A community assessment to inform a multi-level intervention to reduce CVD risk and risk disparities in a rural community

Stephanie B. Jilcott Pitts, PhD [Assistant Professor],
East Carolina University, Department of Public Health, 600 Moye Blvd, MS 660, Greenville, 27834, jilcotts@ecu.edu; Telephone: (252) 744-5572; Fax: (252) 744-4008

Maihan B. Vu, DrPH, MPH [Director of Formative Research],
University of North Carolina at Chapel Hill, Center for Health Promotion and Disease Prevention, 1700 Martin Luther King Jr Blvd, Campus Box 7426, Chapel Hill, NC 27599-7426, maihan.vu@unc.edu; Telephone: 919-966-9793; Fax: 919-966-8564

Beverly A. Garcia, MPH,
UNC Center for Health Promotion and Disease Prevention, CB# 7426, 1700 MLK Jr. Blvd., Chapel Hill, NC 27599-7426, beverly.garcia@unc.edu; Telephone: 919-966-6088; Fax: 919-966-6264

Jared T. McGuirt, MPH,
UNC Center for Health Promotion and Disease Prevention, CB# 7426, 1700 MLK Jr. Blvd., Chapel Hill, NC 27599-7426; mcguirtj@live.unc.edu

Danielle Braxton, MPH, RD,
UNC Center for Health Promotion and Disease Prevention, CB# 7426, 1700 MLK Jr. Blvd., Chapel Hill, NC 27599-7426; furci@unc.edu

Constance E. Hengel, RN, BSN [Director],
Community Programming and Development, Lenoir Memorial Hospital, 100 Airport Road, Kinston, NC 28501, chengel@lenoir.org; Telephone: (252) 522-7028

Joey V. Huff, MPA [Health Director],
Lenoir County Health Department, jhuff@health.co.lenoir.nc.us; Telephone: (252) 526-4299

Thomas C. Keyserling, MD, MPH [Professor], and
Department of Medicine, School of Medicine, University of North Carolina at Chapel Hill, jato@med.unc.edu; Telephone: 919-966-2276; Fax: 919-966-2274

Alice S. Ammerman, DrPH, RD [Professor]
Department of Nutrition, Gillings School of Global Public Health Director, Center for Health Promotion and Disease Prevention, University of North Carolina at Chapel Hill, CB# 7426, Chapel Hill, NC 27599-7426, alice_ammerman@unc.edu; Telephone: 919 966-6082, FAX 919 966-3374

Abstract

Correspondence to: Stephanie B. Jilcott Pitts.

In order to complete a formative evaluation to identify community-level assets and barriers to healthy lifestyle choices, we conducted qualitative interviews, community audits, and secondary data analyses. We solicited local leaders' perspectives regarding 'win-ability' of obesity prevention policy options. Participants noted that many resources were available, yet a barrier was high cost. There were more parks per capita in low-income areas, but they were of lower quality. The most winnable obesity prevention policy was incentives for use of food from local farms. Results are being used to inform an intervention to reduce CVD risk in a rural eastern North Carolina.

Keywords

policy and environmental change; health disparities; rural health; formative evaluation; community assessment

---

When compared to other regions of the country, rates of heart disease and stroke are significantly higher in the "stroke belt" of the Southern U.S., including rural eastern North Carolina.[1] Not only are cardiovascular disease (CVD) rates higher in this region, but there are also geographical, racial and income disparities, with CVD adversely affecting rural dwellers, African Americans, and residents of lower socioeconomic status.[1,2] Behavioral factors, such as healthy eating and physical activity (PA) are important to reduce heart disease risk.[3, 4] It is thought that community-level social, economic, and physical barriers and facilitators may contribute to health disparities through impact on behavioral risk factors and via differential distribution in rural, low-income, and minority communities.[5–7] For instance, rural residents may have less access to a large selection of healthy foods as they often live further from large chain supermarkets.[8–10] Additionally, low-income and minority communities often have less access to affordable, healthy foods and may have more neighborhood crime,[5,7,11] both of which present barriers for residents to pursue healthy eating and PA to reduce CVD risk.

Despite these barriers, rural, low-income communities may also have a variety of assets, or facilitators, promoting healthy eating and physical activity, including farmer's markets and produce stands, parks, and open space. Residents, however, may be unaware of the existence of such resources, may not know how to access them or they may be in poor repair (parks, playground facilities).[11] Linking residents to nutrition and PA resources can facilitate and support healthy lifestyle changes.[12 – 14] As such, in addition to the traditional focus of lifestyle interventions on individual behavioral change, there is increasing interest in chronic disease prevention programs designed to address both individual and community level factors that support healthful behaviors.[15] One method previously employed is to develop a Community Resource Guide linking health promotion program participants to health-promoting PA and nutrition resources.[12] The Socio-Ecological Model (SEM) offers a framework for this type of intervention, suggesting the most effective approach leading to healthy behaviors includes interventions directed at multiple nested levels—individual, interpersonal, organizational, community, and policy.[6, 16] Little has been published describing the coordinated and comprehensive formative data collection and analysis that are required to guide such multi-level interventions.

Community-based Participatory Research (CBPR) is a collaborative approach for identifying and catalyzing community-level change.[17] CBPR can range from study participants identifying the topic of interest to helping design and test intervention materials.[17] Evidence suggests that when community members are engaged in the process, more effective and sustainable change may occur.[17] This paper describes a CBPR-guided formative effort to identify community-level assets and barriers to healthy lifestyle choices. We applied this coordinated assessment approach to identify multi-level factors supporting or inhibiting lifestyle change efforts in a rural eastern NC county to inform intervention development and policy and environmental changes in support of a study to reduce CVD rates and disparities in this county.

Methods

Heart Healthy Lenoir Project Overview

The Heart Healthy Lenoir Project is a collaboration between the University of North Carolina-Chapel Hill (UNC), East Carolina University (ECU), and a broad coalition of local community partners and is sponsored by the UNC Center for Population Health and Health Disparities (CPHHD). The primary goal of the Project is to create long-term, sustainable approaches to reducing CVD risk and disparities in risk in Lenoir County, North Carolina. Three coordinated studies follow a year of in-depth formative research. The first study will test a clinic-based enhanced care intervention for hypertension control. The second study tests a lifestyle intervention to improve nutrition, physical activity and weight management, including policy and environmental change. The third study will explore genetic factors associated with cardiovascular disease risk and treatment success. This paper describes the formative work conducted for the lifestyle intervention to reduce CVD risk, which has two major components: 1) a behavioral intervention for 350 individual community members to reduce CVD risk through lifestyle change and weight loss, as appropriate, and 2) a community-wide policy and environmental change intervention to promote healthful lifestyle opportunities, including partnerships with businesses to promote a healthy environment through innovative economic opportunities. This study was approved and monitored by the UNC institutional review board.

Lenoir County was chosen as the setting for the Heart Healthy Lenoir project as it is situated in the heart of the "stroke belt" that runs through the southeastern United States. In addition, previous assessment and community partnership development through the UNC Community Campus Partnership[18] identified Lenoir County as one of the two counties within reasonable travel distance from UNC-CH that had both the interest and minimum infrastructure/capacity to support a long term academic-community partnership. In 2006, the per capita income of the County (population of approximately 60,000) was $20,965 compared to $32,234 for the rest of NC.[19] Approximately 74% of Lenoir County residents are overweight or obese, compared to 63% of all N.C. residents who are overweight or obese.[19] The county seat is a small town (estimated population 22,056), and the two next largest towns have estimated populations of 2737 and 527, respectively.

The first phase of the Heart Healthy Lenoir Project was a year-long assessment and preparation phase. In keeping with CBPR and guided by the SEM, we used both qualitative

and quantitative methods to assess individual, interpersonal, organizational, community, and policy factors and priorities relevant to CVD risk reduction. The SEM grounded our work, with different levels of the model addressed by various methods, as described in Table 1. We conducted qualitative interviews with community members and agency leaders; performed audits of community, food venues, and park venues; examined secondary data sources; and obtained feedback from local leaders. We used this multi-method approach to (1) improve both our breadth and depth of understanding of community-level assets, barriers, beliefs, and priorities; (2) develop a system to link participants to healthy eating and PA assets via creation of a Community Resource Guide; (3) learn of barriers to address via environmental and policy changes; and (4) determine individual-level interactions with community assets and barriers, and how these might be addressed in the lifestyle intervention developed as a part of the Heart-Healthy Lenoir Project.

We used a CBPR approach to engage community partners. Lenoir County leaders were involved with the initial conceptualization of the project and assisted with development of the grant proposal. When the grant was awarded, we formed a Community Advisory Committee (CAC) that included local community residents and agency leaders, and have held quarterly meetings to solicit feedback and report on the project. We examined social and physical assets and barriers to healthy eating and physical activity in Lenoir County using in-depth interviews among community members (interviewers were also trained community members) and conducted in-depth interviews with community agency leaders. We drafted a Community Resource Guide and obtained input on the Guide from community and CAC members. Community members accompanied the research team members on community audits to provide insider information on context. Finally, CAC members provided feedback regarding 'win-ability' of various nutrition and PA policies.

Community Members' Perspectives of Community Level Assets and Barriers

To assess individuals' interactions with community-level assets and barriers related to healthful lifestyle changes, we conducted face-to-face interviews with community members, inquiring specifically about their eating and physical activity behaviors, knowledge of heart disease risks, and awareness of community resources to facilitate healthy lifestyle choices. Participants (n = 22) were English speaking, over 18 years, and lived in Lenoir County. In an effort to ensure that interviewers were familiar with the community context, in-depth interviews were conducted by trained study staff recruited from Lenoir County. Interviewers received training on the interview protocol and guide, as well as probing and reflective listening from a Co-Investigator with extensive qualitative skills. After 10 interviews were completed, the Co-Investigator conducted telephone debriefings with the trained study staff interviewers and provided feedback on how to enhance in-depth responses. Interviews lasted approximately 60 minutes, were conducted in a private location, were audio-taped and transcribed verbatim. Transcripts were imported into ATLAS Ti. The study team created a codebook with operational definitions using interview guide questions. Two independent coders worked together to reach consensus on codes and definitions, setting a priori rules for coding salient themes. The two coders then independently read and coded the transcripts and resolved discrepancies through discussion of coding decisions and referral to a priori coding rules.

Agency Leader's Perspectives of Community Level Assets and Barriers

To better understand community-level assets and barriers, as well as the potential role of local organizations in addressing CVD risk and disparities, members of the Heart Healthy Lenoir research team conducted in-depth interviews with staff from community agencies and businesses (n = 8), including the health department, hospital, cooperative extension, parks and recreation, faith community, a primary care practice, a pharmacy, and a farmer. These individuals were selected based on the potential role of their organization or business in ameliorating CVD risk factors. Interviews lasted between 30 and 60 minutes, and in most cases were conducted at the respondents' agency or another local venue (e.g., church). Interviews were audio-taped, and a research assistant listened to the audio files and took detailed notes. Interview notes were then reviewed independently by two research assistants to identify common themes. After the individual review, the two research assistants met in person to discuss findings, reconcile any discrepancies and ensure agreement on major themes.

Community audits

To link community members to health-promoting resources, we created a draft nutrition and physical activity (PA) community resource guide, using methods described previously.[12 – 14] We then conducted community audits to achieve the following: (1) to identify physical and social facilitators and barriers to healthful lifestyle changes; (2) to verify nutrition and PA resources on the draft community resource guide, and identify resources not listed on the guide; and (3) to examine the micro food and PA environment within community resources such as food stores, restaurants, and parks.

We developed an initial resource guide using targeted internet searches to provide a baseline list of nutrition and PA resources. Community audits were organized by mapping known resources using Google Earth, and then dividing Lenoir County into six workable catchment zones. Because the County is divided in half by a major highway, with a small town in the North, the county seat of Kinston in the middle, and another small town in the South, the catchment zones included Northern, Southern, Eastern and Western Kinston, and Northern and Southern Lenoir County. From August – November 2010, we conducted six structured community audits of each of the catchment zones, accompanied by a knowledgeable community member to provide community context. A member of the research team took systematic notes on community physical and social attributes. Ground-truthing was used to enumerate nutrition and physical activity (PA) resources (e.g. farmers' markets, parks) already listed on the community resource guide, and to discover any unlisted resources.[13]

Food venue audits

During February – May 2011, we conducted food store and restaurant audits using the Nutrition Environment Measures-Stores-Revised (NEMS-S-Rev)[20] and the Nutrition Environment Measures Survey-Restaurants (NEMS-R).[21] The NEMS-S-Rev and NEMS-R are validated tools to measure availability, pricing, and quality of foods at food stores and restaurants.[20,21] Two research assistants were trained to use each tool by completing NEMS instructional coursework. Both tools were modified to capture additional aspects of the Lenoir County food environment, as deemed appropriate. NEMS-S-Rev modifications

included additions of measures of canned fruit and 2% milk availability, and modifications to NEMS-R included adding measures of breakfast entrees, breakfast side items, and dinner side items. Minor adjustments were made to reference brands and product types to improve consistency of data capture. Food venue audits were conducted in 3 regions of the county. We compiled a list of county food venues (including estimated sales volume) using Reference USA commercial database. Food stores were categorized by North American Industrial Classification System (NAICS) codes, as defined previously.[22] However, because small grocery and convenience stores (as identified by NAICS codes) were similar in layout and product offerings, we combined these two categories.

From our list of food stores and restaurants, we selected stores and restaurants based upon those that might have the greatest impact on reducing CVD risk and disparities, based on multiple factors, including: (1) mention in qualitative interviews; (2) food store or restaurant type, (3) proximity to low-income neighborhoods, (4) potential for changing food selections (i.e. limited corporate influence), and (5) sales volume, as reported in the Reference USA Business Database. Proximity to low income neighborhoods (using Census 2000 data) was determined using Geographic Information Systems (GIS). Based on our criteria, we audited a total of 39 venues, which included 24 food stores (4 chain supermarkets, 17 small grocery/ convenience, and 3 drug/dollar stores) and 15 restaurants (5 fast food and 10 sit-down). At the completion of the audits, food stores and restaurants were scored according to the NEMS scoring protocol, with modifications made according to the additional food items measured. Scoring discrepancies were resolved through communication between the auditors and conformation with the scoring protocol.

Park audits

Park audits were conducted by a member of the research team using the Physical Activity Resource Assessment (PARA) tool.[23] This tool assesses type, features, amenities, qualities, and incivilities (e.g., graffiti) of PA resources using a rating scale ranging from "not present (0)", poor (1)", mediocre (2), and "good (3)" for features and amenities, and "not present" (0), "good" (1)," mediocre" (2), and "poor" (3) for incivilities, such that a higher incivilities score indicates more incivilities.[23] Parks were those listed on the Lenoir County Parks and Recreation Department website, with additional parks being found during community audits. A total of 17 parks in 15 different census block groups (CBGs) were audited (two CBGs had 2 parks each.)

Community Advisory Committee (CAC) Feedback on 'Winnability' of Nutrition and PA Policies

To learn more about winnable obesity-prevention policies in the Lenoir County context, we used the Centers for Disease Control and Prevention "Common Community Measures for Obesity Prevention" (COCOMO), a list of 24 recommended and evidence-based strategies and accompanying measures to guide communities in identifying and implementing obesity-prevention policies.[24] Using the COCOMO strategies, we facilitated discussion among our CAC members regarding obesity-prevention policies, as described in detail elsewhere.[25] In brief, 19 CAC members scored each listed COCOMO recommended strategy based upon how realistic it was for the Lenoir County community context, existing infrastructure

support, leadership support, and available resources. Responses were aggregated, and we announced the "biggest loser" (the least winnable strategy), and the "biggest winner" (the most winnable, or feasible, policy change strategy) to CAC members, who were then prompted to discuss facilitators and barriers to the identified policy change strategies.

Quantitative data analysis

We examined how community-level socioeconomic characteristics were related to geographic access to nutrition and PA resources. First, we examined NEMS scores for food stores and restaurants. Higher NEMS scores indicate greater availability, better price and higher quality of healthy foods. We also compared PARA scores between parks in low- versus high-income Census Block Groups (CBGs). We calculated the median household income for the CBGs that contained parks, and then split the sample by the median household income. We sorted the 17 parks by CBG median household income and removed the park in the middle, to obtain an even number (eight) of parks in high- and low-income CBGs. We calculated the sub-scores (features, amenities, and incivilities) and overall PARA scores for each of the eight parks in high-income CBGs and for each of the eight parks in low-income CBG groups, and then compared PARA scores for parks in high- versus low-income CBGs. We did not conduct any significance tests of the differences in PARA scores because of the small sample size.

In addition, PA and nutrition resources were mapped using GIS (ArcGIS, version 9.3). Public PA facilities (n = 23) were found during community audits and were also those listed on the Lenoir County Department of Parks and Recreation website. Food store addresses (n = 77) were obtained from Reference USA business database, and addresses were verified for 31% of supermarkets during NEMS-Stores audits. Sit down and fast food restaurant addresses (n = 110) were also obtained from Reference USA business database, and addresses were verified for 13% of restaurants during NEMS-Restaurants audits. All food venue types were mapped, but we examined only two types: supermarkets and restaurants. For each CBG (n = 54), we examined the association between CBG median household income (Census 2000) and CBG percent minority population (Census 2000) and the following variables: (1) number of public PA facilities per capita, (2) number of supermarkets per capita, and (3) number of restaurants per capita, using Pearson correlation coefficients. All analyses were conducted in SAS 9.2.

Results

Community Members' Perspectives of Community Level Assets and Barriers

Five themes emerged related to community level assets and barriers for healthier nutrition and PA. In terms of assets, community members highlighted availability, culture, and community resources for supporting healthier lifestyles. In terms of barriers, participants discussed location and cost as key factors influencing their choices about use of community resources.

One of the biggest assets identified by community members was the availability of numerous opportunities to eat healthy and be active, including local farmers' markets and stands. They also said supporting these local businesses was an important habit for them:

"Well, I been buyin' from produce stands for 50 years or more… we try to find out where the produce and fresh fruit and vegetable stands are [and buy from them]."

In addition to produce stand use, some participants mentioned that they lived in an area where gardening and raising your own vegetables is practiced and linked to the community culture. Community members also talked about the presence of local gyms to support PA, and listed several PA resources including parks with walking paths, community centers, senior centers, the Boys and Girls Club, and the hospital wellness center.

The two main barriers from the perspective of community members were location and cost. While opportunities and resources were available within the community, participants said many were not located within close proximity to their homes. Therefore, transportation to stores with healthier foods or better equipped gyms was challenging. Likewise, higher costs were perceived to be associated with healthier food options and newer health clubs. In this rural community where participants have fixed financial resources, it was difficult to make the choice to pay more for gym memberships or fresh foods. As one participant summarized:

"I like fruit. [But] fruit is expensive. It's seasonal. I would never go into a store and buy tangerines and oranges because what I may spend on fruit and eating something like that, I could probably buy enough to cook me a meal."

Perspectives on the community resource guide

Overall, participants were aware of some community resources, and responded favorably to the community resource guide:

"It's colorful, it's attractive and plus it's giving me information and heightened my awareness of places that I didn't know that I could go to."

Agency Leaders' Perspectives of Community Level Assets and Barriers

Agency leaders were asked to identify both assets and barriers for reducing cardiovascular risk factors in their community. Key barriers included lack of *availability* of healthy foods and facilities in which to be physically active (although some leaders argued the opposite), lack of *access to* nutrition and PA resources and community beliefs and culture. On the other hand, key assets mentioned by leaders included availability of healthy foods and facilities in which to be physically active, the existence of strong community agencies that provide various health services, and a rich agricultural history. Also, some agency leadersthought that their community lacked adequate facilities to purchase healthy foods or engage in PA:

"We need more sidewalks. We need more bicycle trails. We need more environmental types of support for those changes in behavior"

Others thought availability of such resources was more than sufficient:

"We have all the right foods in the grocery stores … if you haven't been in a large [chain supermarket] in poor eastern NC, to see that the selection of fresh fruits and vegetables is equal or more to what you'll find in [chain health food store]."

However, despite differing views on availability, most leaders interviewed seem to report the existence of significant barriers that prohibited some community members from accessing these resources, including finances, distance and safety.

Agency leaders also suggested that some community cultural beliefs and practices are a formidable barrier to cardiovascular health. For example, fatalism was mentioned multiple times implying that motivating community members to make health changes could be difficult. Less-healthy southern food preparation practices were also mentioned:

"It's very difficult to get out of that mold of a history, a heritage, or a background or a habit of this is how our life is."

Respondents most frequently cited Cooperative Extension, the Health Department, Lenoir Memorial Hospital and Parks and Recreation as strong and valuable organizations in the community that contribute to community assets. Suggested programs or policies that would be helpful in preventing heart disease included: focusing on education (via the Expanded Food and Nutrition Education Program and local lay health advisors), working with the faith-based community, implementing environmental changes (sidewalks, healthier eating opportunities, etc.), expanding and assisting local agriculture (Good Agricultural Practices (GAP) training and certification, farm-to-school programs), and worksite wellness programs.

The community's rich agricultural heritage was noted as an asset due to its versatile farmland, thriving farmers market and restaurants interested in local foods:

"One of the advantages that we have in this area is that we do have great area to grow some fresh fruits and vegetables and make those available for folks…"

Despite these benefits, Lenoir County faces many challenges related to local agriculture, including challenges with customer recruitment and retention in community supported agriculture and consumer price expectations. Suggestions for improving sales at farmers markets and through restaurants included assistance with advertising and promotion and more partnerships with the Cooperative Extension (e.g., teaching people how to cook local produce). Cost limitations associated with growing, picking and delivering produce limit market expansion opportunities for many farmers to surrounding communities. Other barriers included:

Convenience of other food sources: "…people are reluctant to go to the farmers market, you know it's a lot more convenient to go to the Food Lion and pick up your milk and your eggs and your cereal and all that stuff …"

Low customer volume: "when you only have a following at your farmers market of 1–2% of the population, 1–2% of a million people is a far cry from 1–2% of 20,000 people."

Park Audits

The mean overall PARA score for all 17 parks was 27.3, ranging from 8 to 51. The mean "features" sub-score was 10.6 (range 2 – 25), the "amenities" sub-score was 19.2 (range 3 – 27), and the "incivilities" sub-score was 2.5 (range 0 – 7). When the CBGs containing parks were divided by median household income (eight parks in each of two census block groups), the mean of the overall PARA scores for parks in higher-income CBGs was 32 versus 25 for parks in lower-income CBGs, suggesting that lower-income CBGs have lower quality parks than do higher-income CBGs. For parks in lower- versus higher-income CBGs, the "features" means were 9.4 versus 12.1, "amenities" means were 18.3 vs. 22.1, and "incivilities" means were 2.6 vs. 2.3. This suggests that parks in lower-income CBGs had, on average, fewer features and amenities and more incivilities than did parks in the higher-income CBGs.

Food Venue Audits

In general, small grocery (n = 6, scores ranged from 8 – 34) and convenience stores (n = 10, scores ranged from 4 – 14) had the lowest NEMS-S-Rev scores, followed by dollar stores (n = 2, scores ranged from 19 – 23), and supermarkets had the highest scores (n = 5, scores ranged from 34 – 47), mainly due to higher availability and quality sub-scores. (The quality score is only calculated for fruits and vegetables). Of note, the one supercenter we audited (included in the supermarket category) had the highest scores for availability, price, and quality of healthy foods.

The five purposively selected fast food restaurants audited had a wide range of NEMS-R scores, from −9 to 56 for the NEMS-R, and for the kids menu NEMS-R score, the range was from −3 to 15. The fast food restaurant with the very high NEMS-R scores is a chain sub sandwich shop that markets healthy foods. Of the ten purposively sampled sit-down restaurants, scores ranged from 5.3 to 24.3, and for the kids menu, from 3 to 6.

Community Audits

The final version of the Lenoir County community resource guide included 8 nutrition resources (e.g., farmers' market, local farms), 34 PA resources (e.g., parks, walking trails), and 5 "other" resources (e.g., a cultural center, the Agriculture Extension Office). Qualitatively, several barriers and facilitators to healthful living were noted by researchers during the windshield tours. Quantitatively, there was a marginally statistically significant inverse correlation between CBG median household income and parks per capita (r = −0.25, p = 0.06) and restaurants per capita (r = −0.32, p = 0.02), such that there were more parks and restaurants per capita in lower income areas; and there was a positive correlation between percent minority residents and restaurants per capita (r = 0.29, p = 0.03). There were no statistically significant correlations between socio-demographic characteristics of the CBGs (median household income and percent minority) and food stores, supermarkets, and fast food restaurants per capita.

Community Advisory Committee (CAC) Feedback on Potential Nutrition and PA Policies

The most winnable, or feasible, policies identified by CAC members were the following: Communities should: increase opportunities for extracurricular physical activity; provide

incentives for production, distribution, and procurement of food from local farms; enhance infrastructure supporting bicycling and walking; and enhance personal / traffic safety in areas where persons could be physically active. The least winnable policies were the following: Communities should: limit advertisements of less healthy foods and beverages; restrict availability of less healthy foods and beverages in public service venues; support locating schools within easy walking distance of residential areas; and zone for mixed use development.

Discussion and Next Steps

In this paper, we present formative data collected on multiple levels of the SEM, using CBPR methods, to describe several community assets and barriers related to healthful lifestyle choices. There was corroboration between qualitative interview data from community members and agency leaders as both noted that nutrition and PA resources were available in Lenoir County, but cost and distance to resources are sometimes prohibitive. This is in agreement with previous studies finding distance to healthy food stores[9–10] and PA resources[26] are barriers to healthy eating and PA in rural areas. Both groups mentioned the asset of an agricultural community culture with regards to healthy eating, an asset of rural areas noted by others.[10] Our results are in agreement with others, who also found that lower-income areas had lower-quality parks.[23] Not all of the information gathered from this formative assessment was internally consistent, however. Culture and heritage was thought by some to have a positive influence on eating habits while others thought it was more negative. Also, community leaders were more likely than general community residents to report that PA resources are adequate and healthful food plentiful.

These assets and barriers, specific to the rural Southern food and PA environment, will be addressed in the Heart Healthy Lenoir individual and community-level interventions. For example, we are partnering with the local Health Department and Cooperative Extension on development of community-based interventions, and have cultivated relationships between various community agencies represented on the CAC. We have partnered with two government agencies to promote worksite wellness policies and programs using North Carolina Prevention Partner's Work Healthy America program. The community resource guide was shown to community agencies to verify the completeness of the resource listings. Furthermore, the resource guide will be disseminated via the internet and community agencies.

In response to the policy and environmental level priorities identified by our CAC to "provide incentives for production, distribution, and procurement of food from local farms," we have assisted the community in obtaining 2 foundation grants that will support this endeavor. Lenoir County is similar to other eastern North Carolina counties in that it a primarily agricultural, commodity crop farming community (tobacco, cotton, and soybeans). As community members see commodity markets wax and wane, they are likely to see efforts to engage the expertise of local farmers in growing food crops as an appealing strategy, with both economic and public health benefits.

Data from the park, food store, and restaurant audits serves as a baseline to track healthful environmental changes made over time. We plan to use data from the community audits with data regarding proximity to GIS-mapped resources to examine associations between community resources and health-related outcomes among lifestyle intervention participants. Furthermore, we have learned more about the most and least winnable obesity prevention policies in Lenoir County. We have presented these policy strategies to additional community leaders, and gained further clarity on the winnability of each strategy, including potential next steps concerning policy change to make the Lenoir County nutrition and PA environment more conducive to healthy eating and PA.

Potential limitations of this study include the fact that interview participants were a purposive sample and may have provided socially desirable responses. Because of the difficulty involved in capturing nutrition information for buffet items, and because of limitations in the ability of the NEMS-R to capture healthfulness of all-you-can-eat buffets, we did not include buffets in this analysis. Our selection of food venues to audit was purposive, and not representative. However, we sought to audit venues that were used by our priority population of interest, and used a variety of factors to select venues to audit, including venues mentioned in qualitative interviews, proximity to low-income neighborhoods, potential for changing food selections, and sales volume. Finally, as this mixed-methods formative evaluation was conducted in one county in rural eastern North Carolina, our results may not be generalizable.

Conclusion

Our multilevel approach highlights the importance of using a comprehensive strategy to understand the different perspectives necessary for design of an intervention targeting multiple levels of the SEM, ultimately to reduce CVD risk among those who take part in the lifestyle intervention of this study and also those in the broader community. We believe this strategy may be useful to the growing number of community-wide efforts intended to address chronic disease prevention from a community-wide perspective.

Acknowledgments

References

1. Howard G, Labarthe DR, Hu J, Yoon S, Howard VJ. Regional differences in African Americans' high risk for stroke: the remarkable burden of stroke for Southern African Americans. Ann Epidemiol. 2007; 17(9):689–696. [PubMed: 17719482]

2. Pedigo A, Aldrich T, Odoi A. Neighborhood disparities in stroke and myocardial infarction mortality: a GIS and spatial scan statistics approach. BMC Public Health. 2011; 11:644. [PubMed: 21838897]

3. Willett WC. Overview and perspective in human nutrition. Asia Pac J Clin Nutr. 2008; 17(Suppl 1): 1–4. [PubMed: 18296289]

4. Mozaffarian D, Appel LJ, Van Horn L. Components of a cardioprotective diet: new insights. Circulation. 2011; 123(24):2870–2891. [PubMed: 21690503]

5. Sallis JF, Slymen DJ, Conway TL, et al. Income disparities in perceived neighborhood built and social environment attributes. Health Place. 2011; 17(6):1274–1283. [PubMed: 21885324]

6. Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K. Creating healthy food and eating environments: policy and environmental approaches. Annu Rev Public Health. 2008; 29:253–272. [PubMed: 18031223]

7. Larson NI, Story MT, Nelson MC. Neighborhood environments: disparities in access to healthy foods in the U.S. Am J Prev Med. 2009; 36(1):74–81. [PubMed: 18977112]

8. Liese AD, Weis KE, Pluto D, Smith E, Lawson A. Food store types, availability, and cost of foods in a rural environment. J Am Diet Assoc. 2007; 107(11):1916–1923. [PubMed: 17964311]

9. Jilcott SB, Liu H, Moore JB, Bethel J, Wilson J, Ammerman AS. Commute times, food retail gaps, and body mass index in North Carolina counties. Prev Chronic Dis. 2010; 7(5):A107. [PubMed: 20712934]

10. Yousefian A, Leighton A, Fox K, Hartley D. Understanding the rural food environment--perspectives of low-income parents. Rural Remote Health. 2011; 11(2):1631. [PubMed: 21513422]

11. Lovasi GS, Hutson MA, Monica Guerra M, Neckerman KM. Built environments and obesity in disadvantaged populations. Epidemiol Rev. 2009; 31:7–20. [PubMed: 19589839]

12. Jilcott SB, Vu M, Morgan J, Keyserling TC. Promoting use of nutrition and physical activity community resources among women in a family planning clinic setting. Women Health. 2012; 52(1):55–70. [PubMed: 22324358]

13. McGuirt JT, Jilcott SB, Vu M, Keyserling TC. Conducting community audits to evaluate community resources for healthful lifestyle behaviors: an illustration from rural eastern North Carolina. Prev Chronic Dis. 2011; 8(6):A149. [PubMed: 22005642]

14. Jilcott SB, Laraia BA, Evenson KR, Lowenstein LM, Ammerman AS. A guide for developing intervention tools addressing environmental factors to improve diet and physical activity. Health Promot Pract. 2007; 8(2):192–204. [PubMed: 17384406]

15. Keyserling TC, Samuel-Hodge CD, Jilcott SB, et al. Randomized trial of a clinic-based, community-supported, lifestyle intervention to improve physical activity and diet: the North Carolina enhanced WISEWOMAN project. Prev Med. 2008; 46(6):499–510. [PubMed: 18394692]

16. Sallis JF, Cervero RB, Ascher W, Henderson KA, Kraft MK, Kerr J. An ecological approach to creating active living communities. Annu Rev Public Health. 2006; 27:297–322. [PubMed: 16533119]

17. Viswanathan M, Ammerman A, Eng E, et al. Community-based participatory research: assessing the evidence. Evid Rep Technol Assess (Summ). 2004; (99):1–8. [PubMed: 15460504]

18. The Community-Campus Partnership for Tomorrow. 2011 Available from: http://www.unc.edu/pse/unctomorrow-community-campus-partnership.php.

19. Huff, J. Lenoir County 2007 Community Health Assessment. Kinston, NC: Lenoir County Health Department; 2007.

20. Andreyeva T, Blumenthal DM, Schwartz MB, Long MW, Brownell KD. Availability and prices of foods across stores and neighborhoods: the case of New Haven, Connecticut. Health Aff (Millwood). 2008; 27(5):1381–1388. [PubMed: 18780928]

21. Saelens BE, Glanz K, Sallis JF, Frank LD. Nutrition Environment Measures Study in restaurants (NEMS-R): development and evaluation. Am J Prev Med. 2007; 32(4):273–281. [PubMed: 17383558]

22. Jilcott SB, McGuirt JT, Imai S, Evenson KR. Measuring the retail food environment in rural and urban North Carolina counties. J Public Health Manag Pract. 2010; 16(5):432–440. [PubMed: 20689393]

23. Lee RE, Booth KM, Reese-Smith JY, Regan G, Howard HH. The Physical Activity Resource Assessment (PARA) instrument: evaluating features, amenities and incivilities of physical activity resources in urban neighborhoods. Int J Behav Nutr Phys Act. 2005; 2:13. [PubMed: 16162285]

24. Khan LK, Sobush K, Keener D, et al. Recommended community strategies and measurements to prevent obesity in the United States. MMWR Recomm Rep. 2009; 58(RR-7):1–26. [PubMed: 19629029]

25. Jilcott Pitts SB, Whetstone LM, Wilkerson JR, Smith TW, Ammerman AS. A Community-Driven Approach to Identifying "Winnable" Policies Using the Centers for Disease Control and Prevention's Common Community Measures for Obesity Prevention. Preventing Chronic Disease, Prev Chronic Dis. 2012 Mar.9:E79. PMID: 22459612.

26. Moore JB, Jilcott SB, Shores KA, Evenson KR, Brownson RC, Novick LF. A qualitative examination of perceived barriers and facilitators of physical activity for urban and rural youth. Health Educ Res. 2010; 25(2):355–367. [PubMed: 20167607]

Table 1

Formative data collection method and purpose, organized by level of the Socio-Ecological Model to assess community-level social and physical assets and barriers to be addressed in the intervention study.

Formative Data Collection Method	Purpose	Level of the Socio-Ecological Model
Community member interviews	To assess individuals' opinions about community-level assets and barriers	Individual Community
Agency leader interviews	To examine synergy and potential partnerships between agencies To examine agencies as assets	Organizational Community
Food store and restaurant audits	To examine the retail food environment and community-level assets and barriers relevant to healthy eating	Community
Park audits	To examine community-level social and physical assets and barriers relevant to physical activity	Community Policy
Community audits	To develop a community resource guide To examine community-level social and physical assets and barriers	Organizational Community Policy
Community Advisory Council (CAC) Feedback on Potential Nutrition and PA Policies	To determine winnable nutrition and PA policies to address in future initiatives.	Community Policy