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Food costs are higher in counties with poor health rankings

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Introduction

The cost of food impacts the decision and ability to consistently eat a healthy diet. Poor access to affordable healthy food items is associated with high rates of obesity and cardiovascular disease (1, 2). In many households, fresh fruits and vegetables are often perceived as being so expensive that they are considered luxury items (3). There is evidence that access to larger grocery stores or supermarkets is associated with greater consumption of foods that have cardiovascular disease risk-reducing properties (4). However, low-income individuals are often unable to afford these healthier foods irrespective of proximity to larger grocery stores (5). There has also been a shift in U.S. household food purchases from grocery chain stores to mass merchandisers, warehouse clubs and convenience stores (6). This shift in food shopping locations has resulted in an increase in the purchases of foods with poorer nutrient density (6). Many at-risk individuals live in counties that tend to have high rates of unemployment, food insecurity risk (i.e., the state or risk of being unable to provide food for oneself or family) and a significant number of families dependent on Supplemental Nutrition Assistance Program (SNAP) funds to meet nutrition needs (7). These socioeconomic hardships are particularly notable in Kentucky's Appalachian region, where decades of persistent poverty, geographic isolation and culture influence dietary habits. Many of these disadvantaged counties have small grocery stores and an abundance of convenience and fast food outlets, resulting in residents consuming a diet high in low-cost, highly processed foods associated with high rates of morbidity and mortality (8, 9). Since food cost can inhibit healthy dietary behaviors, the purpose of this cross-sectional study was to determine whether food prices per serving differed across Kentucky counties based on health ranking and overall nutritional quality.

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Authorship: ¹Formulated research question, designed study, supervised data collection and entry, and wrote first draft and all revisions

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Methods

Procedure

The County Health Rankings and Roadmaps ranks every county within each state based on rates of mortality (i.e., premature death from the National Center for Health Statistics 2008–2010) and morbidity (i.e., poor or fair health, poor physical health days, poor mental health days, low birthweight from the Behavioral Risk Factor Surveillance System 2005–2011 and the National Center for Health Statistics 2004–2010) (10). Higher ranking is associated with a greater percentage of mortality and morbidity. We categorized all 120 Kentucky counties into tertiles of health ranking (1 = most healthy counties ranked 1–40, 2 = moderately healthy counties ranked 41–80, 3 = least healthy counties ranked 81–120) and five counties were randomly selected from each tertile. The Overall Nutritional Quality Index (ONQI) rankings of 75 foods based on the USDA market basket were assessed at a large chain supermarket in a metropolitan Kentucky county. Data on type and size of retail food outlets were obtained from the United States Department of Agriculture via a Freedom of Information Act request (Table 1) (11). The largest grocery store or supermarket was selected in each county as the site for cost assessment in order to determine the lowest cost of food items available within each county. The cost of each of the 75 foods was then assessed in all 15 study counties during the same week in October 2014. Food items included whole grain and refined cereals and breads; fresh, frozen and canned vegetables, fresh, frozen and dried fruit; fruit juice; fresh, frozen and canned meats, poultry, and fish; salty snack foods; full fat and skim dairy products; nuts, nut butters and legumes; soda; eggs; jelly and cooking fats. Store managers were notified of the study procedures when the researchers first entered the store and introduced themselves. Managers were assured that the data would only be used for research purposes and that food item costs would not be shared with competitors. The research nurses also offered each store manager the opportunity to review the cost assessments for accuracy and of the 15 store managers notified, one manager requested a review and reported no errors in price assessments.

Prices were assessed per serving size instead of by weight or volume to reflect a more accurate comparison of cost. Serving sizes for fruits (1/2 cup), vegetables (1/2 cup), dairy (1 cup) and grains (3/4 cup or 1 slice of bread) were determined by using USDA standards (12). Protein servings were set at 3 ounces as recommended by the American Heart Association (13). Two nurse researchers assessed all prices and results were compared for accuracy. All grocery stores were regional or national chain stores. Identical generic or brand names were assessed in all 15 stores.

Measures

The ONQI scale, developed to measure the health-contributing properties of foods and beverages, was used to assess nutritional value of food items available in all 15 counties (14). The index quantifies how each food contributes to or protects from disease risk based on an algorithm. Health-promoting nutrients (i.e., antioxidants, minerals, fiber, unsaturated fatty acids, carotenoids and phenolic compounds) comprise the numerator of the index and disease-contributing nutrients (i.e., cholesterol, sodium, sugar and saturated and *trans* fats) make up the denominator. Scores of food items range from 1 to 100, with higher scores

equating with greater concentrations of CVD risk-reducing nutrients. For this analysis, we categorized scores into quartiles (i.e., 0–24 = least nutritious, 25–49 = minimally nutritious, 50–74 = moderately nutritious, and 75–100 = most nutritious).

County health ranking was based on the 2013 County Health Rankings Health Outcomes. Eight of the 15 counties are in Appalachia. Additional county-level variables included 2010 county population (15), poverty rates (15), Appalachian status (16) and unemployment rates (17).

Analysis

Descriptive statistics, including means and standard deviations, were used to summarize study variables. A generalized estimating equations (GEE) model was used to assess differences in food cost by nutritional quality and health ranking, adjusting for multiple measurements (price of foods per serving) across counties. The GEE model included county health ranking (most healthy, moderately health and least healthy), ONQI quartile (least, minimally, moderately and most nutritious), county population and Appalachian status. Post-hoc analysis was used to test for pairwise price difference among county health ranking groups. All analysis was conducted using SAS version 9.3; an alpha level of .05 was used throughout.

Results

County health rankings ranged from 9 to 116 (Table 2). Counties ranked as the least healthy had higher average rates of poverty, SNAP participation and unemployment than moderately and most healthy counties (Table 2). In each of the counties, we measured the prices of 75 food items for this analysis. The most expensive foods were rated in the minimally nutritious ONQI category ($M = \$0.72$; $SD = \$0.49$), followed by the most nutritious ONQI category ($M = \$0.56$; $SD = \$0.54$). Prices for the least nutritious ONQI category and the moderately nutritious ONQI category were $\$0.41$ ($SD = \$0.23$) and $\$0.45$ ($SD = \$0.29$), respectively.

In the GEE model, controlling for county population, Appalachian status and ONQI rating, there was a significant difference in the price per serving of foods based on county health ranking tertiles ($\chi^2 = 12.0$; $P = .003$, Figure 1). Prices per serving were significantly less in the most healthy counties compared to the least healthy counties ($Z = 3.8$; $P < .001$); with average prices being $\$0.08$ higher per serving in the least healthy counties ($b = 0.08$; $SE = 0.02$). Similarly, prices per serving were significantly higher in least healthy counties (tertile 3) compared to moderately healthy counties (tertile 2) ($Z = 2.3$; $P = .024$), with an average difference of $\$0.05$ per serving ($b = 0.05$; $SE = 0.02$). There was no difference between prices in the most healthy and moderately healthy counties. There was also no difference in prices across counties based on ONQI category. County population and Appalachian status were unrelated to price per serving.

Discussion

Disproportionately higher food costs are likely to be placing individuals living in counties with poor health outcomes at a higher risk of food insecurity and poor dietary habits.

Kentucky has the eighth highest rate of CVD deaths in the U.S. (10) and improving access to healthy foods at a reasonable cost can potentially reduce its disproportionate CVD morbidity and mortality. While disparities in access to affordable healthy foods are well-documented (18, 19) this is the first study to analyze cost disparities based on nutritional value of food items and health ranking of counties. Studies that have evaluated cost discrepancies on single food items or food groups have had mixed results. In an analysis of 855 U.S. grocery stores, both 1% fat and skim milk were significantly more expensive in majority black communities than in majority white communities (20). Fruit and vegetable prices did not vary in twelve rural Montana counties, although fruit and vegetable quality was significantly better in the least rural counties (21).

Further research is necessary to develop and test strategies that improve accessibility and affordability of healthy foods in counties with disproportionately poor health outcomes. Strategies should include community interventions and policy advocacy strategies that result in more equitable access to healthy foods. In impoverished counties, increasing access to healthy foods is unlikely to be successful if the reality of disparate food costs is not addressed.

Although overall food costs are higher in counties with poor health outcomes, healthy, affordable foods are available in these regions (22). There are effective community-based interventions aimed at helping individuals identify and access locally available, affordable, healthy foods. These interventions include nutritional education and cooking skills programs delivered by USDA Cooperative Extension Family & Consumer Science (FCS) agents (23–26); incentive programs to encourage families to grow and sell produce to local grocers or via farmers markets (27); and programs that emphasize the cost-effectiveness and positive health outcomes of consistently eating home-prepared foods that reduce the risk of chronic disease (28, 29).

The Centers for Disease Control and Prevention (CDC) recommend that communities provide incentives for the production of foods from local farms as a strategy to prevent obesity (30). Individuals who have limited incomes may be more apt to purchase locally grown produce because there is also less risk of food spoilage when fruits and vegetables are purchased from local growers (31). When individuals perceive easier access to locally grown produce, they eat significantly more fresh fruits and vegetables (32). Incentivizing individuals and families to grow and sell produce locally may afford the opportunity for individuals to purchase fresh produce at a lower cost.

Supplemental Nutrition Assistance Program is a federally funded nutrition assistance program. Individual state legislatures have flexibility in determining eligibility and methods of SNAP distribution (33). Individuals who participate in SNAP tend to consume fewer servings of fruits and vegetables than those who are ineligible for SNAP. However, frequent home cooking, ease of food preparation and greater length of time before food spoilage are associated with greater vegetable consumption (34–35). Programs taught by USDA Cooperative Extension FCS agent-led programs are effective in helping individuals develop cooking skills using affordable, healthy food ingredients (23–26).

Advocacy aimed at improving the efficiency of SNAP should include awareness of discrepancies in food affordability (36). Legislators must take into account region-specific disparities in food affordability. Current SNAP policies do not address food cost disparities in counties where rates of cardiovascular disease prevalence, poverty and SNAP participation are disproportionately higher (37). There are currently no cost considerations on foods that can be purchased with SNAP funds. Participants receive a set dollar amount of SNAP funds each month, depending on the number of individuals living in the household (37).

In contrast to SNAP funds, the Women, Infants and Children's (WIC) Program, which is not limited by a set dollar amount, funds specific foods associated with positive health outcomes (e.g., dairy, legumes, fish, whole wheat breads, fruits and vegetables). Participants in the WIC program receive cash vouchers for fruits and vegetables and other foods are purchased by number of servings or ounces. Purchasing foods by quantity rather than being limited by a set monthly dollar amount eliminates the region-specific cost disparities. Cash vouchers for fruits and vegetables provide the opportunity to purchase fresh produce from local sources (38). This practice of providing "food packages" would eliminate cost disparities and incentivize more local production of fresh fruits and vegetables.

Food cost disparities have an impact on health outcomes. Current SNAP policies do not address these food cost disparities. Health care professionals are in key positions to promote local farming and selling of fresh produce. Public health advocacy should include prompting state legislatures to revise SNAP policies so they reflect the cost disparities experienced by people in regions with disproportionately high rates of chronic disease and poor health outcomes. Local public health officials should also develop partnerships with USDA Cooperative Extension FCS agents to promote community outreach and nutrition education.

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References

1. Ghosh-Dastidar B, Cohen D, Hunter G, Zenk SN, et al. Distance to store, food prices and obesity in urban food deserts. *Am J Prev Med.* 2014; 47(5):587–95. [PubMed: 25217097]
2. Grimm KA, Foltz JL, Blanck HM, Scanlon KS. Household income disparities in fruit and vegetable consumption by state and territory: Results of the 2009 Behavioral Risk Factor Surveillance System. *J Acad Nutr Diet.* 2012; 112(12):2014–21. [PubMed: 23174688]
3. Zepeda L, Reznickova A, Lohr L. Overcoming challenges to effectiveness of mobile markets in US food deserts. *Appetite.* 2015; 79:58–67. [PubMed: 24727100]
4. Giskes K, van Lenthe F, Avendano-Pabon M, Brug J. A systematic review of environmental factors and obesogenic dietary intakes among adults: Are we getting closer to understanding obesogenic environments? *Obes Rev.* 2011; 12(5):e95–e106. [PubMed: 20604870]
5. Horning ML, Fulkerson JA. A systematic review on the affordability of a healthful diet for families in the United States. *Public Health Nurs.* 2014; 32(1):68–80. [PubMed: 25134620]
6. Stern D, Ng SW, Popkin BM. The nutrient content of U.S. household food purchases by store type. *Am J Prev Med.* 2015 Sep 24. pii: S0749-3797(15)00415-8. doi: 10.1016/j.amepre.2015.07.025

7. Hilmers A, Hilmers DC, Dave J. Neighborhood disparities in access to healthy foods and their effects on environmental justice. *Am J Public Health*. 2012; 102(9):1644–54. [PubMed: 22813465]
8. Gearhardt AN, Davis C, Kuschner R, Brownell KD. The addiction potential of hyperpalatable foods. *Curr Drug Abuse Rev*. 2011; 4(3):140–5. [PubMed: 21999688]
9. Monsivais P, Rehm CD. Potential nutritional and economic effects of replacing juice with fruit in the diets of children in the United States. *Arch Pediatr Adolesc Med*. 2012; 166(5):459–64. DOI: 10.1001/archpediatrics.2011.1599 [PubMed: 22566547]
10. County Health Rankings and Roadmaps. Robert Wood Johnson Foundation; 2014. <http://www.americashealthrankings.org/KY/CVDDeaths> [Accessed June 28, 2015]
11. United States Department of Agriculture Food and Nutrition Service Information Management Office. Supplemental Nutrition Assistance Program Authorized Stores/M Meal Services CY. 2013. FOIA Request # 2014-FNS-03906-F
12. United States Department of Agriculture. [Accessed June 30, 2015] Dietary Guidelines for Americans. 2011. <http://www.health.gov/dietaryguidelines>
13. American Heart Association. [Accessed June 30, 2015] What is a serving?. 2012. http://www.heart.org/HEARTORG/Caregiver/Replenish/WhatIsAServing/What-is-a-Serving_UCM_301838_Article.jsp
14. Katz, DL., Njike, VY., Kennedy, D., Faridi, Z., Treu, J., Rhee, LQ. Overall Nutritional Quality Index Version 1 Reference Manual. Prevention Research Center, Yale University School of Medicine; 2007.
15. United States Department of Agriculture Economic Research Service. [Accessed June 21, 2015] 2013. <http://www.ers.usda.gov/Data/povertyrates/>
16. United States Department of Agriculture Economic Research Service. [Accessed June 25, 2015] 2010. <http://www.ers.usda.gov/data-products/food-environment-atlas/data-access-and-documentation-downloads.aspx>
17. United States Department of Labor Bureau of Labor Statistics. [Accessed December 28, 2015] Local Area Unemployment Statistics Map Kentucky. <http://data.bls.gov/map/MapToolServlet>
18. Darmon N, Drewnowski A. Contribution of food prices and diet cost to socioeconomic disparities in diet quality and health: a systematic review and analysis. *Nutr Rev*. 2015 Oct; 73(10):643–60. DOI: 10.1093/nutrit/nuv027 [PubMed: 26307238]
19. Daniel C. Economic constraints on taste formation and the true cost of healthy eating. *Soc Sci Med*. 2015 Nov 25; 148:34–41. DOI: 10.1016/j.socscimed.2015.11.025 [PubMed: 26650928]
20. Rimkus L, Isgor Z, Ohri-Vachaspati P, Zenk SN, Powell LM, Barker DC, Chaloupka FJ. Disparities in the availability and price of low-fat and higher-fat milk in US food stores by community characteristics. *J Acad Nutr Diet*. 2015 Dec; 115(12):1975–85. DOI: 10.1016/j.jand.2015.04.002 [PubMed: 26048532]
21. Byker Shanks C, Ahmed S, Smith T, Houghtaling B, Jenkins M, Margetts M, Schultz D, Stephens L. Availability, Price, and Quality of Fruits and Vegetables in 12 Rural Montana Counties, 2014. *Prev Chronic Dis*. 2015 Aug 13; 12:E128.doi: 10.5888/pcd12.150158 [PubMed: 26270742]
22. Hardin-Fanning F, Rayens MK. Food cost disparities in rural communities. *Health Promot Pract*. 2015; 16(3):383–91. DOI: 10.1177/1524839914554454 [PubMed: 25305093]
23. Kaiser L, Chaidez V, Algert S, et al. Food resource management education with SNAP participation improves food security. *J Nutr Educ Behav*. 2015 Apr 2. pii: S1499-4046(15)00052-4. doi: 10.1016/j.jneb.2015.01.012
24. Hersey JC, Cates SC, Blitstein JL, et al. Eat smart, live strong intervention increases fruit and vegetable consumption among low-income older adults. *J Nutr Gerontol Geriatr*. 2015; 34(1):66–80. [PubMed: 25803605]
25. Buscemi J, Odoms-Young A, Stolley ML, et al. Adaptation and dissemination of an evidence-based obesity prevention intervention: Design of a comparative effectiveness trial. *Contemp Clin Trials*. 2014; 38(2):355–360. [PubMed: 24952282]
26. Hect L, Wass J, Kelly L, Clevenger-Firley E, Dunn C. SNAP-Ed Steps to Health inspires third graders to eat smart and move more. *J Nutr Educ Behav*. 2013; 45(6):800–2. [PubMed: 23665440]
27. [Accessed June 25, 2015] Grow Appalachia. <http://www.berea.edu/grow-appalachia/>

28. Larson N, Fulkerson J, Story M, Neumark-Sztainer D. Shared meals among young adults are associated with better diet quality and predicted by family meal patterns during adolescence. *Public Health Nutr.* 2013; 16(5):883–893. [PubMed: 22857517]
29. Laska MN, Larson NI, Neumark-Sztainer D, Story M. Does involvement in food preparation track from adolescence to young adulthood and is it associated with better dietary quality? Findings from a 10-year longitudinal study. *Public Health Nutr.* 2012; 15(7):1150–8. [PubMed: 22124458]
30. Centers for Disease Control and Prevention. School health guidelines to promote healthy eating and physical activity. *MMWR.* 2011 Sep 16; 60(RR05):1–71.
31. Buzby, JC., Wells, HF., Axtman, B., Mickey, J. Supermarket loss estimates for fresh fruit, vegetables, meat, poultry and seafood and their use in the ER loss-adjusted food availability data. United States Department of Agriculture; 2009. Economic Research Bulletin #44
32. Caldwell EM, Kobayashi MM, DuBow WM, Wytinck SM. Perceived access to fruits and vegetables associated with increased consumption. *Public Health Nutrition.* 2008; 12(10):1743–1750. [PubMed: 19105861]
33. Falk G, Aussenberg RA. The Supplemental Nutrition Assistance Program: Categorical Eligibility. Congressional Research Service. 2013; 7-5700:R42054. [Accessed June 27, 2015] <http://www.fas.org/sgp/crs/misc/R42054.pdf>.
34. Wolfson JA, Bleich SN. Fruit and vegetable consumption and food values: National patterns in the United States by Supplemental Nutrition Assistance Program eligibility and cooking frequency. *Prev Med.* 2015 Jul;76:1–7. [PubMed: 25847732]
35. Jones SA, Walter J, Soliah L, Phifer JT. Perceived motivators to home food preparation: focus group findings. *J Acad Nutr Diet.* 2014; 114(10):1552–6. [PubMed: 24973168]
36. An R. Nationwide expansion of a financial incentive program on fruit and vegetable purchases among Supplemental Nutrition Assistance Program participants: A cost-effectiveness analysis. *Soc Sci Med.* 2015 Dec;147:80–8. DOI: 10.1016/j.socscimed.2015.09.032 [PubMed: 26547363]
37. Center on Budget and Policy Priorities. [Accessed December 29, 2015] Policy Basics: Introduction to Supplemental Nutrition Assistance Program (SNAP). <http://www.cbpp.org/research/policy-basics-introduction-to-the-supplemental-nutrition-assistance-program-snap>
38. United States Department of Agriculture Food and Nutrition Service. [Accessed June 28, 2015] Women, infants and children. 2015. <http://www.fns.usda.gov/wic/final-rule-revisions-wic-food-packages>

Figure 1.

Mean food price per serving by county health ranking tertile. Mean prices of healthy rankings with differing letters are significantly different.

Table 1

Numbers and types of food outlets in study counties (2013 data)

County	Small Grocery ^a	Medium Grocery ^b	Large Grocery ^c	Supermarket ^d	Super Store ^e	Convenience Store ^f
<i>Tertile 1 Most Healthy</i>						
Calloway	0	0	0	3	1	9
Daviess	1	3	1	11	4	47
Boyle	3	0	1	3	1	7
Graves	1	1	1	3	1	15
Bracken	1	0	0	1	0	7
<i>Tertile 2 Moderately Healthy</i>						
Pulaski	6	0	0	5	1	39
Edmonson	0	0	0	3	0	11
Harrison	0	2	0	1	0	7
McLean	1	1	1	2	0	4
Montgomery	0	1	0	1	2	21
<i>Tertile 3 Least Healthy</i>						
Fleming	2	0	0	0	0	25
Rockcastle	1	0	0	2	0	10
McCreary	1	2	0	0	0	17
Powell	0	0	3	0	0	16
Lee	2	2	0	0	0	7

^a Store that carries a small selection of all four staple food categories and primary stock is food.^b Store that carries moderate selection of all four staple food categories and primary stock is food.^c Store that carries a wide selection of all four staple food categories and primary stock is food items.^d Establishments commonly known as supermarkets, food stores, grocery stores and food warehouses primarily engaged in the retail sale of an extensive variety of grocery and other store merchandise.^e Very large supermarkets, "big box" stores, super stores and food warehouses primarily engaged in the retail sale of a wide variety of grocery and other store merchandise. Includes stores that are large food/drug combo stores and mass merchandisers under a single roof, and membership retail/wholesale hybrids offering a limited variety of products in warehouse-type environment.^f Self-service stores that offer a limited line of convenience items and are typically open long hours to provide easy access for customers. Primarily engaged in retail sale of a variety of canned goods, dairy products, pre-packaged meats and other grocery items in limited amounts. Usually sell a large variety of ineligible products; such as hot coffee, alcohol, or tobacco products.

Table 2

Characteristics of study counties

County	Health Ranking	Population	Poverty Rate	Appalachian Status (Y/N)	Supplemental Nutrition Assistance Program Participation	Unemployment Rates (October 2014)
<i>Tertile 1 Most Healthy</i>						
Calloway	9	38,282	22.8	N	13.68	4.6
Daviess	22	98,275	15.3	N	20.04	4.5
Boyle	24	29,706	17.2	N	20.81	5.5
Graves	33	37,618	19.3	N	21.35	6.0
Bracken	40	8,406	16.2	N	26.84	5.7
<i>Tertile 2 Moderately Healthy</i>						
Pulaski	49	63,825	25.2	Y	26.41	6.0
Edmonson	50	12,013	21.2	Y	24.83	6.2
Harrison	55	18,592	17.4	N	25.05	4.7
McLean	57	9,478	18.1	N	20.47	5.2
Montgomery	76	27,474	20.0	Y	26.76	5.9
<i>Tertile 3 Least Healthy</i>						
Fleming	83	14,545	23.2	Y	26.63	4.8
Rockcastle	85	16,826	25.6	Y	34.33	6.0
McCreary	89	17,863	40.7	Y	46.44	8.3
Powell	106	12,434	29.6	Y	42.57	6.5
Lee	116	7,594	35.1	Y	48.87	7.5