer*. 1998;30(2): 148–157.
- Ford ES. Race, education, and dietary cations: findings from the Third National Health and Nutrition Examination Survey. *Ethn Dis.* 1998;8(1):10–20.
- Miller DK, Carter ME, Sigmund RH, et al. Nutritional risk in inner-city-dwelling older Black Americans. J Am Geriatr Soc. 1996; 44(8):959–962.
- Shankar S, Klassen A. Influences on fruit and vegetable procurement and consumption among urban African American public housing residents, and potential strategies for intervention. *Fam Econ Nutr Rev.* 2001; 13(2):34–46.
- Anonymous. American Cancer Society updates guidelines on diet, nutrition and cancer. Am Fam Phys. 1992;45(3):1364.
- National Institutes of Health. *Health Habits* and History Questionnaire: Diet History and Other Risk Factors, Version 02.1. Bethesda, Md: National Cancer Institute, Division of Cancer Prevention and Control, NIH; 1987.

- US Department of Agriculture. *Dietary Guidelines for Americans*. Washington, DC: USDA; 2000.
- CDC. Behavioral Risk Factor Surveillance System Online Prevalence Data, 1995–2004. Atlanta, Ga: Division of Adult and Community Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention; 2004.
- Malmgren JA, Martin ML, Nicola RM. Healthcare access of poverty-level older adults in subsidized public housing. *Public Health Rep.* 1996;111(3):260–263.
- Sallis JF, Nader PR, Rupp JW, Atkins CJ, Wilson WC. San Diego surveyed for hearthealthy foods and exercise facilities. *Public Health Rep.* 1986;101(2):216–219.
- Morland K, Wing S, Diez Roux A, Poole C. Neighborhood characteristics associated with the location of food stores and food service places. *Am J Prev Med.* 2002;22(1):23–29.
- Morland K, Wing S, Diez Roux A. The contextual effect of the local food environment on residents' diets: the Atherosclerosis Risk in Communities study [see comment]. *Am J Public Health.* 2002;92(11):1761–1767.
- Lacey LP, Manfredi C, Balch G, Warnecke RB, Allen K, Edwards C. Social support in smoking cessation among Black women in Chicago public housing. *Public Health Rep.* 1993;108(3):387–394.
- Nollen NL, Catley D, Davies G, Hall M, Ahluwalia JS. Religiosity, social support, and smoking cessation among urban African American smokers. *Addict Behav.* 2005; 30(6):1225–1229.
- Levy-Storms L, Wallace SP. Use of mammography screening among older Samoan women in Los Angeles county: a diffusion network approach. Soc Sci Med. 2003;57(6):987–1000.
- Suarez L, Ramirez AG, Villarreal R, et al. Social networks and cancer screening in four US Hispanic groups. *Am J Prev Med.* 2000; 19(1):47–52.
- Addy CL, Wilson DK, Kirtland KA, Ainsworth BE, Sharpe P, Kimsey D. Associations of perceived social and physical environmental supports with physical activity and walking behavior. *Am J Public Health.* 2004;94(3): 440–443.
- Latkin CA, Forman V, Knowlton A, Sherman S. Norms, social networks, and HIV-related risk behaviors among urban disadvantaged drug users. *Soc Sci Med.* 2003;56(3):465–476.
- Eyler AA, Brownson RC, Donatelle RJ, King AC, Brown D, Sallis JF. Physical activity social support and middle- and older-aged minority women: results from a US survey. *Soc Sci Med.* 1999;49(6):781–789.
- 31. Rosenbaum E, Harris LE. Low-income families in their new neighborhoods: the short-

term effects of moving from Chicago's public housing. *J Fam Issues.* 2001;22(2):183-210.

- Bernstein A, Nelson ME, Tucker KL, et al. A home-based nutrition intervention to increase consumption of fruits, vegetables, and calcium-rich foods in community dwelling elders. *J Am Diet Assoc.* 2002;102(10):1421–1427.
- 33. Fey-Yensan N, English C, Pacheco HE, Belyea M, Schuler D. Elderly food stamp participants are different from eligible nonparticipants by level of nutrition risk but not nutrient intake. *J Am Diet Assoc.* 2003;103:103–107.
- Dynesen AW, Haraldsdottir J, Holm L, Astrup A. Sociodemographic differences in dietary habits described by food frequency questions-results from Denmark. *Eur J Clin Nutr.* 2003;57(12):1586–1597.
- 35. Chase K, Reicks M, Smith C, Henry H, Reimer K. Use of the think-aloud method to identify factors influencing purchase of bread and cereals by low-income African American women and implications for whole-grain education. J Am Diet Assoc. 2003;103(4): 501–504.
- 36. Steenland K, Henley J, Calle E, Thun M. Individual- and area-level socioeconomic status variables as predictors of mortality in a cohort of 179,383 persons. *Am J Epidemiol.* 2004;159(11):1047–1056.
- Araya R, Lewis G, Rojas G, Fritsch R. Education and income: which is more important for mental health? *J Epidemiol Community Health.* 2003;57(7):501–505.
- Wardle J, Steptoe A. Socioeconomic differences in attitudes and beliefs about healthy lifestyles. J Epidemiol Community Health. 2003;57(6):440–443.
- Treiman K, Freimuth V, Damron D, et al. Attitudes and behaviors related to fruits and vegetables among low-income women in the WIC program. *J Nutr Educ.* 1996;28(3): 149–156.
- Katz DL. Dietary counseling in clinical practice. In: *Nutrition in Clinical Practice*. Philadelphia, Pa: Lippincott Williams & Wilkins, 2001;299–331.
- La Vecchia C, Tavani A. Fruit and vegetables, and human cancer. *Eur J Cancer Prev.* 1998;7(1):3–8.
- Murillo G, Mehta RG. Cruciferous vegetables and cancer prevention. *Nutr Cancer*. 2001; 41(1–2):17–28.
- 43. Sanjoaquin MA, Appleby PN, Thorogood M, Mann JI, Key TJ. Nutrition, lifestyle and colorectal cancer incidence: a prospective investigation of 10,998 vegetarians and nonvegetarians in the United Kingdom. *Br J Cancer.* 2004;90(1):118–121.
- 44. Hara M, Hanaoka T, Kobayashi M, et al. Cruciferous vegetables, mushrooms, and gastrointestinal cancer risks in a multicenter,

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hospital-based case-control study in Japan. Nutr Cancer. 2003;46(2):138-147.

- 45. Gaudet MM, Britton JA, Kabat GC, et al. Fruits, vegetables, and micronutrients in relation to breast cancer modified by menopause and hormone receptor status. *Cancer Epidemiol Biomarkers Prev.* 2004;13(9):1485–1494.
- 46. Sato R, Helzlsouer KJ, Alberg AJ, Hoffman SC, Norkus EP, Comstock GW. Prospective study of carotenoids, tocopherols, and retinoid concentrations and the risk of breast cancer. *Cancer Epidemiol Biomarkers Prev.* 2002; 11(5):451–457.
- 47. Bingham SA, Day NE, Luben R, et al. Dietary fiber in food and protection against colorectal cancer in the European Prospective Investigation into Cancer and Nutrition (EPIC): an observational study [see comment]. *Lancet.* 2003;361(9368):1496–1501. (Erratum appears in *Lancet.* 2003;362(9388):1000.)
- Levi F, Pasche C, Lucchini F, La Vecchia C. Dietary fiber and the risk of colorectal cancer. *Eur J Cancer.* 2001;37(16):2091–2096.
- Wooten WJ, Price W. Consensus report of the National Medical Association. The role of dairy and dairy nutrients in the diet of African

Americans. J Natl Am Assoc. 2004;96(12 [suppl]):5S–31S.

- O'Keefe SJ, Kidd M, Espitalier-Noel G, Owira P. Rarity of colon cancer in Africans is associated with low animal product consumption, not fiber [see comment]. *Am J Gastroenterol.* 1999;94(5):1373–1380.
- Mattisson I, Wirfalt E, Wallstrom P, Gullberg B, Olsson H, Berglund G. High fat and alcohol intakes are risk factors of postmenopausal breast cancer: a prospective study from the Malmo diet and cancer cohort. *Int J Cancer*. 2004;110(4):589–597.
- Sieri S, Krogh V, Muti P, et al. Fat and protein intake and subsequent breast cancer risk in postmenopausal women. *Nutr Cancer*. 2002;42(1):10–17.
- 53. Satia-Abouta J, Galanko JA, Potter JD, et al. Associations of total energy and macronutrients with colon cancer risk in African Americans and Whites: results from the North Carolina colon cancer study. *Am J Epidemiol.* 2003;158(10):951–962.
- 54. Key TJ, Schatzkin A, Willett WC, Allen NE, Spencer EA, Travis RC. Diet, nutrition and

the prevention of cancer. *Public Health Nutr.* 2004;7(1A):187–200.

- American Cancer Society recommendations for nutrition and physical activity for cancer prevention, 2001. Available at: http:// www.cancer.org. Accessed in: 2005.
- 56. US Department of Health and Human Services and US Department of Agriculture. *Dietary Guidelines for Americans, 2005.* 6th ed. Washington, DC: US Government Printing Office; January 2005.

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