KENTUCKY FAMILY IMPACT SEMINARS

Building Strong Families for Kentucky:

Partners in Food and Health

October 14, 2013

School of Human Environmental Sciences

Kentucky Cooperative Extension Service

College of Agriculture, Food and Environment

University of Kentucky

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College of Agriculture,
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Briefing Report
for the Kentucky Family Impact Seminar

Building Strong Families for Kentucky:
Partners in Food and Health

Kentucky Family Impact Seminars
A project of the School of Human Environmental Sciences,
Kentucky Cooperative Extension Service and the College of Agriculture,
Food and Environment at the University of Kentucky

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Welcome

Welcome to the first annual Kentucky Family Impact Seminar! As leaders in our Commonwealth, I am sure you are aware of many issues facing Kentucky families today and are actively seeking solutions that are in the best interests of our families. Our goal is to help you with that task by providing evidence-based, unbiased research from renowned scholars.

This year's seminar focuses on the relationship between food and health. Statistics continue to demonstrate that many Kentucky families increasingly face challenges with rising food costs and lower health quality. At the same time, farmers and producers struggle to provide products that are profitable and sustainable. As leaders and policymakers in the state, you have an opportunity to make serious and lasting impacts on these issues. The focus of this briefing report is to identify strategies that are mutually beneficial to farmers, producers, individuals and families. Our hope is that with this knowledge, policymakers can enact policy that is mutually beneficial to all concerned.

The development of this seminar would not be possible without the efforts of many groups and individuals. While it is based on a partnership between the University of Kentucky's School of Human Environmental Sciences and Family and Consumer Sciences Cooperative Extension, it would not be possible without support from our steering committee and advisers. I would like to particularly thank the conceptual artist and founder of the national seminars, Dr. Karen Bogenschneider, as well as our legislative supporters, Sen. Paul Hornback and Rep. Tom McKee.

Your past has demonstrated your commitment to Kentucky families, and I hope you find the seminar to be a valuable educational tool as you go forward in your work. We are all committed to building strong families and stronger Kentucky communities.

Thank you,

Ann Vail

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Purpose and Presenters

Building Strong Families for Kentucky: Partners in Food and Health is the first Kentucky Family Impact Seminar presented by the University of Kentucky. The Kentucky Family Impact Seminar provides objective, current, and solution-oriented family issues research to state legislators and leaders. The intent of the seminar is to provide policymakers with research that will be a resource and will encourage policymakers to examine policies through the family impact lens. The seminar is designed for state legislators and their aides, governor's office staff, legislative service agency staff, and state agency officials. It provides objective, nonpartisan research and does not lobby for specific policy positions. Seminar participants discuss policy options and identify common ground where it exists.

For speakers' Powerpoint presentations, please visit our website at HES.UKY.EDU/FIS.

The Kentucky Family Impact Seminar features the following speakers:

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Acknowledgements

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Sen. Paul Hornback, Co-Chair of the 2013 Joint Committee on Agriculture.

Rep. Tom McKee, Co-Chair of the 2013 Joint Committee on Agriculture.

Rep. (Retired) Danny Ford

Rep. Rita Smart

The Family Impact Seminar Steering Committee members:

Anita Barbee	Kent School of Social Work University of Louisville
Amelia Brown Wilson	Kentucky Department of Agriculture
Fran Feltner	Center for Excellence in Rural Health – Hazard University of Kentucky
Lori Garkovich	Department of Community and Leadership Development University of Kentucky
Leisa Hutchinson	Department of Communication Disorders Western Kentucky University
Judy Littleton	Kentucky Department of Education
Rosanna Raj	Military Families
Javiette Samuel	College of Agriculture, Food Science, and Sustainable Systems Kentucky State University
Jim Tackett	Forward in the Fifth, The Center for Rural Development

University of Kentucky:

Eli Capiluto	President
Christine M. Riordan	Provost
M. Scott Smith	Dean, College of Agriculture, Food and Environment
Jimmy Henning	Associate Dean for Extension and Director, Cooperative Extension Service
Ann Vail	Director, School of Human Environmental Sciences
Drew Graham	Senior Assistant Dean and Director of Advancement, College of Agriculture, Food and Environment

Members of the School of Human of Environmental Sciences: Jewell Brady, Brian Fitzpatrick, Jan Childers, Diana Haleman, Donna Hancock, Kim Henken, Rusty Manseau, Rose Runyons, Darlene Tipton, and Guy Weinberger.

Karen Bogenschneider, Director of the Policy Institute for Family Impact Seminars/University of Wisconsin – Madison

Executive Summary

The relationship between the food environment and health issues remains a priority as the incidence of obesity and diabetes rises among Kentucky families. Food environment research generally focuses on families' access to food stores, the types of foods stocked by accessible food stores, and how food is marketed to families. Researchers also seek to determine whether alterations to the food environment can positively impact the health status of families, especially among rural families with low incomes. In addition, researchers continue to examine how the food environment can positively impact the local economy. Families in Kentucky face considerable issues with their food environment and subsequent food-related health issues.

The 2013 Kentucky Family Impact Seminar will provide research-based information on the topic of the food environment and its related health issues to assist policymakers in making informed policy decisions in the future. The seminar does not advocate for any position. Rather, it is intended to be a resource that provides policymakers with valuable information on how the specified issues are impacting families in the Commonwealth. This seminar begins with a detailed description of the food environment in Kentucky, is followed by an outline of how policies are impacting food marketing in school, and ends with a discussion of how incentive-based programs at various levels are impacting the food environment.

Executive Summary

The first speaker is Dr. Alison Gustafson of the University of Kentucky. Dr. Gustafson will provide an overview of the current food landscape in Kentucky, with a particular focus on rural areas. She will present information on how healthy food sale practices are lagging in certain areas of the state and follow it with an outline of how these practices are impacting the dietary intake of Kentucky families. She will conclude her presentation by describing possible local-level and state-level policy approaches that could simultaneously improve the state of the food environment and local economies.

The second speaker will be Dr. M. Susie Nanney of the University of Minnesota. Dr. Nanney's presentation will focus on marketing within the school environment. She will describe the role that vending plays in the school cafeteria environment and how it can potentially impact adolescents' access to healthy foods. Her presentation will detail how school policies within and around the school setting can possibly improve availability of healthy food, especially in rural and low-income communities. She will end her presentation by exploring the connection of the issue to local agriculture, with improving access to local agricultural foods in schools as one approach to improving adolescents' healthy food intake.

The final speaker will be Dr. Alice Ammerman of The University of North Carolina at Chapel Hill. Dr. Ammerman will illustrate innovative approaches used by farms transitioning from growing tobacco to larger, more industrialized agriculture, and how this change could potentially impact the food environment. She will also address the environmental benefits of smaller-scale sustainable farming practices, as well as the related health and nutrition benefits to local families. In addition, she will present an economic analysis of how smaller-scale sustainable farming practices provide opportunities for the development of integrated local and sustainable food systems. Dr. Ammerman will finish her presentation by conducting a policy analysis of local food systems and sustainable agriculture.

Three chapters are included in this briefing report. Each chapter includes a detailed description of the speaker's presentation. Each description is followed by an article which will supplement their presentation and provide more information of the topic. In addition to the chapters, a resource section has been provided. Following the seminar, each speaker's presentations can be found at HES.UKY.EDU/FIS.

Family Impact Checklist
Using Evidence to Strengthen Families

The family impact checklist is an evidence-based strategy to help ensure that policies and programs are designed in ways that strengthen and support families. This checklist also can be used for conducting a family impact analysis that examines the intended and unintended consequences of policies, programs, agencies, and organizations on family responsibility, family stability, and family relationships. More detailed guidelines can be found at http://www.familyimpactseminars.org.

USING THE CHECKLIST TO CONDUCT A FAMILY IMPACT ANALYSIS

1. Select the rule, legislation, law, program, agency, or organization and decide what components will be analyzed. Family impact analysis can be used to review rules, legislation, laws, or programs for their impact on families, and to evaluate the family focus and operating procedures of agencies and organizations.

2. Determine which family types might be affected. Families come in many forms and configurations. When beginning the process, it is important to identify which types of families may be impacted by the policy, program, or practice. Do the families impacted have a particular structure, stage of life, income level, education level, or cultural background?

3. Select a family impact checklist and conduct the analysis. Five basic principles form the core of a family impact checklist. Each principle includes a series of evidence-based questions that delve deeply into the ways in which families contribute to issues, how they are affected by them, and whether involving families would result in better solutions.

4. Disseminate and apply the results. A family impact analysis seldom results in overwhelming support for or opposition to a policy or program. Disseminating the results to policymakers and the public may generate interest in developing policies, programs, and practices that are more supportive of family well-being.

Family Impact Checklist
Using Evidence to Strengthen Families

PRINCIPLE 1. Family responsibility. Policies and programs should aim to support and empower the functions that families perform for society—family formation, partner relationships, economic support, childrearing, and caregiving.

How well does the policy, program, or practice:

Strong	Adequate	Limited	N/A	
☐	☐	☐	☐	help families fulfill their functions and avoid taking over family responsibilities unless absolutely necessary?
☐	☐	☐	☐	set realistic expectations for families to assume financial and/or caregiving responsibilities for dependent, seriously ill, or disabled family members depending on their family structure, resources, and life challenges?
☐	☐	☐	☐	address root causes of assuming financial responsibility such as high child support debt, low literacy, low wages, and unemployment?

PRINCIPLE 2. Family stability. Whenever possible, policies and programs should encourage and reinforce family commitment and stability, especially when children are involved. Intervention in family membership and living arrangements is usually justified only to protect family members from serious harm or at the request of the family itself.

How well does the policy, program, or practice:

Strong	Adequate	Limited	N/A	
☐	☐	☐	☐	strengthen commitment to family obligations and allocate resources to help keep the family together when this is the appropriate goal?
☐	☐	☐	☐	balance the safety and well-being of individuals with the rights and responsibilities of other family members and the integrity of the family as a whole?
☐	☐	☐	☐	recognize that major changes in family relationships such as aging, divorce, and adoption are processes that extend over time and require continuing support and attention?

Family Impact Checklist
Using Evidence to Strengthen Families

PRINCIPLE 3. Family relationships. Policies and programs must recognize the strength and persistence of family ties, whether positive or negative, and seek to create and sustain strong couple, marital, and parental relationships.

How well does the policy, program, or practice:

Strong	Adequate	Limited	N/A	
☐	☐	☐	☐	recognize that individuals' development and well-being are profoundly affected by the quality of their relationships with close family members and family members' relationships with each other?
☐	☐	☐	☐	acknowledge how interventions and life events can affect family dynamics and, when appropriate, support the need for balancing change and stability in family roles, rules, and leadership?
☐	☐	☐	☐	provide the knowledge, communication skills, conflict resolution strategies, and problem-solving abilities needed for healthy family relationships or link families to information and not land education sources?

PRINCIPLE 4. Family diversity. Policies and programs can have varied effects on different types of families. Policies and programs must acknowledge and respect the diversity of family life.

How well does the policy, program, or practice:

Strong	Adequate	Limited	N/A	
☐	☐	☐	☐	identify and respect the different attitudes, behaviors, and values of families from various cultural, economic, geographic, racial/ethnic, and religious backgrounds, structures, and stages of life?
☐	☐	☐	☐	recognize the complexity and responsibilities involved in caring for and coordinating services for family members with special needs (e.g., cognitive, emotional, physical, etc.)?
☐	☐	☐	☐	work to ensure that operational philosophies and procedures are culturally responsive and that program staff are culturally competent?

Family Impact Checklist
Using Evidence to Strengthen Families

PRINCIPLE 5. Family engagement. Policies and programs must encourage partnerships between professionals and families. Organizational culture, policy, and practice should include relational and participatory practices that preserve family dignity and respect family autonomy.

How well does the policy, program, or practice:

Strong	Adequate	Limited	N/A	
☐	☐	☐	☐	provide full information and a range of choices to families, recognizing that the length and intensity of services may vary according to family needs?
☐	☐	☐	☐	involve family members, particularly from marginalized families, in policy and program development, implementation, and evaluation?
☐	☐	☐	☐	make flexible program options available and easily accessible through co-location, coordinated application and reimbursement procedures, and collaboration across agencies, institutions, and disciplines?
☐	☐	☐	☐	acknowledge that the engagement of families, especially those with limited resources, may require emotional, informational, and instrumental supports (e.g., child care, financial stipends, transportation)?

NOTE: Adapted with permission from Karen Bogenschneider, Family Policy Specialist, UW-Extension

Chapter 1

Validation of Food Store Environment Secondary Data Source and the Role of Neighborhood Deprivation in Appalachia, Kentucky

By Dr. Alison Gustafson

Summary: Dr. Alison Gustafson

Dr. Alison Gustafson, PhD, MPH, RD will present on the state of affairs in Kentucky with regards to access and availability of different food resources for low-income and rural populations. Her research has focused on how access and availability to different types of food venues, such as gas stations, may be associated with dietary intake. Specifically, her talk will delve into how the consumer food environment, food available within stores, and the neighborhood environment, different types of food stores influence what Kentucky resident's purchase.

Obesity prevalence differs significantly among U.S. counties, particularly in the rural, Southern Appalachian region. In the 14 counties being studied within this manuscript, the range of obesity is between 31% and 37%, compared to the national average of 33% in 2010. While at the same time the Appalachian region has been marked by geographic isolation, which in turn may influence the health disparities experienced by residents relative to those living in more urban settings. There is some evidence to suggest that those living in isolation from resources experience worse health outcomes, such as certain cancers, diabetes prevalence and obesity rates, relative to those with greater proximity to health care, food stores, and physical activity resources. What causes these vast differences may be attributed to societal influences, such as the neighborhood food environment and resources, or through effect of social selection, such as individuals who lead a healthy lifestyle may choose to locate in neighborhoods with healthy food outlets. Results from this study find that neighborhoods with low percentages of poverty, unemployment, and other economic indicators have a low probability of having super centers and convenience stores in their neighborhood, compared to those with high deprivation. Additionally, we did not find that neighborhoods with low deprivation have more grocery stores or supermarkets.

The second part of her talk will focus on the connection between socio-economic status and health outcomes that has led to the term 'food insecurity–obesity paradox'. It has been suggested that the food vouchers SNAP participants receive might encourage them to consume more food compared with cash assistance. Several studies have found significant associations between SNAP participation and higher BMI, while others have found the opposite. Dr. Gustafson's research has found that SNAP participants who lived within a half-mile of at least one farmers market/produce stand had higher odds of consuming one serving or more of vegetables, five servings or more of grains, and one serving or more of milk on a daily basis. SNAP participants who lived within a half-mile of stores that had many healthy food items reported higher odds of consuming at least one serving of vegetables daily. Taken together, both the neighborhood food environment and the consumer food environment are associated with a healthy dietary intake among SNAP participants.

In summary, Dr. Gustafson will lay the groundwork for the state of affairs in Kentucky in regards to access and availability for food for Kentucky citizens.

BMC
Public Health

RESEARCH ARTICLE

Open Access

Validation of food store environment secondary data source and the role of neighborhood deprivation in Appalachia, Kentucky

Alison A Gustafson[1*], Sarah Lewis[1], Corey Wilson[1] and Stephanie Jilcott-Pitts[2]

Abstract

Background: Based on the need for better measurement of the retail food environment in rural settings and to examine how deprivation may be unique in rural settings, the aims of this study were: 1) to validate one commercially available data source with direct field observations of food retailers; and 2) to examine the association between modified neighborhood deprivation and the modified retail food environment score (mRFEI).

Methods: Secondary data were obtained from a commercial database, InfoUSA in 2011, on all retail food outlets for each census tract. In 2011, direct observation identifying all listed food retailers was conducted in 14 counties in Kentucky. Sensitivity and positive predictive values (PPV) were compared. Neighborhood deprivation index was derived from American Community Survey data. Multinomial regression was used to examine associations between neighborhood deprivation and the mRFEI score (indicator of retailers selling healthy foods such as low-fat foods and fruits and vegetables relative to retailers selling more energy dense foods).

Results: The sensitivity of the commercial database was high for traditional food retailers (grocery stores, supermarkets, convenience stores), with a range of 0.96-1.00, but lower for non-traditional food retailers; dollar stores (0.20) and Farmer's Markets (0.50). For traditional food outlets, the PPV for smaller non-chain grocery stores was 38%, and large chain supermarkets was 87%. Compared to those with no stores in their neighborhoods, those with a supercenter [OR 0.50 (95% CI 0.27. 0.97)] or convenience store [OR 0.67 (95% CI 0.51, 0.89)] in their neighborhood have lower odds of living in a low deprivation neighborhood relative to a high deprivation neighborhood.

Conclusion: The secondary commercial database used in this study was insufficient to characterize the rural retail food environment. Our findings suggest that neighborhoods with high neighborhood deprivation are associated with having certain store types that may promote less healthy food options.

Background

Obesity prevalence differs significantly among U.S. counties, particularly in the rural, Southern Appalachian region of the U.S. [1,2]. In the 14 counties being studied within this manuscript the range of obesity is between 31% and 37%, compared to the national average of 33% in 2010 [3]. While at the same time, the Appalachian region has been marked by geographic isolation [4] which in turn may influence the health disparities

experienced by residents relative to those living in more urban settings [4-6]. There is some evidence to suggest that those living in isolation from resources experience worse health outcomes such as certain cancers [7,8], diabetes prevalence and obesity rates [9] relative to those with greater proximity to health care [10], food stores [11], and physical activity resources [12,13]. What causes these vast differences may be attributed to societal influences, such as the neighborhood food environment and resources, or through effect of social selection [14,15], such as individuals who lead a healthy lifestyle may choose to locate in neighborhoods with healthy food outlets. In order to disentangle the effects the environment has on individual choice, there has been increased

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attention on measuring the community and consumer food environment as a determinant of health [16].

There have been several international [17-20] and U.S. based [21-23] studies examining the validity of secondary data sources examining the retail food environment at the macro level. However, there are few studies examining the validity of data sources currently used to define and measure the rural community food environment [11,21,24,25]. The lack of consistency between methods and data sources suggests that approaches for measuring the macro-level food environment in rural and remote areas may require different techniques relative to studies conducted in urban settings. To date, one study in Chicago found a positive predictive value (PPV) between commercial data sources and direct field observation of 80% [26]. Most recently in rural South Carolina, the positive predictive value (PPV) was 66% [21] between commercial data source and direct field observation. The results from these two studies suggest that commercial data sources may perhaps have greater validity in urban settings relative to rural areas. One potential reason for the difference between rural and urban settings is that in urban settings the rate of store closings is lower than in rural areas, with 1 in 4 stores closing in 2007 in rural areas compared to 1 in 6 in urban settings. Added to this issue is that a population of 3,252 is needed to support a grocery store in 2010, whereas in 2000 the population needed was only 2,843 [27]. In many of these small census tracts the population is not sufficient to support a store and therefore there may be higher rate of store closings which are not captured with a commercial data source.

Parallel to using valid methods to measure the rural community food environment, especially with higher rates of store closings, is the need to spatially measure access to various food outlets in rural areas to understand the deprivation amplification prevalent in rural and disadvantaged areas [28]. Deprivation amplification suggests that individual or household deprivation (for example, low income) is amplified by area level deprivation (for example, lack of affordable nutritious food or facilities for physical activity in the neighborhood) [29]. Although neighborhood deprivation theory is under much debate [10], in terms of the food environment, findings from the UK suggest that those in remote or disadvantaged areas tend to have adequate access to healthy food resources such as supermarkets [28]. Additionally, other studies conducted in Denmark [30], and Australia [31] corroborates findings from the UK. However, most of these studies were conducted in semi-rural or urban environments or in other countries outside the United States [32], whereas in the Appalachia region there are limited food resources overall, which may suggest that neighborhood deprivation is context specific [28].

Several studies have found that in rural areas supermarket availability does not necessarily indicate an abundant resource of healthy, high quality foods [33,34]. Food environment researchers need to move beyond the assumption that having a supermarket is equivalent to a less deprived neighborhood. This assumption suggests that the presence of supermarkets or healthy food outlets supersedes the effect of fast-food restaurants and less healthy food outlets on health outcomes. Research has recently documented that people with access to supermarket do not necessarily consume more fruits and vegetables or a better body mass index [35,36]. These findings highlight the need to also understand the role of individual choice in store type and in food selection within stores beyond just proximity or access to certain stores. Yet, prior studies show that proximity to fast-food restaurants is associated with more meals consumed at these locations [35]. To explain neighborhood deprivation of food resources in rural areas what might be more meaningful is to examine the coverage area of all food resources in rural settings [25,37,38], which may more accurately depict the overabundance of less healthy food items which nullifies the effect of healthy food outlets [32,38].

Based on the need for better measurement of the food environment in rural settings and to examine how deprivation may be unique in remote, rural settings, the aims of this study were the following: 1) to validate commercially available data source with direct field observations of several food outlet types and 2) to examine the association between neighborhood deprivation and retail food environment.

Methods

Study region

The spatial area under analysis consisted of 14 counties in the Appalachia region with a total population of 345,000 people [39]. The study was reviewed and determined exempt from Internal Review Board, as it was secondary data analyses not involving human subjects.

Census tracts characteristics

Outlets were categorized within their U.S. census tract and a corresponding level of rurality based on the United States Department of Agriculture rural–urban codes (http://www.ers.usda.gov/Data/RuralUrbanCommuting AreaCodes/2000/). We conducted analyses in 14 (25% of the 54-county Appalachia region) contiguous counties within the 54-county Kentucky Appalachian Regions (http://www.arc.gov/counties); Owsley, Jackson, Clay, Lee, Estill, Powell, Lincoln, Pulaski, Garrard, Madison, Robertson, Fleming, Montgomery, and Bath. These counties were selected based on location to each other as well as having a diverse sample of counties with

different rural codes, a range of 7–9. Descriptive characteristics of counties are shown in Table 1.

Identifying food outlets via commercial database

Food outlet addresses were purchased from InfoUSA database in July 2011. In most studies to date secondary data sources have been either purchased from InfoUSA or Dunn & Bradstreet as a means to gather large sets of addresses [40,41]. Addresses were categorized based on North American Industry Classification System (NAICS) codes. The categories reflected supercenters (452990), supermarket/grocery stores (Group 445100), convenience stores (446110), gas stations with food marts (447110), fast-casual restaurants (722212), and fast-food restaurants (722213), respectively. Farmers' markets and produce stands were identified through the health departments' listing of such vendors. Farmers' markets were verified through the Kentucky Department of Agriculture. Small grocery stores were categorized based on number of cash registers, less than 5, which has been used as a standard measure for small size stores [16]. Additional criteria for small grocery store was not having a second listing or a known chain within the same county or in another county as used in previous studies [42]. The trained graduate student went into each store to count cash registers as part of the validation efforts described below. Store type was dichotomized has 'one' for having any store type and 'none' for having zero store type, based on distribution of the data.

Identifying food outlets via ground-truthing

We conducted ground-truthing [43] to verify the presence of each food outlet in the commercial database and to identify any new outlets (Table 2) in summer and fall of 2011. Ground-truthing is defined as a wind shield audit to verify if the store is located in the same address as InfoUSA has provided and if the location is open. One graduate student was trained in ground-truthing methods and conducted 12 trips, averaging 2 trips per week. Training consisted of both the student and PI driving within the communities with the address to verify location and open status of all stores listed. After one county was jointly performed the graduate student conducted all other assessments. The principal investigator of the study verified addresses by randomly selecting counties and conducted ground-truth verification on 25% of the stores. The field work began in September 2011 and ended in November 2011. Facilities were classified as 1) "**located and open**" (facility was open and found in the database); 2) "**closed**" (outlet listed in database and located but permanently closed); 3) "**not found**" (outlet not found during ground-truthing but was listed in database); or 4) "**ineligible**" (outlet located but not was not within definition of NAICS code

assigned) [21]. The original list of stores was obtained from InfoUSA. Outlet name, type, address were recorded for new outlets identified which were not in the Info USA database.

Neighborhood deprivation

The Neighborhood Deprivation Index (NDI) was calculated using the method described by Messer et al. [44]. The Index is an empirical score of socioeconomic deprivation based on eight census variables collected from American Community Survey 5-year estimates 2005–2009 [39]: percentage of individuals with income in 2009 below poverty level; percentage of families with female headed households with no husband present and children under age 18 y; percentage of households with incomes under \$30,000/year; percentage of households with public assistance income; percentage of people age 16 or older in civilian labor force currently unemployed; percentage of males in management; percentage of all persons age 25 or older with less than a high school degree; and, percentage of households with more than one person per room. We fit a principal component analysis (PCA) to obtain the item loadings, which were used to weight each census variable's contribution to the first principal component. The component was then applied for each census tract within the study area. Neighborhood deprivation retained its linear shape after diagnostic testing of the variable addressing normality. The range of values for NDI was −4.07 – 4.34 (see Table 1 and Figure 1).

Modified retail food environment index

Coverage represents the number of purchasing opportunities within a given neighborhood [25] or the number of food outlets within a census tract. We calculated a modified retail food environment index [24] (http://www.cdc.gov/obesity/downloads/NationalActionGuide.pdf) (mRFEI) for each census tract in the Appalachia region. The mRFEI is an indicator of access to retailers that sell healthy foods, like fresh fruits and vegetables. The mRFEI is based on a range from zero (no food retailers that typically sell healthy food) to 100 (only food retailers that sell healthy food).

The mRFEI is constructed for each census tract, by using the following formula:

$$mRFE = 100 * \frac{\text{\# Healthy Food Retailers}}{\text{\# Healthy Food Retailers} + \text{\# Less Healthy Food Retailers}}$$

The definitions for healthy and less healthy food retailers are based on the Centers for Disease Control and Prevention definition [45]. Healthy food retailers consist of: grocery stores, supermarkets, supercenters,

Table 1 Descriptive of Census Tracts aggregated at County level in rural Appalachia Kentucky, 2011

Averaged Census Tracts	% of individuals with income below poverty level	% of families with female headed households with no husband and children under 18	% of households with income under $30,000/yr	% of households with public assistance income	% of people age 16 or older in civilian labor force unemployed	% pop in management	% of all persons age 25 or older with less than a HS degree	% of households with more than one person per room	Neighborhood deprivation score (average)	p-value difference between census tracts
Owsley	16.75	3.60	63.40	33.80	6.90	27.50	28.35	1.50	−1.39	0.110
Lee	34.88	6.10	59.40	36.80	17.60	24.10	39.00	0.00	**1.98**	**0.02***
Clay	34.32	5.50	55.00	20.90	22.90	21.90	41.02	2.50	**2.38**	**0.001***
Jackson	30.16	7.30	47.60	23.50	13.20	23.50	38.87	3.00	1.33	0.334
Bath	26.40	13.20	43.50	21.40	8.10	29.30	29.17	2.10	−0.24	0.703
Lincoln	18.70	6.80	34.60	15.50	7.27	22.90	31.25	1.30	−0.70	0.221
Estill	28.90	7.60	47.00	21.70	9.27	21.50	34.80	0.40	0.44	0.656
Pulaski	24.73	5.90	40.10	15.30	8.60	27.10	29.93	1.10	−0.27	0.445
Montgomery	20.90	7.10	37.90	16.90	4.70	25.10	26.40	1.40	−1.11	0.104
Rockcastle	31.80	4.60	49.10	26.30	10.60	27.00	34.40	0.80	0.55	0.638
Fleming	21.30	5.70	42.80	22.60	8.10	29.50	26.30	2.40	−0.56	0.506
Powell	25.50	9.40	42.30	24.10	9.00	24.90	26.60	1.60	−0.28	0.590
Breathitt	31.10	7.30	56.80	34.30	11.50	22.10	39.50	0.90	**1.98**	**0.018***
Madison	19.60	6.80	31.90	11.90	7.70	30.80	17.40	0.90	**−1.67**	**0.003***
Mean	26.07429	6.921429	46.52857	23.21429	10.38857	25.51429	31.64214	1.421429	0.17	
Median	25.95	6.8	45.25	22.15	8.8	25	30.59	1.35	−0.26	
Range	5.1-69.6	0-15.2	12.9-80.1	0-25.3	0-52.7	6.1-46.6	7.3-56.9	0-9.1	−4.07-4.34	

*p ≤ 0.05.

Table 2 Comparison of ground-truth to secondary data source listing among 14 counties in rural Appalachia Kentucky 2011

Data Source and Type of Food Outlet	Disposition%				
	No. of outlets listed	Located & Open	Located & Closed	Not Found	No. of outlets found but not listed
InfoUSA 2011 All Food Outlets	540	**378**	**27**	**135**	**15**
Grocery Store	26% (140/540)	38% (53/140)	37% (10/27)	53% (71/135)	0
Super Market	6% (31/540)	87% (27/31)	0	3% (4/135)	7% (1/15)
Super Center	1% (5/540)	100% (5/5)	0	0	0
Convenience Store	11% (62/540)	56% (35/62)	26% (7/27)	19% (26/135)	0
Gas station with food mart	22% (120/540)	74% (89/120)	26% (7/27)	18% (24/135)	7% (1/15)
Fast-food and Fast-casual restaurants	28% (151/540)	94% (142/151)	7% (2/27)	5% (7/135)	0
Pizza Parlors	5% (27/540)	81% (22/27)	4% (1/27)	4% (5/135)	7% (1/15)
Dollar Stores	<1% (2/540)	100% (2/2)	0	0	53% (8/15)
Farmer's Markets	<1% (2/540)	100% (2/2)	0	0	13% (2/15)

and produce vendors (produce stores and farmers markets). Less healthy food retailers consist of: fast-food restaurants, gas stations with food marts, and convenience stores, and dollar stores. To date the mRFEI is an environmental indicator of food access or the proportion of healthy stores within a defined neighborhood relative to all the stores accessible [46]. It is not however an indicator of availability of healthy food within the store or availability of unhealthy food items.

Due to the high frequency of food shopping conducted at dollar stores among rural residents [47] but the lack of fresh produce options within this type of store [48], dollar stores were included in the denominator. Dollar stores were tested in the numerator and denominator but results did not significantly change and therefore dollar stores were retained in the denominator. The mRFEI was split into 3 categories based on the distribution of the data (category one = 0; category two = 1–27; category three = 28–100). We conducted sensitivity test for various cut-points and retained high, medium, and low categories based on the results.

Validation of food outlets in the commercial data base

To characterize the validity of the commercial food venue address database against the ground-truthing field observations, we conducted a sensitivity analysis [21]. The sensitivity analyses consisted of calculating the fraction of food outlets that were listed and found to be open (i.e., "located and open"/("located and open" + "found, not listed")). The positive predictive value (PPV) was calculated as the fraction of all listed food outlets that were "located and open" during the field census (i.e., "located and open"/("located and open" + "closed but listed in database" + "not found during ground-truthing but listed in database")). The final categories consisted of 1) located and open; 2) located and

closed; 3) not found; 4) not listed but found. Because of structural zeroes, chance-adjusted kappa statistics could not be computed. We calculated an exact binomial confidence interval for each proportion. Fisher's exact tests were used to evaluate accuracy due to small cell size (Table 3).

The sensitivity percentage can be interpreted as the ability of the InfoUSA data base to accurately capture the food outlets that are listed. A sensitivity of 100% is deemed to be highly sensitive, while 50- 70% is moderate, and less than 50% is low [21]. The PPV can be interpreted as the likelihood that an establishment is open and found. We used cut-points of below 0.30 as poor, 0.31-0.50 as fair, 0.51-0.70 as moderate, from 0.71-.90 as good, and over 0.91 as excellent [18,49].

Statistical and geospatial analysis

All analyses were conducted using Stata 11.0 version [50]. To test for differences between census tracts within counties on neighborhood deprivation scores, t-tests were used with a Type I error rate of 0.05. The hypothesis originally proposed asked whether neighborhoods with more deprivation would have less healthy stores or a lower mRFEI. To test this hypothesis multinomial logistic regression was used to model the association between neighborhood deprivation and mRFEI. Our secondary hypothesis asked whether neighborhoods with a specific type of store would have more or less deprivation. To test neighborhood deprivation for each store type (super center, super market) logistic regression was used. A measurement error correction factor was added for all models due to the sensitivity and positive predictive value results [51] and to improve retail food environment estimates. The measurement error correction was set at .3 using C + simex commands. We used census tracts with zero for store values as the
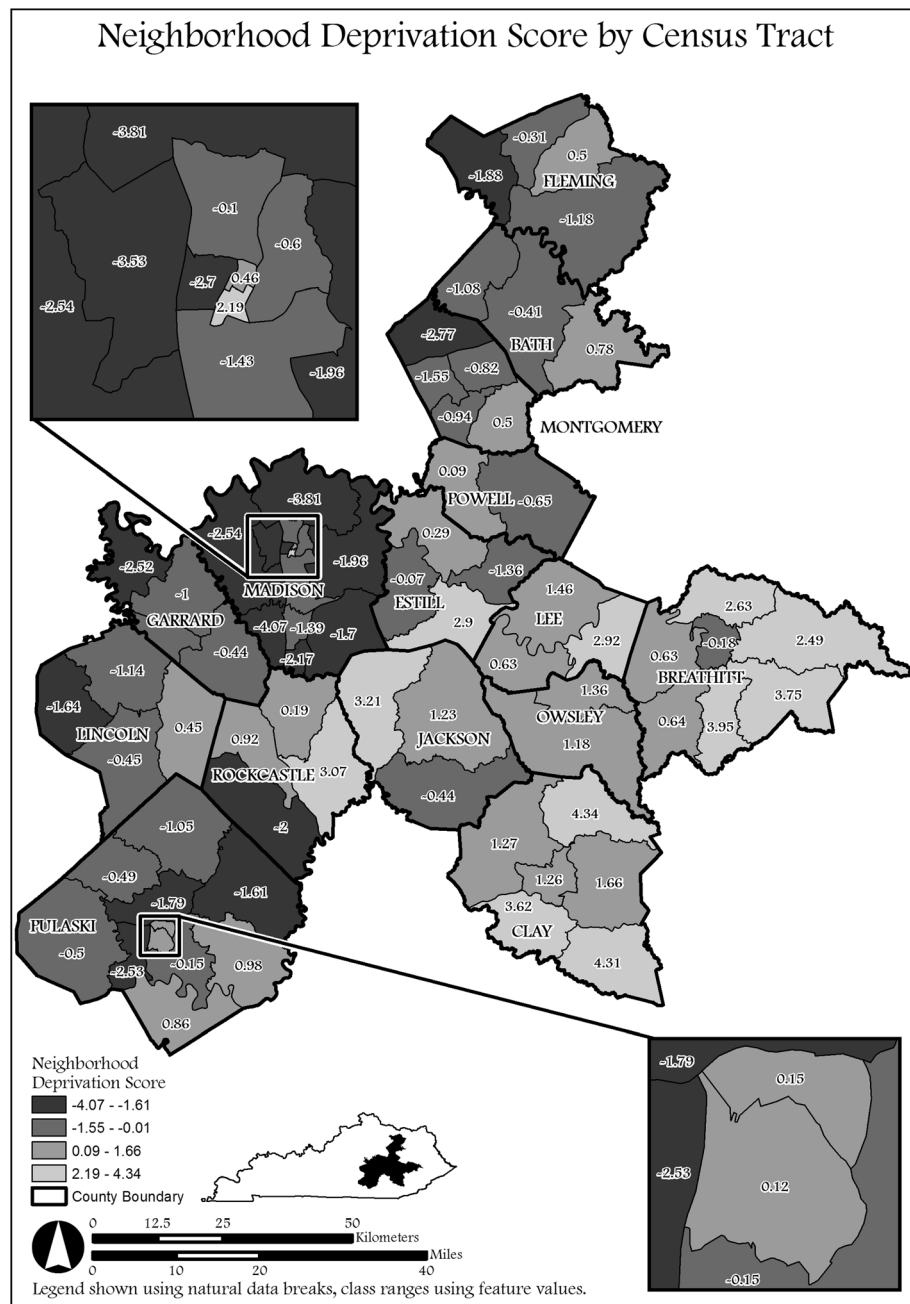
Figure 1 Neighborhood Deprivation Scores in Appalachia, KY.

reference group for models testing the association between neighborhood deprivation and mRFEI. We used no store in census tract relative to having a store for models testing the association between neighborhood deprivation and each store type (e.g. Super Center). Additionally, research thus far has used zero as the referent to look at neighborhood deprivation in food deserts relative to neighborhoods with adequate variability of store types [52].

Results

Figure 1 depicts the spatial distribution of the census tracts within the counties for each level of neighborhood deprivation. For ease of graphical representation various levels of deprivation have been shown. The two extreme levels of deprivation are indicated by light gray and dark gray. Low neighborhood deprivation is depicted by light gray with a range in scores of –4.07 - -1.51 while high neighborhood deprivation is depicted by dark gray with

Table 3 Validity of secondary data source as compared to ground-truth effort among 14 counties in rural Appalachia Kentucky 2011

Data Source and Type of Food Outlet	Sensitivity	95% CI	PPV	95% CI
InfoUSA 2011				
All Food Outlets	0.96	0.89, 1.03	0.7	0.67,0.73
Grocery Store	1.00	1.00, 1.00	0.38	0.32, 0.45
Super Market	0.96	0.85, 1.07	0.87	0.83, 0.95
Super Center	1.00	1.00, 1.00	1	1.00, 1.00
Convenience Store	1.00	1.00, 1.00	0.56	0.48, 0.60
Gas station with food mart	0.99	0.85, 1.08	0.74	0.69, 0.87
Fast-food and Fast-casual restaurants	1.00	1.00 , 1.00	0.95	0.89, 1.02
Pizza Parlors	0.96	0.82, 1.09	0.81	0.75, 0.89
Dollar Stores	0.20	0.14, 0.24	1	1.00, 1.00
Farmer's Markets	0.50	0.41, 0.62	1	1.00, 1.00

Abbreviations: CI, confidence interval; PPV, positive predictive value.

a range in scores of 2.19 – 4.34. Figure 1 graphically indicates there are many census tracts with high deprivation clustered together within counties. Additionally several census tracts with high deprivation are next to census tracts in other counties with high deprivation.

Figure 2 depicts the spatial distribution of the census tracts within the counties for each level of the modified retail food environment index (mRFEI). Each level of the mRFEI is shown by shades of gray and with line or dot mark patterns. The census tracts that are shaded light gray with cross hatch marks indicate no stores or zero. The census tracts with a mRFEI score of 1–27 that have diagonal lines indicate a low ratio of healthy stores relative to all stores within the census tract. The census tracts with a mRFEI score of 28–100 that are dark gray with dots indicate a high ratio of healthy stores relative to all stores within the census tract. Similar to the neighborhood deprivation clustering pattern, those census tracts with no stores tend to cluster within the same county. However, graphically there are different patterns between counties that have a low mRFEI adjacent to census tracts with high mRFEI. While some counties have all census tracts with high mRFEI scores, other counties have one census tract with low mRFEI scores next to census tracts with high mRFEI scores.

Table 1 shows the descriptive statistics for each county in the rural Appalachian area of the variables the are used to create the neighborhood deprivation score. Most of the counties experience high rates of poverty and unemployment. The mean percentage of poverty among all counties is 26.07% with a range of 5.1-69.6%. The mean percentage of unemployment among those 16 years of age and older is 10.38% with a range of 0–52.7%. The mean neighborhood deprivation score for all counties was 0.17 with a range of −4.07 – 4.34. There are also significant differences between census tracts within

counties for neighborhood deprivation scores but in fewer counties; 4 of the 14.

Table 2 compares findings from direct observation (ground-truthing) to the secondary commercial database for all stores and for each store type. Of all the stores found in the commercial database, (n = 540), there were a total of 378 open and located (70%), 27 located and closed (5%), and 135 not found (25%). Additionally, there were 15 stores not on the commercial database list but that were located. Of the 540 stores on the original InfoUSA list, the most common type of stores are fast-food and fast-casual restaurants (28%, 151/540), and grocery stores (26%, 140/540). The type of food outlet with the greatest likelihood of being on the original list and located and open was supercenters (100%), followed by fast-food and fast-casual restaurants (94%, 142/151). The type of food outlet with the lowest likelihood of being on the list and located and open was small non-chain grocery stores (38% 53/140). Additionally, the lowest percentage of stores not listed and found was dollar stores (53% 8/15).

Table 3 highlights the validation results of the commercial database versus direct observation (ground-truthing) (% agreement, sensitivity, PPV). Results indicate that the sensitivity of the commercial database was very high for traditional food outlets (grocery stores, supermarkets, convenience stores), with a range of 0.96-1.00. These results indicate that InfoUSA commercial database is highly sensitive for traditional food retailers overall. If a traditional store type was listed and open close to 100% of the time InfoUSA listed this store on their list of addresses. However, the sensitivity for non-traditional food outlets was low compared to traditional food venues with a range of 0.2-0.5. These results indicate the InfoUSA commercial database is not sensitive to non-traditional food venues.
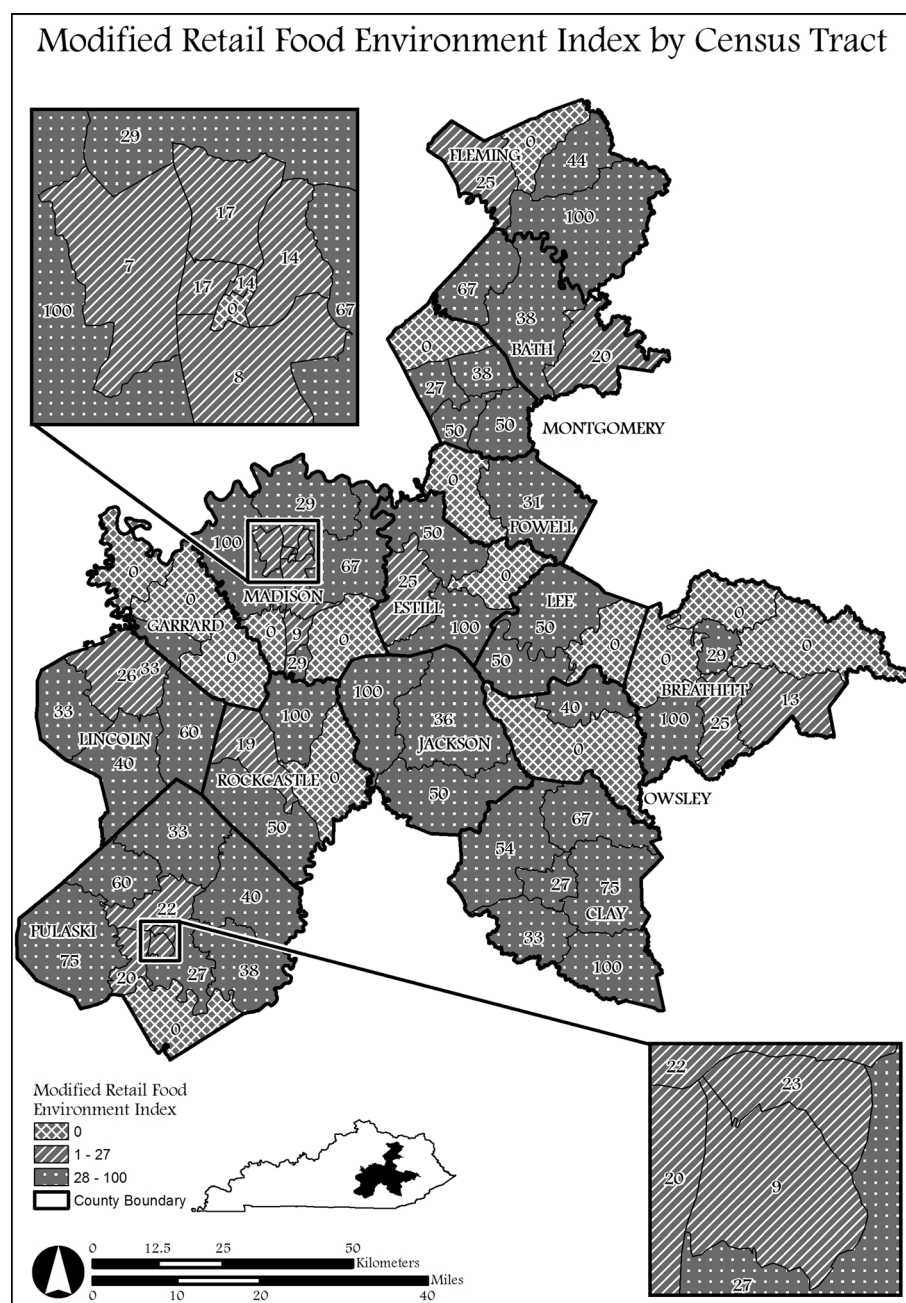
Figure 2 Retail Food Environment Index Scores in Appalachia, KY.

Specifically, the sensitivity result for supermarkets, a traditional food venue, was 0.96. This result indicates that 96% of the time if a store was on the InfoUSA database it was located and open per direct observation. A similar result was found for supercenters; 100% of the time the supercenter was located and open per direct observation relative to the InfoUSA data base. However, the sensitivity was much lower for non-traditional food venues (Dollar stores (0.2) and Farmer's Markets (0.5)).

Dollar stores and Farmer's Markets were found through the ground-truthing approach but were not listed on the InfoUSA commercial list.

Similar to the sensitivity analyses the PPV was excellent for supercenters with a PPV of 1.0. The PPV for super markets was a bit lower with a PPV of 0.87 indicating the InfoUSA was good compared to direct observation. However, the PPV was much lower for small grocery stores, with a score of 0.38 indicating InfoUSA

Table 4 Neighborhood Deprivation and the association with Modified Retail Food Environment Index and Stratified Store Type, Appalachia Kentucky, 2011

	Neighborhood Deprivation Score (Z-score)	p-value	95% CI
mRFEI Score*			
Low mRFEI Score (0 no stores)	−1.3	0.19	−0.7, 0.11
Medium mRFEI Score (1–27)	−1.9	0.06	−0.71, 0.01
High mRFEI Score □ (28–100)	REF	REF	REF
Stratified Store Typeδ	**Neighborhood Deprivation Score (Odds Ratio)**	**p-value**	**95% CI**
Super Center (1 or more)	0.51	**0.04**	0.27, 0.97
Grocery and Super market (1 or more)	0.99	0.95	0.75, 1.31
Gas stations (1 or more)	0.87	0.15	0.62, 1.08
Convenience Stores (1 or more)	0.67	**0.01**	0.51, 0.89
Fast-Food Restaurants including take-out pizza (1 or more)	0.81	0.11	0.64, 1.05
Dollar Stores (1 or more)	0.95	0.87	0.72, 1.52

* Modified Retail Food Environment Index mRFEI = (Healthy Food Outlets)/(Healthy Food Outlets + Less Healthy Food Outlets) *100.
□ Reference is High mRFEI.
δ Reference is 'none' for each store type.

was a poor measure for assessing if stores are actually open compared to direct observation. There were a low percentage of stores open when they were located through direct observation. Although the store was found, a small percentage of the stores were actually open; only 38%. Lastly, the PPV was high for dollar stores and Farmer's Markets, at 100% was excellent, as we found stores listed on the commercial database 100% of the time.

Table 4 shows the results of the association between neighborhood deprivation and the mRFEI. There was no association between neighborhood deprivation and the mRFEI. However, when stratified by store type the results indicate that neighborhoods with low deprivation have lower odds of having at least one super center [OR 0.50 (95% CI 0.27. 0.97)] and convenience store [OR 0.67 (95% CI 0.51, 0.89)] compared to those with no store types and higher deprivation. Such that, neighborhoods with low percentages of poverty, unemployment, and other economic indicators have a low probability of having super centers and convenience stores in their neighborhood compared to those with high deprivation Additionally, we did not find that neighborhoods with low deprivation have more grocery stores or super markets.

Discussion

Research regarding the role of the macro-level food environment has experienced a surge in publications in recent years [53,54], with many studies using secondary data sources as a way to classify neighborhoods with regard to access and availability of food stores [41,55,56]. Reliance upon secondary data sources has led to substantial measurement error [17,21,48]. Our findings provide further evidence to support conducting direct

observation or ground-truthing in rural settings to verify the presence of food venues in the retail food environment [21,48] obtained from commercial data sources. Previous studies assessing the macro-level food environment, such as number and type of food outlets in a neighborhood, may have introduced bias by not conducting validation studies. This may explain why results of such studies examining association and between the retail food environment and neighborhood characteristics have been conflicting [34,40,57-59].

To date, there are few studies using several approaches to characterize the macro-level food environment, with fewer studies reporting on validation efforts [21,43] among rural settings. Our results are similar to a previous study conducted in some rural locations in South Carolina [21] such that there were low positive predictive values for non-traditional food outlets, such as dollar stores and pharmacies. Our secondary data source had greater sensitivity which may be due to the separation of grocery stores from supermarkets, geographic difference between the studies, and the high percentage of establishments not being found in the South Carolina study. The South Carolina study found many establishments, yet they were closed. Additionally, the previous study validated locational presence from several secondary data sources, whereas in this study we only validated one secondary data source with direct observation. However, we conducted our analyses in 14 rural counties to specifically address accuracy of food venues in rural areas. As previous research has shown, rural residents shop for food in non-traditional food outlets such as dollar stores, farmer's markets, and gas stations with marts [47,60]. Relying solely on one secondary data source to determine location of key establishments

would introduce a biased measure of the retail food environment. Future studies should consider employing direct observation for measuring the retail food store environment, especially in rural areas.

We did not find an association between neighborhood deprivation and the retail food environment for census tracts with no retail stores. This is consistent with several studies, both in the U.S. [61,62] and internationally [32,63]. However, in our study those neighborhoods with lower deprivation were less likely to have a super center or a convenience store in their neighborhood. This result is consistent with studies conducted in rural settings [11,28]. The dynamic between deprivation and the retail food environment is complex. Given that neighborhoods with high deprivation generally have less population, and lower income per individual, there is less incentive for chain food outlets to open stores [64]. With less opportunities to purchase food individuals in remote areas and with more deprivation face greater odds of having access to stores in general [11] and especially stores that sell affordable healthy options [24,34]. Added to this dynamic is the difficulty that individuals in remote areas face with regard to travel time to certain locations [28]. Taken together, there are limited opportunities for economic development in these areas, especially for large supermarkets or grocery stores, which tend to sell the highest percentage of healthy items at the best prices [65]. These findings suggest that the degree of neighborhood deprivation may play a role in access and availability of healthy food options in rural areas [66].

There are several limitations to our study. We do not have data on consumer shopping patterns and behaviors. It is highly likely that residents living in neighborhoods with no stores shop for food in adjacent neighborhoods with retail food stores. The actual food environment individuals are exposed to are adjacent to where they reside [67]. The results did show that several of the census tracts with zero stores are in point of fact adjacent to census tracts with stores (Figure 2). However, in some cases the proportion of stores favored healthy options while in other cases the proportion of stores favored unhealthy options. Suggesting that individuals are able to access food outlets, yet those outlets may or may not have an abundance of healthy items. The mRFEI is a measure of proportion and does provide the context of availability where individuals shop. Therefore a strong limitation to our study is the lack of both consumer food environment measures and macro level measures such as number and type of stores within a neighborhood. Availability of food within the stores may be more relevant in regards to purchasing behaviors and dietary intake [68] which has not been captured in this study. Future research should examine how living in a

neighborhood with no retail food outlets influences food purchasing habits and travel patterns over time, while also assessing the consumer food environment within the stores where individuals shop.

Lastly, we only used one source of secondary data and therefore our sensitivity and positive predictive values might have been higher or lower had more secondary data been collected and validated. Previous studies using more than one secondary data source have found lower values overall [21].

Strengths of this study are the rather large effort at conducting ground-truthing across a rural and remote area. Few studies have been able to verify food venue location in a rural remote setting [48]. Additionally, this study has provided further evidence between store type and deprivation in rural areas of the U.S.

Conclusion

This study provides further support for the need to conduct direct observation of retail food stores when characterizing the food store environment, especially in rural areas, due to the low sensitivity and positive predictive values for certain types of food retailers. This study also suggests that in rural areas, neighborhood deprivation is associated with having certain store types which may or may not sell healthy food items. It is suggested that policies and development aimed at improving healthy food access and availability in rural areas is a promising public health strategy for those most in need.

Figure 1 76 census tract neighborhoods within 14 counties in the Appalachia region of Kentucky. The shaded census tracts represent neighborhood deprivation score for that census tract within the county. The various shades of gray represent 4 different categories of neighborhood deprivation. The most extreme ends of the spectrum for neighborhood deprivation are indicated with dark gray on one end and light gray on the other end. Dark gray is low neighborhood deprivation (i.e. low rates of unemployment; low rates of poverty a range of −4.07−−1.51). Light gray is high deprivation (i.e. high rates of unemployment; high rates of poverty a range of 2.19−4.34).

Figure 2 76 census tract neighborhoods within 14 counties in the Appalachia region of Kentucky. The shaded and patterned census tracts represent the modified retail food environment index score within the county. The census tracts that are shaded light gray with cross hatch marks indicate no stores or zero. The census tracts with a mRFEI score of 1−27 that have diagonal lines indicate a low ratio of healthy stores relative to all stores within the census tract. The census tracts with a mRFEI score of 28−100 that are dark gray with dots indicate a high ratio of healthy stores relative to all stores within the census tract.

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Chapter 2

Rural Disparities in the Distribution of Policies that Support Healthy Eating in U.S. Secondary Schools

By Dr. Susie Nanney

Chapter 2
Summary: Dr. Susie Nanney

Dr. Susie Nanney will present on the role that schools can play in promoting access to healthy food for students, especially in rural communities. Her research has focused on how school breakfast, vending and after-school snacks may be associated with student health outcomes such as dietary intake and weight, as well as academic performance. Specifically, her talk will highlight how rural schools in America lag in promoting healthy eating and offer evidence-informed strategies to address this gap.

Why focus efforts on rural communities?
Students in rural schools are more likely to attend small schools, live in poverty, be food insecure, be eligible for free or reduced lunch, and come to school unprepared to learn. Very little research has been done on how to improve the school food environment in small town and rural school environments even though these environments are lagging behind urban and suburban schools.

What are the promising healthy eating practices for rural schools?
School Breakfast Program (SBP). Breakfast intake is associated with improved behavior, test outcomes and attendance among youths. Teens experiencing hunger are more likely to have been suspended from school and have difficulty getting along with others. SBP eaters weigh less and have healthier eating habits. Dr. Nanney's research with rural Minnesota high schools has shown:

- Increased participation in the SBP among low-income students, girls, and minority students
- Slowed weight gain among high school students eating the SBP
- Better grades among SBP eaters

School Healthy Eating Policies. A study conducted by Dr. Nanney of 28 U.S. states, including Kentucky, representing 6,732 secondary schools identified that schools in small town and rural locations had significantly fewer healthy eating policies and practices. Specifically, rural schools were:

- More likely to allow marketing of junk foods and soda and sports drinks
- Less likely to promote healthy eating (e.g., provide nutrition information to students and parents, price healthy foods lower, taste test)
- Less likely to have fruits and/or vegetables at school celebrations
- Less likely to have fruits and/or vegetables in vending machines
- Less likely to limit package serving sizes

What are some evidence-informed actions?

- Increase participation in the School Breakfast Program to improve youth health and academics
- Promote family and community involvement in school eating (and activity) policy development to increase access to healthy foods in schools
- Encourage farm-to-school programs to improve access to local foods and support local economies

In summary, Dr. Nanney will highlight the evidence-based opportunities to promote healthy eating in rural school settings.

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Rural Disparities in the Distribution of Policies that Support Healthy Eating in US Secondary Schools

Marilyn S. Nanney, PhD, MPH, RD; Cynthia S. Davey, MS; Martha Y. Kubik, PhD, RN

ABSTRACT

The distribution of food and nutrition policies and practices from 28 US states representing 6,732 secondary schools was evaluated using data from the 2008 School Health Profiles principal survey. School policies and practices evaluated were: availability of low-nutrient, energy-dense (LNED) snacks/drinks; use of healthy eating strategies; banning food marketing; availability of fruits and vegetables; and food package sizes. For each school, school-level demographic characteristics (percentage of students enrolled in free/reduced-price meals, minority enrollment, and geographic location) were also evaluated. Schools in small town/rural locations had significantly fewer policies that support healthy eating strategies and ban food marketing, and were less likely to serve fruits and vegetables at school celebrations, have fruits and vegetables available in vending or school stores, and limit serving-size packages. Schools serving the highest percentage of minority students consistently reported the same or better school food environments. However, schools serving the highest percentage of low-income students had varied results: vending and LNED vending policies were consistently better and fruit and vegetable availability−related policies were consistently worse. Disparities in the distribution of policies and practices that promote healthy school food environments seem most pronounced in small town/rural schools. The data also support the need for continued reinforcement and the potential for expansion of these efforts in urban and suburban areas and schools with highest minority enrollment.
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THE CHILD NUTRITION AND WIC REAUTHORIZATION Act of 2004 (CNRA 2004), a major federal legislative milestone to address childhood obesity, included a mandate to school districts participating in the school meal program to establish and implement policies addressing nutrition at school by the start of the 2006-2007 school year. Evaluating the effectiveness of these school nutrition policies is a nationwide priority.[1] Research suggests that school food environments, especially competitive foods, contribute excess energy to children's diets.[2,3] Estimates show that low-nutrient, energy-dense (LNED) competitive foods provide 171 kcal/day to the diets of middle school students and 219 kcal/day to high school students.[4] Although evidence of the impact on student body mass index remains mixed,[5] a few studies suggest inverse associations between youth overweight and school food environments when mandated by states[6] and whether strong district wellness policies[7] and local school policies and practices are in place.[8,9]

Monitoring the distribution of school food policies and practices and evaluating effectiveness through a health disparities lens is important.[10] Minority and low-socioeconomic groups are disproportionately affected by excess weight at all ages.[11] Obesity rates among rural youth are as much as 50% higher compared with their urban counterparts.[12-14] Although recent (2001-2008) evidence suggests a leveling off of obesity prevalence among white students, it also points to a worsening disparity among nonwhite students, especially for severe obesity.[15] Descriptive evaluations considering school obesity prevention policies and disparities have identified differences by geographic region of the country (eg, southern states)[16] and across schools by poverty status and geographic location (eg, schools in rural communities).[17,18] Two evaluation studies report more favorable behavioral outcomes for minority students with stronger state mandates for competitive foods in schools.[19,20] Evidence-based recommendations directed at competitive foods that aim to reverse the obesity trajectory include: (a) establishing nutrition standards for competitive foods available at school,[21] (b) incorporating collaborative strategies to encourage healthy eating at school,[22] and (c) banning advertising and marketing of LNED foods to youth in schools.[21,23] The extent that the adoption of these recommendations is evenly distributed across US schools is not known. The goal of this study was to compare the distribution of food and nutrition−related policies and practices across US middle and junior/senior high schools (6th to 12th grade) by geographic location, minority enrollment, and free/reduced-price school meal enrollment after implementation of the 2004 CNRA in 2006. This inquiry is especially relevant as schools prepare to respond to the Healthy, Hunger-Free Kids Act of 2010, which focuses on competitive foods sold at school with a rolling implementation timeline beginning 2012-2020.[24]

METHODS

Dependent Variables and Source

The dependent variables for this cross-sectional study were school-level food and nutrition–related policy and practice questions collected as part of the 2008 School Health Profiles Principal Survey (Profiles), a surveillance tool sponsored by the Centers for Disease Control and Prevention (CDC), which has good validity and reliability.[25] Profiles include a biennial survey of public school principals of middle and junior/senior high schools collected by state education and health agencies. School response rates for individual states for 2008 ranged from 70% to 93%.[26] Most states give the CDC permission to share their de-identified dataset. For this study, states were individually contacted and asked to share their school *identified* data sets for the purpose of linking the school-level demographic data (geographic location, minority enrollment, free/reduced-priced meal enrollment).

Data Collection

An e-mail letter of invitation was sent to all 50 states' Profiles coordinators from the principal investigator explaining the study purpose and requesting access to their existing 2008 school-level policy data. A signed data use agreement detailing data confidentiality was also included. State Profiles administrators (ie, Department of Education, Department of Health) had varying comfort levels with data-sharing, ranging from accepting the terms of agreement, to requiring additional paperwork, to engaging in an iterative process with the project data manager that accomplished the data linking without divulging school identifying data. Total contacts (ie, emails, phone calls) to state agencies to share and transfer their states' Profiles data ranged from 1 to 35 with an average of 10. Fifty-six percent of states (n=28) contacted agreed to share their datasets. A map of the participating states is available at the project website (http://z.umn.edu/schoolnutrition). Seven states did not respond to multiple requests to participate (14%); eight refused to participate (16%), citing change in leadership, concerns that sharing the identified datasets violated agreements with participating schools, or inability to locate data due to staff turnover and loss of positions. Seven states (14%) sent de-identified data, which could not be used.

State nonresponse bias was assessed using publicly available state-level policy and practice data from the nonparticipating states. The absolute differences between participating and nonparticipating states in the median weighted percentage of schools reporting each nutrition policy item were less than 5% for all but two items. The two items were "allowed students to purchase non-fried vegetables" (20% vs 28%) and "collected suggestions on food preferences" (45% vs 55%). Altogether, these results suggest similar nutrition policy implementation for participating and nonparticipating states.

Scale Development

Food and nutrition–related policy and practice items from the Profiles principal survey were identified and grouped to represent three domains: availability of LNED snacks and drinks, engaging in healthy eating strategies, and marketing of LNED snacks and drinks. Four other policy and practice items were evaluated individually.

Availability of LNED snacks and drinks. Ten items were identified and included whether the following were available for purchase in vending machines or school stores (VMSS): chocolate candy, candy, salty snacks not low in fat, cookies, cakes, crackers not low in fat, ice cream not low in fat, 2% or whole milk, frozen water ices or slushes that do not contain juice, soda pop or fruit drinks that are not 100% juice, sport drinks, and caffeinated foods or beverages. Responses were coded as yes=1, no=0. The summated scale score represented the total number of LNED snacks and drinks available for purchase. Cronbach's α for this scale was .80. Schools without VMSS were excluded from this analysis.

Healthy eating strategies. Five items were identified and included whether the following strategies were used: strategic pricing of healthy snacks and drinks lower in cost and/or LNED snacks and drinks higher in cost, suggestions collected from students and families, calorie information provided to students/families, student taste-testing of new products, and student visits to the cafeteria for learning. Responses were coded as yes=1, no=0. The summated scale score represented the total number of implemented healthy eating strategies. Cronbach's α for this scale was .61.

Marketing of LNED snacks and drinks. Four items were identified and included whether the school prohibits advertisements for candy, fast food, or soft drinks in (1) school building (yes/no), (2) on school grounds (yes/no), (3) on school buses (yes/no), (4) in school publications (yes/no). Responses were coded as yes=1, no=0. The summated scale score represented the total number of banned marketing practices. Cronbach's α for this scale was .89.

Other policy/practice items not included in the scales. Four additional items were examined separately: fruits and/or vegetables available at school celebrations (almost always or always, rarely, or never), any VMSS availability (yes or no), fruits and/or vegetables available for purchase from VMSS (yes or no), and limited package/serving size of items sold in VMSS (yes or no).

Independent Variables and Sources

The independent variables for this study were school-level demographic variables: geographic location (town/rural, urban, suburban), percentage minority enrollment (ie, defined as racial and ethnic minorities), and free/reduced-price school meal enrollment. The source of the independent variables was the National Center for Education Statistics Public Elementary/Secondary School Universe Survey (NCES), which is publicly available and updated annually.[27]

Twelve NCES-defined geographic designations were combined into three locations for easiest interpretation: city (n=1,232 schools, 18.3%), suburban (n=1,467, 21.8%), and town/rural (n=4,033, 59.9%). The number of minority students for each school was calculated by subtracting the number of white non-Hispanic students enrolled from the total student enrollment and then dividing by the total student enrollment to calculate percentage minority enrollment. Similarly, the number of students enrolled in the free/reduced-price meal program was divided by the total student enrollment to calculate percent free/reduced-price meal enrollment.

These variables were categorized using approximate quartile cutpoints rounded to the nearest percentile divisible by five. The lack of significant differences in policy prevalence between the middle two quartiles resulted in the decision to combine these quartiles into one medium level category while preserving categories for the upper and lower approximate quartiles of schools. Minority percent enrollment data was available for 6,696 schools and was categorized as follows: <5% (low) (n=1,180 schools, 17.6%), 5% to <50% (medium) (n=3,802, 56.8%), and 50% or more (high) minority enrollment (n=1,714, 25.6%). Free/reduced-price meal enrollment data was available for 6,421 schools and categorized as follows: <20% (low) (n=1,533 schools, 23.9%), 20% to <60% (medium) (n=3,501, 54.5%), and 60% or more (high) free/reduced-priced meal enrollment (n=1,387, 21.6%). The relationship between minority enrollment percentile and free/reduced-price percentile was examined to confirm that these two variables were not surrogates for each other. The correlation coefficient was 0.55, indicating that the two variables contribute unique school-level demographic information.

Analysis

Cronbach's α was used to assess internal reliability of summated scale variables. Correlation analysis was used to examine the linear relationship between minority enrollment percentile and free/reduced-price meal enrollment percentile. Multiple logistic regression models were used to estimate adjusted odds ratios for individual nutrition policy and practice items by location, minority enrollment category, and free/reduced-price meal enrollment category. Generalized linear models were used to evaluate location, minority enrollment category, and free/reduced-price meal enrollment category differences in adjusted mean scores for the nutrition policy and practice scales. Significant factors in each model were further evaluated to identify levels of school characteristics with significant differences. The Bonferroni method was used to adjust significance levels for these multiple comparisons (α of .017 for means, α of .008 for odds ratios). Model estimates and standard errors were used to construct 95% CIs for the adjusted means for each level of the school characteristic and adjusted odds ratios for school characteristic levels relative to the reference level.

RESULTS AND DISCUSSION

A total of 6,732 schools from 28 states were included in the analysis. A table detailing the distribution of each policy and practice item by each demographic characteristic is available from the project website (http://z.umn.edu/schoolnutrition). Table 1 identifies the mean score (95% CI) for each scale by school location and demographic category adjusted for the other school characteristic variables. For the *Availability of LNED Snacks and Drinks Policy Scale,* a lower score was the better result. The adjusted mean number of LNED snacks or drinks available for purchase from VMSS was significantly less (ie, better) for schools with the highest free/reduced-price meal enrollment than for schools with low or medium enrollment and was also significantly less for schools with medium enrollment than for schools with low enrollment. Studies show that restricting the availability of LNED foods in schools while increasing the availability of healthful

foods might be an effective strategy for promoting more healthful choices among students at school.[4,28]

For the *Healthy Eating Strategies Policy Scale*, a higher score was the better result. The adjusted mean number of healthy eating strategies implemented was significantly higher (ie, better) in urban and suburban schools than in town/rural schools. This finding is important because studies show that youth are sensitive to food pricing[29] and respond positively to taste testing healthy foods.[30]

For the *Marketing of LNED Snacks and Drinks Policy Scale*, a higher score was the better result. The adjusted mean number of locations in which advertisement for candy, fast food, or soft drinks was banned was significantly higher (ie, better) in urban and suburban schools than in town/rural schools; and significantly higher in schools with high minority enrollment than in schools with low or medium minority enrollment. An increasing number of studies demonstrate direct causal effects of exposure to food advertising on young people's weight and higher rates of obesity.[31]

Table 2 identifies the individual policy and practice items by school location and demographic category adjusted for the other school characteristic variables. The likelihood of fruits and/or vegetables almost always or always being available at school celebrations was significantly higher at suburban schools than at town/rural schools, significantly lower at schools with low and medium minority enrollment than at schools with highest minority enrollment, and significantly higher at schools with lowest free/reduced-price meal enrollment than at schools with highest free/reduced-price meal enrollment.

The likelihood of having no vending or school store availability of foods was significantly lower in schools with low and medium minority enrollment than in schools with the highest minority enrollment, and was significantly lower at schools with low and medium free/reduced-price meal enrollment than at schools with the highest free/reduced-price meal enrollment.

The likelihood of fruits and/or vegetables being available for purchase from vending machines or school stores was significantly higher in urban and suburban schools than in town/rural schools, was significantly lower at schools with low and medium minority enrollment than at schools with highest minority enrollment, and was significantly higher at schools with low and medium free/reduced-price meal enrollment than at schools with highest free/reduced-price meal enrollment.

The likelihood of limited package or serving sizes of foods sold in school stores or vending was significantly higher in urban and suburban schools than in town/rural schools. Studies have identified an impact upon student dietary intake when portion sizes were limited in schools.[32,33]

Strengths and Limitations

To our knowledge, this is the first study to compare a multistate sample of food and nutrition–related policies and practices across categories of place, ethnicity, and socioeconomic status after the implementation of the 2004 CNRA in 2006. The state response rate is a limitation. However, the authors made a reasonable attempt to determine whether bias exists. The school food and nutrition–related policies and practices evaluated were limited to those previously collected by states. No new data were collected.

Table 1. Adjusted mean scale scores of policies and practices by school demographic characteristics for a sample of US secondary schools[a]

Policy Domains	Sample Mean±SD[b]	Sample (Min, Max)	Location			Minority Enrollment			Free/Reduced-Price Meal Enrollment		
			Urban	Suburban	Town/Rural	Low (<5%)	Medium (5% to <50%)	High (≥50%)	Low (<20%)	Medium (20% to <60%)	High (≥60%)
Availability of LNED[c,d] Snacks and Drinks Lower score better	4.42±2.82	(0, 10)	4.28 (4.06, 4.51)	4.39 (4.19, 4.59)	4.20 (4.06, 4.34)	4.26 (4.01, 4.51)	4.48 (4.33, 4.63)	4.13 (3.89, 4.38)	5.02** (4.76, 5.28)	4.29** (4.15, 4.43)	3.57 (3.33, 3.81)
Healthy Eating Strategies[c] Higher score better	1.42±1.32	(0, 5)	1.53 (1.44, 1.61)	1.51 (1.43, 1.58)	1.36** (1.31, 1.41)	1.46 (1.37, 1.55)	1.52 (1.47, 1.57)	1.41 (1.34, 1.48)	1.54 (1.46, 1.61)	1.44 (1.39, 1.49)	1.42 (1.33, 1.50)
Marketing of LNED Snacks and Drinks[c] Higher score better	2.60±1.64	(0, 4)	2.75 (2.65, 2.85)	2.79 (2.70, 2.88)	2.48** (2.42, 2.54)	2.47** (2.36, 2.58)	2.69* (2.63, 2.76)	2.85 (2.77, 2.94)	2.71 (2.61, 2.80)	2.60 (2.53, 2.67)	2.71 (2.61, 2.82)

[a]N=2008 School Health Profiles data representing 6,732 schools from 28 states.

[b]SD=standard deviation.

[c]Mean scores (95% confidence intervals), adjusted for other school-level characteristics, are reported for each scale.

[d]LNED=low-nutrient, energy-dense. Includes chocolate candy, candy, salty snacks not low in fat, cookies, cakes, crackers not low in fat, 2% or whole milk, water ices that do not contain juice, soda pop or fruit drinks that are not 100% juice, sport drinks, and caffeinated foods or beverages available for purchase in school vending machines or stores. The adjusted mean scores for the availability of LNED snacks and drinks scale are also adjusted for a significant interaction between minority enrollment and free/reduced-price meal eligibility.

*Significantly worse scores than one or more location, minority enrollment, or free/reduced-price meal enrollment categories, adjusted for multiple comparisons from 0 at the 0.01 level.

**Significantly worse scores than one or more location, minority enrollment, or free/reduced-price meal enrollment categories, adjusted for multiple comparisons from 0 at the 0.001 level.

Table 2. Adjusted odds ratio[a] for each policy and practice by demographic characteristic for a sample of US secondary schools[b]

Individual Policy items	Location			Minority Enrollment			Free/Reduced-Price Meal Enrollment		
	Urban	Suburban	Town/ Rural	Low (<5%)	Medium (5% to <50%)	High (≥50%)	Low (<20%)	Medium (20% to <60%)	High (≥60%)
Fruits and/or vegetables available at school celebrations[c]	1.17 (1.003, 1.36)	1.24* (1.08, 1.42)	ref[e]	0.60* (0.49, 0.72)	0.67* (0.58, 0.78)	ref	1.32* (1.10, 1.59)	1.14 (0.98, 1.32)	ref
No VMSS[d] availability of foods	1.09 (0.93, 1.28)	0.94 (0.81, 1.10)	ref	0.66* (0.54, 0.81)	0.64* (0.55, 0.75)	ref	0.60* (0.49, 0.72)	0.62* (0.54, 0.73)	ref
Fruits and/or vegetables are available for purchase from VMSS	1.48* (1.25, 1.76)	1.67* (1.43, 1.95)	ref	0.70* (0.57, 0.88)	0.78* (0.66, 0.93)	ref	2.26* (1.83, 2.79)	1.52* (1.27, 1.82)	ref
Limited package serving size of items sold in VMSS[f]	1.43* (1.19, 1.72)	1.64* (1.39, 1.93)	ref	0.79 (0.63, 0.98)	0.87 (0.72, 1.04)	ref	0.95 (0.77, 1.18)	1.03 (0.86, 1.23)	ref

[a]Odds ratio and (95% confidence intervals), adjusted for other school-level characteristics for each nutrition policy item.
[b]N=2008 School Health Profiles data representing 6,732 schools from 28 states.
[c]Includes responses "almost always or always".
[d]VMSS=vending machines or school stores.
[e]ref=reference group.
[f]For example: Does this school limit the package or serving size of any individual food and beverage items sold in vending machines or at the school store?
*Odds ratios significantly different from the reference group after adjusting for multiple comparisons at the 0.008 level.

The most pronounced disparity in the distribution of policies and practices that support healthy school food environments seems to exist among schools located in town and rural communities. These findings are troubling given the health and weight disparities that already exist among these communities. Living in rural areas is a risk factor for children being overweight or obese.[12] Explanations for this geographic difference supported by the literature include: smaller school size and therefore fewer resources, less availability of healthy foods, and higher cost of high-quality produce. A study of 14 rural Kansas high schools reported that smaller food-service programs had fewer financial resources, fewer total products, and lower product volume, resulting in fewer fruit and vegetable options.[13] Several studies have found that the availability and cost of healthy foods, especially high-quality produce, are most problematic in small town and rural settings.[34-36]

Schools serving the highest percentage of minority students consistently reported the same or better school food environments. However, schools serving the highest percentage of low-income students had varied results; vending and LNED vending policies were consistently better and fruit and vegetable availability related policies were consistently worse. A national multistate, multischool study investigating the school food environment reported better food and nutrition—related policies and practices among both lower income and higher minority enrollment schools.[37] However, this investigation occurred before the 2006 implementation of the 2004 CNRA. Another contradictory study involving a state examination of wellness policy language identified stronger policy language in the schools with the highest percentage of free/reduced-price meal enrollment.[17] One plausible explanation for the counterintuitive findings is that schools serving high-needs areas have been targeted for supportive programming: coordinated school health, fresh fruit and vegetable programs, and summer foodservice programs.[25,38,39] At the time of the current data collection, however, school-based fresh fruit and vegetable programs primarily targeted elementary schools and were in the piloting phase with limited reach. Continued monitoring of food policies and practices in secondary schools for geographic, income, and racial disparities is justified.

CONCLUSIONS

Students attending schools in small town and rural areas have significantly less exposure to healthy eating policies and practices and significantly more exposure to LNED marketing at school than students attending urban and suburban schools. Students attending city and suburban schools and schools with the highest minority enrollment seem to be attending schools with better food environments, although the overall scale scores were low, indicating room for improvement. Findings from this study uniquely add to the literature in two ways. First, the evaluation period captures 2 years after the implementation of the mandatory school district wellness policies. Second, the assessments of policies and practices include those with a substantial evidence base not previously examined (eg, food marketing, promotional strategies). This post-CNRA implementation study strengthens the need for small town and rural focused policy supports, especially as next steps (the Healthy, Hunger-Free Kids Act of 2010) are implemented. The data also support the need for continued reinforcement and the potential for expansion of these efforts in urban and suburban areas and schools with the highest minority enrollment. Lastly, future research should examine the impact of these school food policy environments on student diet, weight, health, and academic outcomes. Especially important are evaluations by student sex, race/ethnicity, and income categories.

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Chapter 3

Accessing Nutritious Food
in Low-Income Neighborhoods

By Dr. Alice Ammerman

Summary: Dr. Alice Ammerman:

Dr. Alice Ammerman is a professor in the Department of Nutrition, Gillings School of Global Public Health at the University of North Carolina at Chapel Hill. She also directs the Center for Health Promotion and Disease Prevention, a CDC Prevention Research Center. Her father grew up on a small, integrated farm (tobacco, livestock, garden for the family) in Cynthiana, Ky., which she visited frequently as a child.

Tobacco transition:

- Fewer economic opportunities for small-scale farms with removal of tobacco supports
- Produce or integrated agriculture offers an option for small acreage farms (vs. commodity crops)
- New markets needed to make transition viable – local food interest creates opportunities
- Innovation around value-added products and agro-tourism
- New marketing strategies include farm-to-institution, CSAs, online ordering systems
- Need to attract and keep younger farmers

Environmental challenges and opportunities:

- Large-scale commodity crop production is often heavily fossil fuel dependent (oil, pesticides, fertilizers) and creates environmental problems with agricultural run-off
- Increasing market opportunities for sustainable agricultural practices – high demand
- Need for research on labor-saving devices for smaller-scale farms
- Heavy use of antibiotics for animal production raises concern about food supply for humans and antibiotic resistance

Policies to support sustainable agricultural practices:

- Zoning to protect from development and high taxation rates
- City/county/state commitments to sourcing local foods
- Support for land acquisition or borrowing for young farmers
- Farm incubator programs, help with GAP certification

Multiplier benefits of federal food programs (SNAP, WIC, School lunch/breakfast):

- Dollars spent in local food venues (grocery stores, convenience stores)
- Jobs creation to support food distribution systems (e.g., Farm to School), 10% campaign, FMs
- Sourcing locally grown food benefits producers as well as vendors.

Community and economic benefits of local/healthy food access and sustainable agriculture:

- Healthier workforce – less absenteeism, more "presenteeism"
- More potential for recruiting industry to a location with a healthier workforce
- Community spirit of supporting local businesses

Innovations- North Carolina:

- Quick Chef – to teach cooking on a budget and healthy cooking skills
- Green Cart – delivering healthy lower cost foods to low-income people.
- Produce Packs – increasing access to fruits and vegetables for WIC clients and others in corner stores

Innovations- Kentucky:

- Community Farm Alliance: www.communityfarmalliance.org
- MACED (Mountain Association for Community Economic Development), www.maced.org)
- Center for Rural Strategies (www.ruralstrategies.org).

Resources

Additional information on the food environment can be found at the following sites:

The Food Project
http://thefoodproject.org/

Kentucky Association of Food Banks
http://www.kafb.org/

Office of Kentucky First Lady Jane Beshear
http://firstlady.ky.gov/Pages/Default.aspx

Food Research and Action Center
http://frac.org/

Feeding America
http://feedingamerica.org/

Policy Institute for Family Impact Seminars
http://familyimpactseminars.org/

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