# Assessing Children's Restaurant Menus in a Health Disparate Region

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## ABSTRACT

Obesity is an increasing problem in the United States with 17% of youth currently classified as obese and an even higher prevalence of obesity among disadvantaged populations. The food environment may be contributing to these high rates as there has been a well documented association among increased away from home food consumption and excess adiposity, as well as evidence to support that children's diets are composed of a large portion of restaurant foods. The main purpose of this study is to describe the quality of restaurant food offered to children in a rural health disparate region. Two trained research assistants conducted systematic audits of all food outlets offering a children's menu in the Dan River region using the Children's Menu Assessment (CMA) tool. A composite score for each outlet for was calculated from the 29 scored items on the CMA. The total sample consisted of 137 outlets with CMA scores ranging from -4 to 9 with a mean score of $1.6 \pm 2.7$. Scores were lowest in the predominantly Black block groups ($0.2 \pm 0.4$) when compared to the predominately White block groups ($1.4 \pm 1.6$) and Mixed block groups ($2.6 \pm 2.4$) with significantly lower scores in the predominantly Black block group than the Mixed block groups ($F=4.3$; $p<0.05$). The results of this study reveal a lack of few healthy food options available for children in this region. These findings have the potential to contribute to public health efforts in developing public policy changes or environmental interventions for the children's food environment in the Dan River Region.

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## *Introduction*

The Dan River Partnership for a Healthy Community (DRPHC) is a community-academic partnership that was established in the health disparate Dan River Region of south central Virginia and north central North Carolina. The foundation for this coalition is Community-Based Participatory Research (CBPR), which may be an effective approach to address health disparities in vulnerable populations (Israel, 2005; Minkler, 2008). CBPR leverages the collective knowledge, expertise, and resources that community members and academic researchers can provide and is based on shared trust and resources by all partners (Israel 1998; Wallerstein 2010). This collaborative partnership allows for the development and implementation of culturally sensitive interventions and provides an avenue to disseminate findings to the community. Through a participatory process, the DRPHC prioritized obesity and obesity-related outcomes and thus, developed a mission to reduce and prevent obesity within their community (Zoellner, 2012). The DRPHC identified the built environment and geographical influences as a potential causes of obesity in the region due to its role in nutrition and physical activity (Zoellner, 2012). Community stakeholders also noted that access to healthy food was of great concern in the community. No comprehensive environmental data was available for this region, therefore, food and physical activity outlets were enumerated and detailed audits were conducted to assess the quality of these outlets (Hill, 2012). The current study adds additional information to the environmental data in an attempt to increase the comprehensiveness of the collected data by adding information on children's menu options in this region. In accordance with the CBPR approach, all data collection and conclusions drawn from previous studies, as well as this study are made available to the members of the DRPHC to aid in developing policies and interventions to distribute to the rest of the community.

## *Literature Review*

### Childhood Obesity

Childhood obesity rates have more than tripled over the past 30 years affecting 17% of all children and adolescents in the United States (Ogden 2006, Ogden 2010). Currently, obesity for children is defined as at or above the 95$^{th}$ percentile of body mass index for age and gender and overweight is defined as above the 85$^{th}$ percentile (Barlow, 2007) based on the 2000 Centers for Disease Control and Prevention (CDC) growth charts for the United States (Kuczmarski, 2002). Although it does not directly measure body fat, BMI percentile is a good indicator of body fat at the population level for children and adolescents (Dietz, 1999). The National Health and Nutrition Examination Survey (NHANES) for 1999-2000, showed the prevalence of overweight was 10.4% among children aged 2-5, 15.3% among children aged 6-11, and 15.5% among children aged 12-19 (see Table below) (Ogden, 2002). This was a significant increase in prevalence of obesity compared with the 1988-1994 (NHANES III) data that presented prevalence rates of 7.2%, 11.3%, and 10.5% respectively (Ogden, 2002). Not only have the rates of obesity increased, but also the heaviest children in the most recent NHANES study were significantly heavier than those in the previous study (see table below) (Ogden, 2002).

According to the World Health Organization (WHO), childhood obesity is “one of the most serious public health challenges of the 21st century” (World Health Organization (WHO) Global Strategy on Diet, Physical Activity, and Health, n.d.). The severity of the issue stems from the increased risk factors associated with childhood obesity. Children who are obese are more likely to remain obese into adulthood and to develop noncommunicable disease such as type 2 diabetes, cardiovascular disease, and hypertension at a younger age than non-obese children (Daniels, 2005). Overweight or obese adolescents have a 70% chance of being overweight or obese as adults, which increases to 80% if one or more parent is overweight or obese (Torgan, 2002). Increased risk for chronic diseases was also present even if excess weight is lost in adulthood (Whitaker, 1997). Additionally, early onset obesity, defined by a BMI above the 95th percentile before the age of 10, is proposed as an increased risk factor for morbidity and mortality later in life (Maffeis, 2001). Hospital costs associated with childhood obesity have increased dramatically as well. During 1979-1981, hospital costs associated with childhood obesity were estimated to be $35 million and increased to $127 million during 1997-1999 (CDC, 2008). The association between childhood obesity and adult morbidity and mortality highlights the severity of the current childhood obesity epidemic for the long-term health of the U.S. population. Further, the costs associated with treating childhood and later adult obesity and it’s related conditions is unsustainable. Fortunately, childhood obesity is a largely preventable condition and efforts at primary prevention are a public health priority (Muller, 2001).

The Social Ecological Model provides a comprehensive framework to understanding behaviors with factors that influence behavior at multiple levels: intrapersonal, interpersonal, organization, community, and public policy (Glanz, 2008). This model outlines that in order to influence a behavior, multiple levels must be considered (Glanz, 2008). Given the complex nature of childhood obesity, with several factors influencing weight maintenance, a social ecological approach to this issue is critical.

Until recently, the popular approach in attempts to reduce childhood obesity have focused primarily on the intrapersonal, or individual level including childhood obesity treatment and improving diet and exercise behaviors to prevent obesity. These approaches seem to have had little impact on the childhood obesity, as the rates continue to rise (Dehghan, 2005). Therefore, new approaches to combating childhood obesity need to be considered. The environment also plays a large role in childhood obesity and must be addressed in order to lessen this problem. The larger community, public policy, and demographic and societal characteristics such as ethnicity, socioeconomic status (SES), and the availability of healthy foods play a role in influencing children's dietary and physical activity behaviors (Davison, 2001).

Several factors can be attributed to weight gain in children, including biological, psychosocial, and environmental factors. Genetics can affect one’s risk for obesity at the intrapersonal level affecting metabolism (i.e. basal metabolic rate) and general adiposity, however the current evidence varies on how big of a role genetics has in obesity, with some studies indicating that 50-70% of a person's BMI and adiposity is influenced by genetics (US Department of Health and Human Services, n.d.). Despite the influence of genetics on obesity, recent increases in weight in the American population is not driven by genetics alone as the genetic composition does not change as rapidly as the rates of obesity (US Department of Health and Human Services, n.d.). This strongly suggests that increases in childhood obesity are likely to be a result of behavioral or environmental factors and their interactions with genetics (US Department of Health and Human Services, n.d.).

In a biological sense, body weight is maintained via an energy balance system in which the amount of calories consumed is equivalent to amount of calories burned through physical exertion, adaptive thermogenesis, and basal metabolic rate. A positive energy balance, in which more calories are consumed than calories burned, results in obesity. Currently, most experts agree that the main drivers of overweight and obese status in children are excessive caloric intake paired with physical inactivity (Speiser, 2005). There has been a steady decline in physical activity among children with only 25% of adolescents reporting that they engage in regular exercise and 14% claiming they do not exercise at all (Speiser, 2005). It has also been shown that sedentary behaviors like watching television and playing on the computer are associated with increased prevalence of obesity and have become increasingly popular activities among children (Swinburn, 2002). In addition, eating patterns and behaviors of children and adolescents have changed dramatically in the past decades (Bowman, 2004). These changes include increases in the frequency of consumption of meals from restaurants, portion sizes, food availability, meal-skipping, and snacking that may help to explain the increase in obesity in children (Nicklas, 2001). The American culture has become characterized by increased consumption of less healthy food and physical inactivity largely promoted by the environment (CDC, 2012). Being exposed to these environments in their home, school, and/or community makes it more difficult for children and their parents to make healthy food choices and engage in an adequate amount of physical activity (CDC, 2012).

As childhood obesity rates continue to escalate, there has been a paralleled increase in concern for this issue (WHO, n.d.). An increase in amount of calories consumed and a decrease in the amount of physical activity performed by children has been noted over the past few decades and in turn has affected their weight status significantly (Dietz, 1999). Obesity has been found to have grave effects on children's health putting them at risk for a plethora of chronic diseases (Daniels, 2005) that could have impacts on their health for the rest of their lives (Daniels, 2005; Torgan, 2002; Whitaker, 1997; Maffeis, 2001). This increase not only affects the overweight or obese children, but also places a burden on the economy (CDC, 2008) especially in areas suffering from high unemployment rates. There are several factors that contribute to the augmentation of obesity rates, however most factors do not function independently and only focusing on one factor may not make a significant impact on the issue of childhood obesity.

*Health Disparities in Childhood Obesity*

While the overall prevalence of childhood obesity is rising, it is evident that some sectors of the population bear a greater burden of the costs and poor outcomes associated with childhood obesity. Not all groups of children are equally affected. Disparities in childhood obesity exist across racial/ethnic groups, socioeconomic status, parent's education, and geographic region (U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, n.d.; Wang, 2007)

There are considerable racial/ethnic disparities in obesity in children and young adults. According to data from NHANES (1999-2002), 21% of African American and 23% of Mexican American adolescents aged 12-19 obese compared to only 14% of Non-Hispanic white adolescents (Hedley, 2004). A similar obesity disproportionately also affects children aged 6-11 years old with obesity rates of 22 percent for Mexican Americans, 20 percent of African American, and 14 percent of Non-Hispanic whites (Hedley, 2004). Similar results have been found in other cross-national studies. Wang et al. also found Blacks and Mexican American children and adolescents found to be at a higher risk for obesity and overweight than their white counterparts (Hedley, 2004). Additionally this study found that African American girls and Mexican American girls were also found to be more likely to have a higher BMI than white girls when controlling for income and urban-rural residence (Hedley, 2004). It is evident the racial/ethnic disparities in obesity are clearly established by adolescence, especially for females, and that these disparities begin to emerge by 6 to 11 years of age (Hedley, 2004). Another cross-sectional study using data from the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B) even found that obesity prevalence differed by racial/ethnic groups among children at 4 years of age with American Indian/Native American having the highest provenance, followed by Hispanic and Non-Hispanic black children. The lowest prevalence was found in Non-Hispanic whites and Asian children (Anderson, 2009). There is research that also suggests that minority groups are more likely to remain obese into adulthood as well (Freedman, 2005), therefore, health disparities in childhood obesity among racial/ethnic groups should begin in early childhood to prevent racial/ ethnic disparities for obesity in adults and the associated negative risk factors.

Disparities in obesity are also apparent in regards to socioeconomic status (SES). While obesity has increased across all levels of SES, it is an important independent predictor for high overweight and obesity prevalence in U.S. children (Wang, 2007). SES is inversely related to obesity prevalence among Non-Hispanic Whites, but this negative relationship was not found among African Americans or Hispanics in regards to children (Wang, 2007). A recent study based on the NHANES 1999-2002 data, found that young boys of high SES had the lowest prevalence of obesity, but the SES differences in obesity prevalence among young girls was minor (Wang, 2006). Among adolescents, there was no association between SES and obesity for boys, but low-SES adolescent girls had a much higher prevalence of obesity than their male counterparts (Wang, 2006). High-SES Black adolescent girls were also at an increased risk with prevalence rates of 38% compared to their medium- and low-SES counterparts with rates of 18.7 percent and 24.5 percent, respectively (Wang, 2006).

Unlike race/ethnicity and SES little data exists on regional differences in obesity among children and adolescents in the United States. The NHANES III data showed that rural-urban differences were small and that they differences varied across age groups (Wang, 2007). In children 6-9 years old, the combined prevalence was higher in urban than in rural areas (26.1% compared to 22.8%), but the prevalence of overweight was almost the same (11.9% to 112.1%). However, among adolescents 10-18 years of age, the combined prevalence was slightly higher in rural than in urban areas (27.2% to 24.4%), but again the prevalence of overweight was similar between the two areas (11.2% compared to 10.2%) (Wang, 2007). Another study based on the Add Health study 1994-1995 baseline data, examined the differences in the risk of obesity and patterns of physical activity of US adolescents according to neighborhood characteristics (Nelson, 2006). Participants of this study were grouped into six categories: rural working class; exurban; newer suburban; upper-middle class, older suburban; mixed-ethnicity urban; and low-SES, inner-city areas (Nelson, 2006). US adolescents living in rural working-class, exurban, and mixed ethnicity urban areas were approximately 30% more likely to be overweight compared to those living in newer suburbs (Nelson, 2006). Although there is insufficient evidence to support geographic disparities for childhood obesity, as previously mentioned, evidence exists to suggest that there are disparities in the built environment that could affect obesity prevalence in certain regions, but further research is necessary. This study addresses an important gap in the current disparities literature by examining potential impacts of the food environment across rural and urban residents.

*Built Environment*

Recent attempts to understand the childhood obesity epidemic have shifted focused from intervening on the individual level to determining the role of the “built environment” in obesity. The built environment may be defined as the physical or human-made surroundings that influence dietary intake or energy expenditure, such as restaurants, grocery stores, or playgrounds (Papas, 2007). These surroundings can both positively and negatively influence healthy dietary behaviors and the amount of activity a person is likely to engage in (Ball, 2006). Using a social ecological framework, many experts now assent that the built environment must be taken into consideration when addressing the obesity issue (McKinnon, 2009) largely because to the influence it has on obesity.

The built environment consists of both physical activity opportunities and food outlets. The physical activity environment is composed of 3 elements: physical design, land use, and transportation systems (Handy, 2009). Research on built environments and physical activity suggest that different domains of physical activity (e.g., leisure and transportation) are affected by different environmental attributes (Giles, 2005; King, 2006; Owen, 2004). Leisure physical activity is most affected by availability of public and private recreation facilities and their characteristics, such as gyms, playgrounds, and parks (Kahn, 2002). Transportation physical activity is most related to the distance and directness of routes from home to destinations (referred to as walkability) as well as characteristics of the walking infrastructure, including sidewalks, bicycle lanes, and trails, as well as social environmental factors, such as perceived safety (Heath, 2006). There is a growing body of evidence that indicates that racial and ethnic minority and low-income neighborhoods have less built and social environmental supports for physical activity (Sallis, 2006), which may be contributing to the health disparities among these disadvantaged groups.

Another subset of the built environment is the food environment, representing the opportunities within a defined area to obtain food for purchase or consumption (Townshed, 2009). The food environment includes both food stores (e.g., grocery stores and convenience stores) and restaurants (e.g., fast food and full-service restaurants) (Townshed, 2009). Due to our reliance on this environment for sustenance, an understanding of the food environment is important to inform intervention or policy that aims to address childhood obesity.

Americans currently report spending almost half of their budget for food on away-from-home food and it has been noted that consumption of food away from home has risen (National Restaurant Association 2008). In addition, in 2008, 45% of U.S. adults disclosed that restaurants are an essential part of their lifestyle (National Restaurant Association, 2008). The rise in consumption of food away from home includes parents and families alike. A study conducted to examine the prevalence of fast-food purchases for family meals found that the majority of parents surveyed reported purchasing food prepared away from home for a family meal one or more times a week (Boutelle, 2007). Another study found that parents of families who ate at restaurants at least weekly reported that their children consumed more sugar-sweetened beverages, more snacks high in sugar and fat, and less water compared with families that did not consume food away from home as often (Ayala, 2008). It is well documented in the literature that the consumption of foods prepared outside of the home is associated with greater weight gain and obesity in both adults and children (Ayala, 2008; Bowman, 2004; Thompson, 2004; McCrory, 1999). Due to this increase in away-from-home food consumption and the negative impact on dietary quality, what is available for children at restaurants is important. Although many restaurants offer children's menus, the availability of healthy options may be limited on these menus (O'Donnell, 2008).

Given the rise of food eaten away from home and the increased focus on environmental influences for obesity, the food environment in general has been associated with increased obesity rates in adults (Swinburn 2004; French 2001). In an attempt to understand the relationship between obesity and the food environment, studies often measure the access to food, such as the distance to the nearest food store or restaurant, or the density of food outlets within an area (Papas, 2007). There is a great deal of literature to support the relationship between exposure to fast food restaurants and obesity, however a limited number of these studies focus on children (Fraser, 2010). Of those studies that do focus on childhood obesity, the connection between fast food restaurants and obesity is inconclusive. For example, Davis and colleagues found that adolescent students who attended school with fast-food restaurants within a one half mile of their school, consumed less fruits and vegetables, more sugar-sweetened beverages, and were more likely to be overweight compared to adolescents who attended a school that was not near fast food restaurants (Davis, 2009). Similarly, a study of elementary and middle school students found those who resided within 1/10 or 1/4 of a mile from a fast food restaurant had significantly higher BMI values (Mellor, 2011). However, there was no association between BMI and non non-fast food restaurants (Mellor, 2011). On the other hand, a number of studies observe no relationship between proximity to fast food and obesity in children (Jeffrey, 2006; Sturm, 2005; Crawford, 2008). In a 2006 study, accessibility defined as the number of restaurants within a 2-mile radius from the home was not predictive of frequency of "fast food" restaurant usage (Jeffrey, 2006). However, it was predictive of the frequency of reported overall restaurant usage, including "non-fast food" restaurants (Jeffrey, 2006). In this same study, the number of restaurants within the 2-mile buffer was not associated with BMI (Jeffrey, 2006).

A related avenue of research explores the cost of food and how it may impact obesity. In the food environment literature, this is most often conceptualized as 'extra' expense of healthy food options. In an analysis of food price increases between 1985-2000, it was found that the cost of sweets, fats, and sugar-sweetened beverages fell substantially when compared to fresh vegetables and fruits (US Department of Argiculture, n.d.). Healthy diets can be constructed from inexpensive food items such as dry legumes, peanuts, and canned fish, but such diets were shown to score low in taste, enjoyment, variety, and convenience (Blaylock, 1999). As the cost of healthy options increase, consumers of low socioeconomic status may be inclined select energy-dense foods that are highly refined, with added sugars, high fat and low fiber due to limited resources (Papas, 2007).

Evidence has also been found that disadvantaged groups are more likely to live in obesogenic environments with respect to the lack of availability of opportunities to purchase healthy food (Larson, 2009). Although inconclusive, the current literature suggests that those that reside in neighborhoods with better access to grocery stores and limited access to convenience stores, which tend to have less healthy food options, tend to consume healthier diets and have lower prevalence of obesity (Larson, 2009). Additionally, some evidence exists to suggest that residents in neighborhoods with low availability of fast food restaurants eat healthier foods and had lower levels of obesity (Larson, 2009). Numerous studies across the United States suggest that residents of minority, low-income, and rural neighborhoods are more likely to have poor access to grocery stores and healthy food options and greater access to fast food restaurants and energy-dense foods (Powell, 2007; Kaufman 1998; Sharkey, 2008; Moore, 2006; Morland, 2002; Morland, 2007; Sloane, 2003).

As stated previously, excessive caloric intake is one half of the energy balance equation and data have shown that access to food may impact obesity and dietary quality. Given the early evidence that food away from home may be more calorically dense and nutrient poor, the frequency and type of food that families consume away from home is important. Determining the degree to which children's menus consist of food that is energy rich and nutrient poor may be important for effective behavioral choice by children or their parents. Research by Ebbeling et al. (2002) indicates that fast food has several dietary features that may be the cause of the excessive weight gain seen in children. This includes food that is high in saturated and trans fats and energy dense, but low in fiber and large portion sizes (Ebbeling, 2002). A study conducted by Bowman et al. (2004) reviewed the effects of fast-food consumption on children's quality of diet and found that fast food consumption was associated with adverse effects that could possibly increase the risk of obesity for children (Bowman, 2004). In this study, 30% of children reported consuming fast food daily (Bowman, 2004). Fast-food consumption was high for both genders, all racial/ethnic groups, and in all regions of the country. Increased fast-food consumption was independently associated with males, higher incomes, Blacks, and residing in the South, when controlling for socioeconomic and demographic variables (Bowman, 2004). Children who consumed fast food were found to consume more total and saturated fat, more total carbohydrates, less fiber, more added sugars, more sugar-sweetened beverages, less milk, and fewer fruits and non-starchy vegetables (Bowman, 2004). Moreover, children who ate fast food consumed 29-38% of their total energy from fast food dependent on age. When compared to children who do not regularly consume fast-food, total energy intake was ~63 kcal (3.6%) greater per day in 4- to 8- year olds, 132 kcal or greater (6.4%) in 9- to 13- year olds, and 379 kcal or greater (16.8%) in 14 to 19- year olds (Bowman, 2004). To regain energy balance, it would take between 1-2 hours of vigorous activity by children to counteract a single large-sized (i.e. >=785 kcal) children's meal at a fast food restaurant (Styne, 2005). Frequent consumption of these meals, or consumption of fast food for more than one meal would make it very difficult to achieve energy balance with physical activity by the average child (Styne, 2005). An increase in calories consumption for those who report consuming fast food can be expected due to the fact that as children get older, they have more autonomy in making food choices (Lytle, 2000). Additionally, one study found that the consumption of fast food is negatively associated with physical activity (Jeffery, 2006). The findings of these studies suggest that the local food environment, in particular fast food consumption, may be one factor contributing to the current obesity epidemic in children.

### *Menu Labeling*

Although the number of restaurants in the U.S. that provide nutrition information has increased over the past decade, the majority of restaurants do not label the menu to provide nutrition information at the point of purchase (Wootan, 2006; Wootan, 2006). Consumers have been shown to underestimate the number of calories and fat in foods purchased away from home and errors tend to be greater for food items that are high in calories or when ordering menu items that are promoted as healthy by the establishment (Chandon, 2007; Burton, 2006).

Research in adults illustrates the difficulty in accurately estimating the amount of calories in restaurant foods as shown in a study conducted by Burton et al. (2006) which provided 193 adult consumers with serving size information, as well as brief descriptions for nine common restaurant menu items with varied levels of calories and fat (Burton, 2006). The study found that 73% of consumers underestimated the number of calories in light entrees by an average of 43 calories where the light entrees ranged from 370 to 543 calories. For less-healthy entrees, 93% of consumers underestimated the number of calories by an average of 642 calories when entrees actually contained 930 to 1660 total calories (Burton). Health claims made by food establishments were also found to lead consumers to underestimate the number of calories in entrees and order side dishes, drinks, or desserts that are higher in calorie (Chandon, 2007). A study in which consumers (n=316) were approached and asked to estimate the amount of calories in two sandwiches containing the same number of calories—one from a restaurant menu promoted as healthy (Subway), and the other from a burger-and-fries restaurant menu (McDonald) found that of those surveyed, consumers who reported paying little attention to nutrition information underestimated the number of calories in the 600-calorie sandwich by 247 calories when it was listed on a menu from a "healthy" restaurant, compared to only 40 calories when listed on a menu from a burger-and-fries restaurant (Chandon, 2007). Among consumers who reported that they pay close attention to nutrition information, results found that these consumers were similarly biased, but their estimations were higher and more accurate of the actual calories contained the in sandwiches from both food establishments (Chandon, 2007). These studies show that it is difficult for consumers to estimate the amount of calories when purchasing restaurant foods and that promoting menus as healthy may lead to even greater error for estimation.

Little research has been conducted on menu labeling for children when purchasing food away from home. One study conducted by Tandon et al. (2010) was the first to test the impact of nutrition labeling on fast food choices for children. This randomized, controlled experiment enrolled 99 parents with children 3 to 6 years of age. Participants were provided a menu from a McDonald's restaurant and were asked to select what they would order for themselves and their children. The intervention group was provided a menu with nutrition information, but otherwise, both menus were identical. Parents provided the nutrition information ordered an average of 102 fewer calories for their children when compared to the control group (567 vs. 671 cal; p= 0.04) (Tandon, 2010). The results of this study suggest that nutrition information can play a role in the decision making process of parents in choosing food items for children. Overall, requiring restaurants to provide nutrition information at the point of purchase may impact consumer's choices and could lead to the introduction of healthier menu options by restaurants, in turn helping to reduce the prevalence of obesity (Levy, 1996).

Based on the current literature it is apparent that childhood obesity has reached epidemic proportions. For this reason, it is critical that prevention targets the root causes of obesity. Two primary factors of childhood obesity are lack of physical activity and poor nutrition. It is has become increasingly apparent that the built environment can determine the level of exposure to these risk factors. Disadvantaged groups possess higher prevalence of obesity and tend to reside in environments that are more likely to promote unhealthy choices and behaviors (Larson, 2009). The food environment may be of particular importance due to the large amount of away-from-home food currently consumed regularly in our society, especially by children (National Restaurant Association, 2008; Boutelle, 2007; Fulkerson, 2007). Consumption of this food has been associated with increased caloric intake, increased BMI, and poor dietary quality (Ebbeling, 2002; Bowman, 2004). Menu labeling may help improve dietary quality as it has been suggested to promote healthier choices by consumers when purchasing foods (Chandon, 2007), as well as promoting healthier options provided by food outlets (Levy, 1996).

**Specific Aims & Hypothesis**

***Research question****: What does children's food environment of the Dan River region look like?*

The overall purpose of the proposed research is to describe the food environment for children in the health disparate Dan River Region using the Children's Menu Assessment (CMA) (Krukowski, 2011). We hypothesize that there will be low availability of healthy food options targeted at children in this region.

***Research question****: How does the children's food environment compare to the adult's food environment? Is there a correlation between adults and children's menus for healthy option availability at the same food outlets?*

Additionally, we aim to compare the healthy option availability of children's menus to adults menus audited with the Nutrition Environment Measures Survey (NEMS) at the same food outlets (Saelens, 2007). No previous studies have compared the health options available on both the children's and adult's menus. Therefore, we assume the null hypothesis that there will be no significant difference between the two menus in terms of healthy food availability.

***Research question****: Does healthy food availability for children differ between rural and urban areas?*

Third, we aim to compare rural and urban areas to determine if the availability of healthy food options differs among geographic region. We hypothesize that there will be less healthy food options for children in rural areas.

***Research question****: Are there differences among block group races in the availability of healthy food options offered on children's menu?*

Lastly, we aim to determine if there are differences in availability of healthy menu options for children based on block group race. We hypothesize a difference exists among socio-demographics and that there will be less healthy food availability options for children living in predominately black or mixed race block groups.

## Methods

*Study Area*
The Dan River Region is a predominantly rural region that includes the city of Danville, Pittsylvania County and Henry County in Virginia, as well as Caswell County, North Carolina. This rural region covers 1,700 square miles and is anchored by one regional city (approximately 45,000 residents). In the region, approximately 50% of the population is female and 27% are black (US Census Bureau, 2009). This region suffers considerably from the current economic recession with unemployment rates double the state and national averages (US Department of Labor, 2011). In the region, 16.5% live below the Federal Poverty Level and only 9% possess a bachelor's degree (US Census Bureau, 2009). Additionally, the US Department of Health and Human Services designated these counties as a medically underserved region (US Department of Health and Human Services, 1997).

*Systematic Audits using CMA*

This project utilizes the Children's Menu Assessment (CMA), an expansion of the Nutrition Environment Measures Survey-Restaurant (NEMS-R) (Saelens, 2007). The CMA was developed by Krukowski et al. in Little Rock, Arkansas (Krukowski, 2011). The initial calibration conducted in the Little Rock area demonstrated high inter-rater reliability and test-retest reliability for this tool (Krukowski, 2011).

*Enumeration of Food Outlets*

This study was conducted concurrently with the NEMS-R study for this region to assess the overall food environment for the region under question. Food establishments were enumerated in this region from a list collected by the research team via searchable database from the Virginia's Department of Health and Caswell County's Environmental Health offices (Hill, 2012; Chau, 2013). In addition, an online business directory verified the sate and county lists, and any outlets that were found on the directory were added to the database. While auditing the food establishments from this list, CMA was conducted in the restaurants that also offered a children's menu. See Figure 1 for details regarding the number of outlets.

*Training of Auditors and Fieldwork*

All research assistants had previously been trained and certified with the NEMS-R tool (Chau, 2013; Saelens, 2007) and received specialized training on the CMA tool. A total of 4 undergraduate research assistants and 2 graduate research assistants were trained in CMA for the duration of the study. Research assistants were instructed to read the original CMA article, then received training through an oral presentation, written information and field practice. Researchers then practiced with children's menus that were previously collected from local restaurants and discrepancies were discussed to ensure auditors were following the guidelines for assessment and were in agreement.

Some questions were encountered during fieldwork and training in assessing the children's menu and there was insufficient detail to be able to classify menu items as healthy or not. To clarify uncertainty, definitions established by the NEMS-R tool were utilized and all auditors were trained on these definitions. Items are assumed to be unhealthy unless the menu provides information that contradicts this claim (i.e., steamed) or if the item is naturally healthy (i.e., fresh fruit) (Krukowski, 2011). These assumptions and guidelines are necessary due to the lack of nutrition information for consumers when selecting meals from the menu, thus simulating a realistic dining experience for the average consumer.

After didactic training, all auditors practiced with the tool in the field in Blacksburg, Virginia to ensure a consistent inter-rater reliability before conducting the assessments in study area. Auditors visited 5 pre-selected local establishments to complete audits and data was entered into SPSS 20.0 Kappa statistics were calculated for all practice audits and a threshold of 0.60 was required by each auditor to be certified for CMA data collection. After the initial field practice, a debriefing occurred and all questions that arose during in-field practice were addressed and resolved. By the end of training, all auditors surpassed the 0.60 kappa threshold and were certified for data collection.

*Data Collection*

After all research assistants completed certification, auditing in the study area ensued. Two independent research assistants conducted audits on the children's menus at each of the previously selected restaurants and all food outlets in the Dan River Region offering a children's menu were audited. Each rater was required to track the date the outlets that were visited and document reasons for any outlets that were not audited (i.e. out of business, closed, did not offer a children's menu, etc.). Outlets that were not open at the time of visit were revisited and audited at a later date. All field notes were compiled into one tracking sheet. If auditors encountered an outlet during auditing that was not on the previously enumerated list of outlets and it offered a children's menu, an audit was performed and the outlet was added to the sample. Audit sheets were collected following each trip to the study region and were checked ensure completeness.

Kappa statistics were computed for each food outlet audited to determine inter-rater reliability. An a-priori kappa value of >0.60 was set and scores lower than this threshold would warrant a re-audit. However, no food outlets required re-auditing. Inter-rater reliability was high with a mean kappa coefficient of 0.946 and all kappas above 0.60. Kappa values ranged from 0.63 to 1.00 with a mode of 1.00.

*Scoring of CMA*

The CMA consists of 29 items total. Of the 29 items, 21 are scored menu items (i.e. availability of healthier or less healthy items) and eight are descriptive items (i.e. restaurant type, cuisine type, targeted age for children's menu). The CMA expands upon the NEMS-R by including greater quantification of healthy food items, assessment of whether soda is specifically included on the children's menu, an extended examination of healthy side dishes, and the presence of a food marketing/toys for children's meals. Other new additions to the CMA are assessments of the availability of whole grains, fruits and vegetables, lower fat or lower sugar options, and non-fried foods (Krukowski, 2011). See Appendix C for complete Children's Menu Assessment survey.

The scoring system provided information on the availability of healthy options. Possible scores ranged from -5 to 21 with higher scores indicating greater availability of healthy menu options for children (Krukowski, 2011). Points (0,1, or 2) were given to menus based of the amount of healthier entrees, salads, and wholes grains, as well as the presence of healthier beverages, side dishes, desserts, and salad dressing (Krukowski, 2011). Points were deducted (-1) for soda, free refills on sugary beverages, unhealthy desserts, and the use of toys or marketing (Krukowski, 2011). The scores were totaled up for each assessment and an overall score was given to each restaurant.

*Block Group Data*

For all counties, block group level socio-demographic characteristics were determined by the 2010 Census data for race. Census data provides detailed demographic data with a hierarchy starting at the largest population (nation) and divided to smaller parts (regions, divisions, states, counties, census tracts) down to the block group level (US Census Bureau, 2010). The block group level (BG) is a collection of census blocks within a census tract (US Census Bureau, 2001). The 2010 Census Data divides the Dan River Region into 157 block groups (US Census Bureau, 2010) (78). Based on census data, nearly 95% of the population is Black or White. It had been previous determined through a sensitivity analysis that 55% was sufficient as an appropriate cut point for block race determination (Chau, 2013; Hill, 2012). Therefore, a block group with >55% of a single race, was classified as predominantly "White" or "Black" (Chau, 2013; Hill, 2012). All other races were collapsed into one category. Block groups were categorized as predominantly Black, predominantly White, or Mixed. The Mixed category was used to distinguish block groups that were not predominantly White or Black and/or had a large percentage of other minorities.

## Analytic Plan

The audit responses were coded and entered into Statistical Package for Social Sciences (SPSS®) 20.0. Entered data was double-checked by two research assistants and errors in data entry were corrected prior to analysis. Given the high inter-rater reliability among auditors, a random-delete strategy was used to eliminate one audit for each outlet in order to obtain the final data set for scoring and analysis. Descriptive statistics such as range, mean, and percentages were calculated for the number of restaurants offering a children's menu; restaurant type; age targeted for the children's menu; nutrition guidance; and entrée side dish, dessert, and beverage categories. One-way analysis of variance (ANOVA) tested for mean differences in healthy availability scores by geographic location and block group race.

## Results

A total of 137 restaurants offered a children's menu and provided a copy of the menu to complete the audit from the 483 that were originally audited with the Nutrition Environmental Measures (NEMS) in the Dan River Region. Thirteen percent of the outlets were fast-casual restaurants (n=18), 37% fast-food restaurants (n=51), and 50% sit-down restaurants (n=68). The majority (61%; n=84) of the restaurants did not specify an age range for which the children's menu was intended, 29% specified that their children's menu was for children ages 12 and under (n=40), 9% specified that their children's menu was for ages 10 and under, and only 1 restaurant specified that their children's menu was for customers 8 years of age and under.

Restaurants presented an average of $5.0 \pm 2.0$ (range= 1 to 14) total entrees on the children's menu. Only 11% of restaurants included at least one healthy entrée (max= 4) among the entrees that were offered on the children's menu, and only about 9% (n=12) offered a non-fried vegetable side item and 39% (n=54) offered fruit, although only 23.4% (n=32) of restaurants offered fruit without added sugar. Only 7.3% (n=10) included a dessert as part of the children's meal, however, no restaurants offered healthy desserts (ie, low-fat, sugar-free ice cream). Almost a third of the restaurants included a toy in the children's meal (29%; n=30), however only 8% (n=11) used branded marketing to promote their children's meal.

In addition, 29% (n=39) of restaurants specifically identified soda as the beverage option on the children's menu, and only a third of restaurants (32.8%; n=45) offered a healthier beverage substitution in lieu of a sugar-sweetened beverage. Although half of the restaurants offered milk, only a quarter of the restaurants offered low-fat and/or skim milk as a beverage option for children. Additionally, 40% of restaurants (n=55) offered juice as a beverage option for children, but very few (15%; n=20) offered 100% juice as an option. Table 1 presents this information, as well as the proportion of children's menus that offered other items of interest.

Scores on overall children's menu assessments ranged from -4 to 9 with a mean score of $1.6 \pm 2.7$. The total health availability scores for the children's menu not including the branded marketing and toy point deductions were also calculated. This score was $1.9 \pm 2.9$ ranging from -3 to 11. Scores were also compared among type of restaurant. The mean score for fast casual restaurants was $5.0 \pm 3.7$, which was the highest among the different types. Fast food and sit-down restaurants had mean scores of $1.3 \pm 2.2$ and $0.8 \pm 2.1$, respectively. One-way ANOVAs tested for significant difference in scores among restaurant type. Fast-casual restaurants had a statistically significant difference between fast food and sit-down restaurants ($F=22.4$, $p<0.001$).

A Pearson correlation compared the availability of healthy options of the adult's menus to the children's menus. The correlation was significant between the two menus ($r=0.641$, $p<0.001$). Pearson Chi-Squares were computed to determine differences between nutrition labeling on the adult and children menus at the same outlets. Nutrition labeling was not significantly different between the two menus ($X^2$=2.64, p=0.104).

Table 2 presents the mean scores by geographic location for overall CMA score, healthy entrees, and whole grains. Overall CMA scores with and without the toy and marketing point deductions were not significantly different between urban (n=76) and rural areas (n=61). The healthy entrée ratio score was higher in urban areas than rural areas (F=4.45, p<0.05). On the other hand, the whole grain ratio score was higher in rural areas when compared to urban (F=4.39, p<0.05). Nutrition labeling was also evaluated between urban and rural areas, but was not significantly different by location.

Predominately White block groups had a higher number of outlets (n=34), followed by Mixed (n=6), and predominantly Black (n=12) block groups. As presented in table 3, overall CMA scores were low across all block groups. Scores were lowest in the predominantly Black block groups (0.2$\pm$0.4) when compared to the predominately White block groups (1.4$\pm$1.6) and Mixed block groups (2.6$\pm$2.4). Predominantly Black block groups had significantly lower scores than the Mixed block groups (F=4.3; p<0.05). Given the number of low CMA scores, block group race medians were also calculated. Similar results were found with predominantly Black block groups possessing the lowest scores (0.0$\pm$0.0) followed by predominantly White block groups (1.2$\pm$1.6) and Mixed block group scores (2.3$\pm$2.6). Again, predominantly Black block groups were found to be significantly different from the Mixed block groups (F=3.25, p<0.05).

**Discussion**

Our results indicate that the food environment of the Dan River Region lacks healthy options for children based on children's menu review. Only a third of the outlets in this region offered a children's menu. Of those outlets, few offered healthy entrees for children. Similar to the original CMA article, the overall scores for the CMA for this study were within the lower third of the range and a third of the restaurants for both studies specifically identified soda as a drink option on their children's menu. There was also a lack of menu labeling on children's menus in both studies (Krukowski, 2012). There were no restaurants that offered healthy desserts; similarly Krukowski et al. only encountered one outlet that offered a healthy dessert option (Krukowksi, 2012). Similar studies in the Dan River Region on adult's food environment found comparable results in terms of a lack of healthy food options (Chau, 2013).

The protocol for the CMA is based on what is described or listed on the menu because this is what the consumer would observe in order to select a food item. Only two restaurants provided nutrition information on their children's menus, consistent with previous literature that the majority of restaurants do not provide labeled menus (Wootan, 2006). Additionally, few restaurants had healthy alternatives on their children's menus. According to the protocol, this was determined if the auditor was able to distinguish that the sides were not fried and no creams or sauces were served with the side that would make it unhealthy. Lack of information on children's menus made it difficult to determine healthfulness of menu items. Nearly one-third of restaurants specifically included soda as a beverage of choice for children, only a quarter of restaurants offered low-fat milk as a beverage option, and even fewer offered 100% juice. This is concerning given the well-documented increase in sugar-sweetened beverages consumed by children, particularly those who consume more food away from home than their counterparts (Ayala, 2008).

Overall CMA scores were consistently low across all restaurant types. It was not surprising that fast-food restaurants had lower overall scores, than fast-casual restaurants, however, sit-down restaurants had the worst scores and were statistically different from the fast casual. This indicates that sit-down restaurants may not be the healthiest option when choosing to consume food away from home and nutrition labeling is imperative for consumers to accurately assess the nutrition value when purchasing food (Chandon, 2007).

When compared to the adult's menus at the same outlets, the children's menu is highly correlated. It would be expected that the CMA would be correlated to the NEMS-R because the CMA was developed as an expansion of the NEMS-R. This is an area that needs to be further investigated given the recent increases in childhood obesity (Ogden, 2002). There was no significant difference in nutrition labeling between adult's menus and children's menus, however, there were 17 adult's menus and only 2 children's menus that listed nutrition information on the menu. This could have affected the results and a larger sample may be needed to detect differences between the food environments. No other studies have compared the food environments of both adults and children; therefore, there is not literature with which to compare the findings of this study.

The overall CMA scores between urban and rural locations were not statistically different, however, there were differences among healthy entrée and whole grain. Urban areas had higher scores of healthy entrée options, whereas rural areas had higher scores for whole grain. Again, since this study was one of the few studies to evaluate the children's food environment in this way, there are no other results comparable to determine if these findings are to be expected. Overall, our study region is predominantly rural which can affect the results when looking at differences between geographic locations.

The predominantly Black block group had a lower average CMA score than predominantly White and Mixed block groups. In addition, the predominantly Black block groups had statistically significant differences in CMA scores from Mixed block groups. These results add to the body of literature that supports disparities in the availability of healthy food options for disadvantaged populations (Chau, 2013; Larson, 2009; Sharkey, 2008).

*Limitations*

This study is not without limitations. It cannot be determined that because a children's menu is offered, that parents will order for their children from this menu. In addition, although children's menus were offered at 137 outlets, this was only a small portion of the outlets in this region, thus we have no ability to know what children are consuming at those outlets without a children's menu as we know that families still visit and purchase food at these outlets. However, based on other studies in the region we know there is a general lack of healthy options available on the adult's menus as well (Chau, 2013). However, our study shows that the food that is being promoted for children is relatively unhealthy and may be contributing to poor dietary quality and childhood obesity. Additionally, the sample size is small with only 137 outlets offering children's menus. This may limit our ability to detect statistical differences due to reduced power. This number of food outlets represents all the restaurants in this region that offer a children's menu, not a selected sample therefore the data does present what is be available for children in the region.

The CMA has not been widely used by many studies since it's development in 2011, thus making it difficult to compare the results obtained from this study to other study regions. The CMA was developed as an expansion of the NEMS-R, thus it is beneficial to compare it to the NEMS-R in evaluation. This study does provide additional information to support the use of the CMA in evaluating one piece of the food environment (Krukowksi, 2011).

**Future Directions**

As previously mentioned, very few studies have used the CMA to assess the children's food environment. Additional studies utilizing the CMA are necessary to establish the reliability of the CMA in a variety of settings. There is also a need for more research evaluating the adult's menus and children's menus to determine how the health availability of these two menus compares. It would also be advantageous to investigate the purchasing behavior of adults and children to see what is being purchased for children and what is in demand.

Aligning with an ecological approach, this study gathered data at the community level and can now be used to intervene at other levels (Glanz, 2008). These findings can be applied at the individual level to devise better ways to educate parents and children when consuming food away from home or in advising them to consume more healthful food prepared at home. In addition, the results of this study could be used to partner with local food establishments in the region to improve quality of food on the children's menus. Furthermore, these findings will help inform ongoing and future interventions on childhood obesity in the region.

The results of this study will be disseminated to the members of the DRPHC and community stakeholders. The Dan River Region suffers from a great deal of health disparities and has several disadvantaged groups of different race, socioeconomic status, and low educational attainment (US Census Bureau, 2009). As a result, children in this region are at an increased risk for obesity and related health conditions. The DRPHC established childhood obesity as an immense concern for their region (Zoellner, 2012). The poor food environment was also determined an area of concern as adds to the high obesity rates. The results of this study present evidence that there is a lack of healthy food options in this region for children and provide compelling reasoning to implement change in this region. Community stakeholders and research staff will determine the degree to which this data is useful and how to disseminate these findings with community members. Only a small number of studies make use of the results in the community in which the data was initially gathered. The use of this data may influence local public policy in improving the children's food environment or lead to sustainable interventions that could impact childhood obesity in this region.

## References


1. Anderson SE, Whitaker RC. (2009). Prevalence of Obesity Among US Preschool Children in Different Racial and Ethnic Groups. *Arch Pediatr Adolesc Med,* 163(4), 344-348.
2. Ayala GX, Rogers M, Campbell NR, Elder, JP. (2008). Away-from-home food intake and risk for obesity: Examining the influence of context. *Obesity,* 16, 1002-1008.
3. Ball K, Timperio AF, Crawford DA. (2006). Understanding environmental influences on nutrition and physical activity behaviors: Where should we look and what should we count? *Int J Behav Nutr Phys Act,* 3, 33.
4. Barlow SE and the Expert Committee. (2007). Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics,* 120, 164-192.
5. Blaylock J, Smallwood D, Kassel K, Variyam J, Aldrich L. (1999). Economics, food choices, and nutrition. Food Policy, 24, 269–86.
6. Boutelle K, Fulkerson J, Neumark-Sztainer D, et al. (2007). "Fast Food for Family Meals: Relationships with Parent and Adolescent Food Intake, Home Food Environment and Weight Status." *Public Health Nutrition,* 10(1), 16–23.
7. Bowman SA, Gortmaker SL, Ebbeling CB, Pereira MA, Ludwig DS. (2004). Effects of fast-food consumption on energy intake and diet quality among children in a national household survey. *Pediatrics*, 113, 112–118.
8. Bowman S and Vinyard B. (2004). Fast Food Consumption of U.S. Adults: Impact on Energy and Nutrient Intakes and Overweight Status. *J Am Coll Nutr,* 23(2), 163–168.
9. Burton S, Creyer E, Kees J, Huggins K. (2006). Attacking the Obesity Epidemic: The Potential Health Benefits of Providing Nutrition Information in Restaurants. *American Journal of Public Health,* 96(9), 1669–1675.
10. Centers for Disease Control and Prevention. (2011). *Childhood obesity facts*. Retrieved from http://www.cdc.gov/ healthyyouth/obesity/facts.htm.
11. Centers for Disease Control and Prevention. (2008). *Preventing Chronic Diseases: Investing Wisely in Health*. Retrieved from http://www.cdc.gov/nccdphp/publications/ factsheets/prevention/pdf/obesity.pdf
12. Centers for Disease Control and Prevention. (2012) A Growing Problem. Retrieved from http://www.cdc.gov/obesity/childhood/problem.html.
13. Chandon P and Wansink B. (2007). The Biasing Health Halos of Fast-Food Restaurant Health Claims: Lower Calorie Estimates and Higher Side-Dish Consumption Intentions. *Journal of Consumer Research,* 34(3), 301–314.
14. Chau CN, Zoellner JM, Hill JL. (2013). Availability of healthy food: Does block group race and income matter? J Hunger Environ Nutr. 8:22-38.
15. Crawford D, Timperio A, Salmon J, Baur L, Giles-Corti B, Roberts R, Jackson M, Andrianopoulos N, Ball K. (2008) Neighborhood fast food outlets and obesity in children and adults: the CLAN study. *Int J Pediatr Obes*, **3**, 249–256.

16. Darmon, N., Briend, A. & Drewnowski, A. (2004) Energy-dense diets are associated with lower diet costs: A community study of French adults. Publ. Health Nutr. 7:21-27.
17. Daniels SR, Arnett DK, Eckel RH. (2005). Overweight in children and adolescents: pathophysiology, consequences, prevention, and treatment. *Circulation*, 11, 1999-2002.
18. Danville Regional Foundation. (2011). 2010 Regional Report Card. Retrieved from http://www.drfonline.org/region/report_ card.php.
19. Davis B, Carpenter C. (2009). Proximity of fast-food restaurants to schools and adolescent obesity. *Am J Public Health*, 99, 505–510.
20. Davison, K. K. and Birch, L. L. (2001), Childhood overweight: a contextual model and recommendations for future research. Obesity Reviews, 2: 159–171.
21. Dehghan M, Akhtar-Danesh N, and Merchant AT. (2005). *Childhood obesity, Prevalence and Prevention*. *Nutrition Journal,* 4, 24.
22. Dietz WH, Bellizzi MC. (1999). Introduction: the use of body mass index to assess obesity in children. *Am J Clin Nutr,* 70, 123S-125S.
23. Ebbeling CB, Pawlak DB, Ludwig DS. (2002). Childhood obesity: public-health crisis, common sense cure. *Lancet,* 360*,* 473– 482.
24. Fraser LK, Edwards KL, Cade J, Clark GP. (2010). The geography of fast food outlets: a review. Int J Environ Res Public Health 7, 2290–2308.
25. Freedman DS, Khan LK, Serdula MK, Dietz WH, Srinivasan SR and Berenson GS. (2005). Racial differences in the tracking of childhood BMI to adulthood. Obes Res, 13, 928–935.
26. French, S. A., Story, M. & Jeffery, R. W. (2001) Environmental influences on eating and physical activity. Annu. Rev. Public Health 22:309-335.
27. Giles-Corti B, Timperio A, Bull F, Pikora T. (2005). Understanding physical activity environmental correlates: increased specificity for ecological models. Exerc Sport Sci Rev, 33(4), 175–81.
28. Glanz K, Rimer BK, Viswanath K. (2008). Health Behavior and Health Education: theory, research, and practice. 4th ed. San Francisco: Jossey-Bass.
29. Handy S, Clifton K. (2007). Planning and the built environment: implications for obesity prevention.. Handbook of obesity prevention. A resource for health professionals. Springer; New York.
30. Heath GW, Brownson RC, Kruger J. (2006). The effectiveness of urban design and land-use and transport policies and practices to increase physical activity: a systematic review. J Phys Act Health, 3(1S), S55–S76.
31. Hedley, AA, Ogden, CL, Johnson, CL, Carroll, MD, Curtin, LR, Flegal, KM. (2004). Overweight and obesity among US children, adolescents, and adults, 1999-2002. *JAMA*, 291, 2847-50.
32. Hill, J. L., Chau, C., Luebbering, C. R., Kolivras, K. K., & Zoellner, J. (2012). Does availability of physical activity and food outlets differ by race and income? Findings from an enumeration study in a health disparate region. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 105.

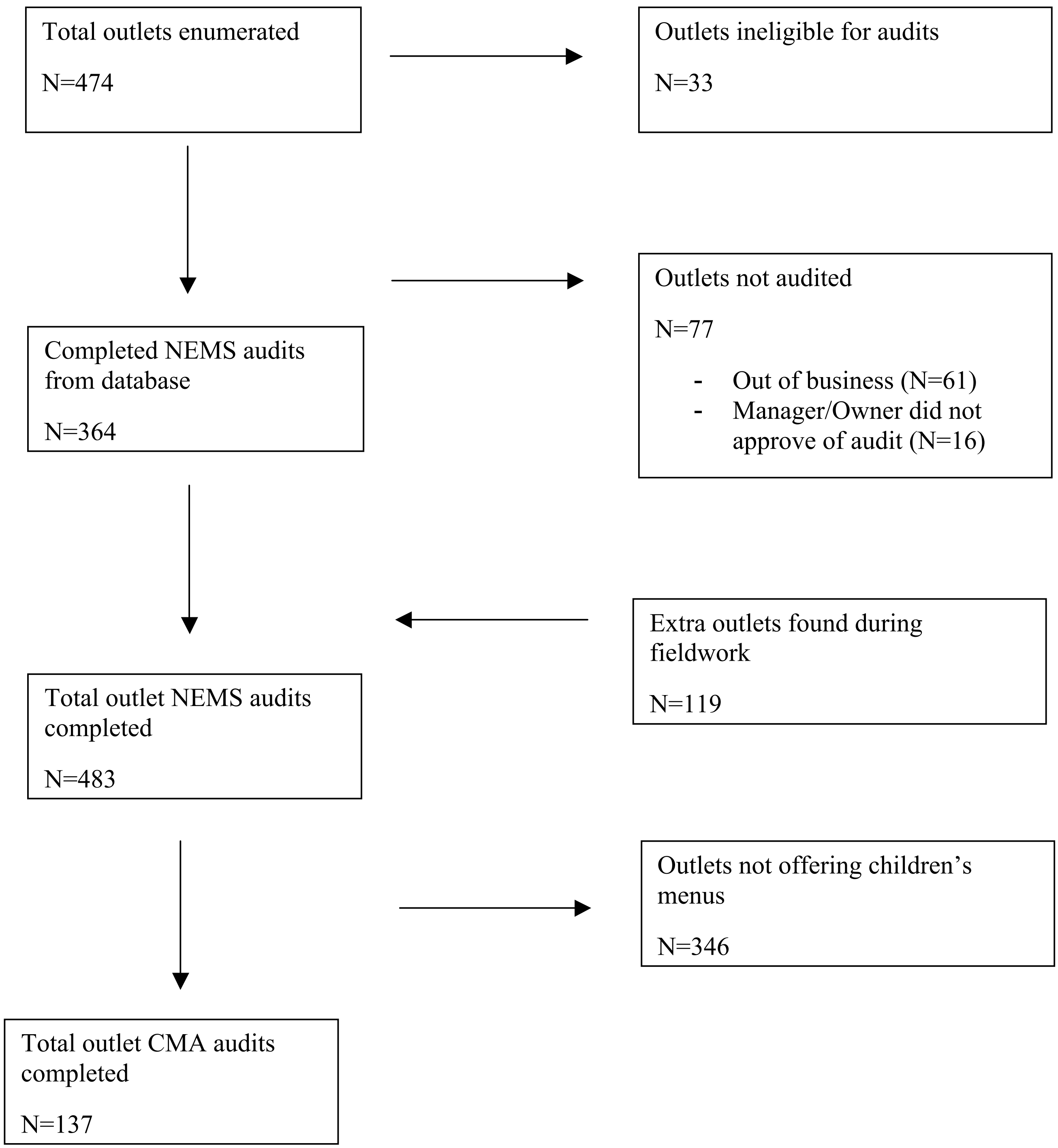
33. Israel BA, Eng E, Schulz AJ, Parker EA. (2005). *Methods in Community-Based Participatory Research for Health 1st edition*. San Francisco: Jossey-Bass.
34. Israel BA, Schultz A, Parker EA, Becker AB. (1998). Review of community based research: assessing partnership approaches to improve public health. *Annu Rev Public Health*, 19,173-202.
35. Jeffery, R. W. Baxter , J. McGuire , M. Linde , J. (2006). Are fast food restaurants an environmental risk factor for obesity? Int J Behav Nutr Phys Act, 3, 2.
36. Kahn EB, Ramsey LT, Brownson RC. (2002). The effectiveness of interventions to increase physical activity. A systematic review. Am J Prev Med, 22(4S1), 73–107.
37. Kaufman P. (1998). Rural poor have less access to supermarkets, large grocery stores. *Rural Development Perspectives*, 13, 19–26.
38. King AC, Toobert D, Ahn D. (2006). Perceived environments as physical activity correlates and moderators of intervention in five studies. Am J Health Promot, 21, (1), 24–35.
39. Krukowski RA, Eddings K, West DS. (2011). The children's menu assessment: development, evaluation, and relevance of a tool for evaluating children's menus. *J Am Diet Assoc,* 111(6),884-888.
40. Kuczmarski RJ, Ogden CL, Guo SS. (2002). 2000 CDC growth charts for the United States: methods and development. *Vital Health Stat 11,* 246,1-190.
41. Larson NI, Story MT, Nelson MC. (2009). Neighborhood environments: disparities in access to healthy foods in the U.S. *Am J Prev Med,* 36(1),10-17.
42. Levy A and Derby B. (1996). The Impact of the Nutrition Labeling and Education Act on Consumers: Recent Findings from the Food and Drug Administration’s Food Label and Nutrition Tracking System. Washington, DC: FDA Office of the Commissioner.
43. Lytle LA, Seifert S, Greenstein J, McGovern P. (2000). How do children's eating patterns and food choices change over time? Results from a cohort study. *Am J Health Promot*, 14, 222–228.
44. Maffeis C, Tato L. (2001). Long-term effects of childhood obesity on morbidity and mortality. *Horm Res,* 55 Suppl 1, 42-45.
45. McCrory M, Fuss P, Hays N, et al. (1999). Overeating in America: Association between Restaurant Food Consumption and Body Fatness in Healthy Adult Men and Women Ages 19 to 80. *Obesity Research,* 7(6), 564–571.
46. McKinnon RA, Reedy J, Handy SL, Rogers AB. (2009). Measuring the food and physical activity environments: Shaping the research agenda. *Am J Prev Med*, 36, S81–S85.
47. Mellor JM, Dolan CB & Rapoport RB (2011) Child body mass index, obesity, and proximity to fast food restaurants. Int J Pediatr Obes 6, 60–68.
48. Minkler M. (2008). *Community-based participatory research for health*. San Francisco: Jossey-Bass.
49. Moore LV, Roux, AVD. (2006). Associations of neighborhood characteristics with the location and type of food stores. *Journal Information*, *96*(2).

50. Morland K, Filomena S. (2007). Disparities in the availability of fruits and vegetables between racially segregated urban neighborhoods. *Public Health Nutr*, 10, 1481–1489.
51. Morland K, Wing S, Diez Roux A, Poole C. (2002). Neighborhood characteristics associated with the location of food stores and food service places**.** *Am J Prev Med*, 22, 23–29.
52. Muller MJ, Mast M, Asbeck I, Langnase K, Grund A. (2001) Prevention of obesity—is it possible? *Obes Rev*, 2, 15-28.
53. National Restaurant Association. (2008). Restaurant Industry Expected to PostModest Sales Growth in 2009 as It Copes with the Weakest Economy in Decades. Washington, DC: National Restaurant Association. Retrieved from *www.restaurant.org/pressroom/pressrelease.cfm?ID=1725.*
54. Nelson MC, Gordon-Larsen P, Song Y, Popkin BM. (2006). Built and social environments asscoiations with adolescent overweight and activity. Am J Prev Med, 31,109-117.
55. Nicklas TA, Baranowski T, Cullen KW, Berenson G. Eating patterns, dietary quality and obesity. J Am Coll Nutr, 20, 599–608.
56. O'Donnell SI, Hoerr SL, Mendoza JA, Goh ET. (2008). Nutrient quality of fast food kids meals. Am J Clin Nutr, 88, 1388–1395.
57. Ogden CL, Flegal KM, Carroll MD, Johnson CL. (2002). Prevalence and trends in overweight among US children and adolescents, 1999-2000. *JAMA*, 288,1728-1737.
58. Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. (2006). Prevalence of overweight and obesity in the United States, 1999-2004. JAMA, 295(13),1549-55.
59. Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. (2010). Prevalence of high body mass index in US children and adolescents, 2007–2008. *Journal of the American Medical Association*, 303(3),242–249.
60. Owen N, Humpel N, Leslie E, Bauman A, Sallis JF. (2004). Understanding environmental influences on walking; review and research agenda. Am J Prev Med, 27(1), 67–76.
61. Papas MA, Alberg AJ, Ewing R, Helzlsouer KJ, Gary TL, Klassen AC. (2007). The built environment and obesity. Epidemiol Rev, 29,129–143.
62. Powell L, Slater S, Mirtcheva D, Bao Y, Chaloupka F**.** (2007). Food store availability and neighborhood characteristics in the United States. *Prev Med*, 44,189–195.
63. Saelens BE, Glanz K, Sallis JF, Frank LD. (2007) Nutrition Environment Measures Study in restaurants (NEMS-R): development and evaluation. *American journal of preventive medicine*, *32*(4), 273-281.
64. Sallis JF, Glanz K. (2006). The role of built environments in physical activity, eating, and obesity in childhood. Future Child, 16, 89–108.
65. Sharkey J, Horel S. (2008). Neighborhood socioeconomic deprivation and minority composition are associated with better potential spatial access to the ground-truthed food environment in a large rural area. *J Nutr*, 138, 620–627.

66. Sloane DC, Diamant AL, Lewis LB, Yancey AK, Flynn G, Nascimento LM, Cousineau MR. (2003). Improving the nutritional resource environment for healthy living through community-based participatory research. *Journal of General Internal Medicine*, *18*(7), 568-575.
67. Speiser P, Rudolf M, Anhalt H, Camacho-Hubner C, Chiarelli F, Eliakim A, et al. (2005). Childhood obesity. *J Clin Endocrinol Metab,* 90,1871-87.
68. Sturm, R.; Datar, A. (2005). Body Mass Index in elementary school children; metropolitan food prices and food outlet density. *Public Health***,** *119,* 1059-1068.
69. Styne DM. (2005). Obesity in childhood: what's activity got to do with it? *American Journal of Clinical Nutrition,* 81, 337-338.
70. Swinburn, BA, Caterson, I, Seidell, JC, James, WP. (2004) Diet, nutrition and the prevention of excess weight gain and obesity. Publ. Health Nutr. 7, 123-146.
71. Swinburn B, Egger G. (2002). Preventive strategies against weight gain and obesity. *Obes Rev,* 3, 281-301.
72. Tandon PS, Wright J, Zhou C, Rogers CB, Christakis DA. (2010). Nutrition menu labeling may lead to lower-calorie restaurant meal choices for children. Pediatrics, 125(2), 244–248.
73. Thompson O, Ballew C, Resnicow K, et al. (2004). Food Purchased Away from Home as a Predictor of Change in BMI Z-Score among Girls. Int J Obes Relat Metab Disord*,* 28(2), 282–289.
74. Torgan, C. (2002). Childhood obesity on the rise. The NIH Word on Health. Downloaded from: http://www.nih.gov/news/WordonHealth/jun2002/childhoodobesity.htm
75. Townshend T, Lake AA. (2009). Obesogenic urban form: Theory, policy and practice. Health & Place, 15(4), 909–916.
76. US Census Bureau. (2009). State and county quickfacts. Retrieved from http://quickfacts.census.gov/qfd/states/51/51143.html.
77. US Census Bureau. (2001). Cartographic Boundary Files. Retrieved from http://www.census.gov/geo/www/cob/bg_metadata.html
78. US Census Bureau. (2010). Standard Hierarchy of Census Geographic Entities. Retrieved from http://www.census.gov/geo/www/geodiagram.pdf
79. US Department of Agriculture, Economic Research Service. (n.d.) Briefing room. Retrieved from http://www.ers.usda.gov/data-products/food-expenditures.aspx
80. US Department of Health and Human Services. (1997). Medically underserved areas/populations. Retrieved from http://muafind.hrsa.gov/.
81. US Department of Health and Human Services. (2001) The Surgeon General's call to action to prevent and decrease overweight and obesity. Retrieved from http://www.surgeongeneral.gov /library/calls/obesity/CalltoAction.pdf.pdf
82. US Department of Health and Human Services Assistant Secretary for Planning and Evaluation. (n.d.). Childhood Obesity. Retrieved from http://aspe.hhs.gov/health/reports/child_obesity/.
83. US Department of Health and Human Services. Office of Disease Prevention and Health Promotion. Healthy People 2020. Washington, DC. Retrieved from http://healthypeople.gov/2020/about/DisparitiesAbout.aspx#five

84. US Department of Labor. (2011). Regional and State Unemployment. Retrieved from http://www.bls.gov/newrelease/pdf/ laus.pdf.
85. Wallerstein N, Duran B. (2010). Community-based participatory research contributions to intervention research: the intersection of science and practice to improve health equity. *Am J Public Health*, 100,S40-S46.
86. Wang Y, Beydoun MA. (2007). The obesity epidemic in the United States—gender, age, socioeconomic, racial/ethnic, and geographic characteristics: a systematic review and meta-regression analysis. *Epidemiol Rev,* 29, 6-28.
87. Wang Y, Zhang Q. (2006). Are American children and adolescents of low socioeconimic status at increased risk of obesity? Changes in association between overweight and family income between 1971 and 2002. *Am J Clin Nutr*, 84, 707-716.
88. Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. (1997). Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med,* 337, 869-873.
89. Wootan M and Osborn M. (2006). Availability of Nutrition Information from Chain Restaurants in the United States. *American Journal of Preventive Medicine,* 30(3), 266–268.
90. Wootan M, Osborn M and Malloy C. (2006). Availability of Point-of-Purchase Nutrition Information at a Fast-Food Restaurant." *Preventive Medicine,* 43(6), 458–459.
91. World Health Organization (WHO) Global Strategy on Diet, Physical Activity, and Health. (n.d.). *Childhood overweight and obesity.* Retrieved from http://www.who.int/dietphysicalactivity/ childhood/ en/.
92. Zoellner J, Motley M, Hill J, Wilkinson M, Jackman B, Barlow M. (2012). Engaging the Dan River Region to reduce obesity: Application of the Comprehensive Participatory Planning and Evaluation process. Fam Community Health, 35(1), 44-56.

**Appendix A: Consort Diagram for CMA Food Outlets**



## Appendix B: Tables

Table 1. Categories scored on children’s menus in the Dan River Region (n=137).

| | Available (n=137) n | % |
|---|---|---|
| **Nutrition guidance** | | |
| Any nutrition information | 2 | 1.5 |
| Healthier item symbol | 15 | 10.9 |
| **Entrees** | | |
| Any healthier entrees | 15 | 10.9 |
| Any healthier entrée salads | 3 | 2.2 |
| Any whole grains | 9 | 6.6 |
| **Beverages** | | |
| Any juice | 55 | 40.1 |
| Identified as 100% juice | 20 | 14.6 |
| Any milk | 68 | 49.6 |
| Identified as low-fat milk (1% or nonfat) | 36 | 26.3 |
| Soda targeted at children | 39 | 28.5 |
| Opportunity for healthier beverage | 45 | 32.8 |
| substitution | 10 | 7.3 |
| Free soda refills for children | | |
| **Side dishes** | 12 | 8.8 |
| Nonfried vegetables | 54 | 39.4 |
| Fruit | 32 | 23.4 |
| Fruit without added sugar | 1 | 0.7 |
| Dairy side dish | 30 | 21.9 |
| Opportunity for healthier side substitution | | |
| **Desserts** | 0 | 0.0 |
| Healthier desserts | 10 | 7.3 |
| Included dessert in children’s meal | | |
| **Toys/marketing** | 11 | 8.0 |
| Marketing toward children | 30 | 29.1 |
| Toy with children’s meal | | |

Table 2. CMA scores for food outlets based on location.

| | Total Sample (Mean±SD) | Urban (Mean±SD) | Rural (Mean±SD) | Sig. |
|---|---|---|---|---|
| Overall CMA with Toy | 1.55±2.73 | 1.78±2.93 | 1.28±2.46 | 0.291 |
| Overall CMA without Toy | 1.85±2.93 | 2.16±3.11 | 1.48±2.68 | 0.177 |
| Healthy Entrée | 0.02±0.58 | 0.29±0.69 | 0.08±0.38 | 0.037 |
| Whole Grain | 0.13±0.50 | 0.05±0.32 | 0.23±0.64 | 0.038 |

Table 3. One-way ANOVA of CMA score by block group race.

| Race | n | (Mean+SD) | Sig. |
|---|---|---|---|
| White | 34 | 1.38±1.61 | 0.018 |
| Black | 6 | 0.15±0.44 | |
| Mixed | 12 | 2.63±2.41 | |

## Appendix C: Children's Menu Assessment Survey

**Children's Menu Assessment (CMA)**
**Food Outlet Cover Page**

Rater ID: |__| |__|

Reviewer ID: |__| |__|

---

Name: ______________________________________________

Census ID: |__| |__| |__| |__| |__|

○ FC ○ FF ○ SD ○ SP ○ Other: ________________________

Category: |__| - |__| |__|

Restaurant ID: |__| |__| |__|

**Site Visit**

Date: |__| |__| / |__| |__| / |__| |__| |__| |__|
M M D D Y Y Y Y

Start Time: |__| |__| **:** |__| |__| ○ AM ○ PM

End Time: |__| |__| **:** |__| |__| ○ AM ○ PM

Comments: ________________________________________________________________________________________________

________________________________________________________________________________________________

**Children's Menu Assessment (CMA)**
**Food Outlet Cover Page**

## Children's Menu Assessment (CMA)
## RESTAURANT MEASURES – DATA COLLECTION

Rater ID: |__| |__|

Category: |__| - |__| |__|

Date: |__| |__| / |__| |__| / |__| |__| |__| |__|
M M D D Y Y Y Y

Restaurant ID: |__| |__| |__|

| | Select One | Comments |
|---|---|---|
| 3) Age limit for children's menu | ○ 10 and under<br>○ 12 and under<br>○ Other ______<br>○ NA | ______________________<br>______________________ |
| 4) Is nutrition information (e.g., calories) available on the children's menu? | ○ yes ○ no | ______________________<br>______________________ |
| 5) Are healthy entrees identified on the children's menu via a symbol or words that indicate "light", "low-calorie", or "low-fat" (e.g. fit)? | ○ yes ○ no | ______________________<br>______________________ |
| 6) Entrees on the children's menu | | ______________________ |
| a. How many total entrees are available? | ○ yes ○ no<br>#________ | ______________________<br>______________________ |
| b. How many healthy entrees are offered (baked, grilled, broiled, or boiled and do not have bacon, cheese, cream or butter sauce added)? | #________ | ______________________<br>______________________ |
| c. How many healthy entrees salads offered (do not have bacon, sausage, cheese, fried chips/croutons/wontons, or fried meat)? | #________ | ______________________<br>______________________ |
| d. How many whole grain/ wheat products are offered? | #________ | ______________________<br>______________________ |
| e. How many white grain products are offered? | #________ | ______________________<br>______________________ |

## Children's Menu Assessment (CMA)
## RESTAURANT MEASURES – DATA COLLECTION

Rater ID: |__| |__|

Category: |__| - |__| |__|

Date: |__| |__| / |__| |__| / |__| |__| |__| |__|
M M D D Y Y Y Y

Restaurant ID: |__| |__| |__|

| | Select One | Comments |
|---|---|---|
| 7) Beverages | | |
| 7a) Is fruit juice available (on the children's menu or on the general menu)? | ○ yes ○ no/can't tell | ____________ |
| 7a.1) If juice is available are one or more specified as 100% fruit juice? | ○ yes ○ no/can't tell | ____________ |
| 7b) Is milk available (on the children's menu or on the general menu)? | ○ yes ○ no/can't tell | ____________ |
| 7b.1) If available, is it (select all that apply): | ○ Skim/ non-fat<br>○ 1%<br>○ 2%<br>○ Whole<br>○ All types of flavored milk<br>○ Can't tell<br>○ NA | ____________ |
| 7c) Is soda noted as a beverage of choice, specifically for children? | ○ yes ○ no/can't tell | ____________ |
| 7d) If available, can 100% juice, low-fat milk, or water be substituted without an additional charge in combination meals? | ○ yes ○ no/can't tell | ____________ |
| 7e) Does the menu indicate that there are free refills on sugar-sweetened beverages for children? | ○ yes ○ no ○ NA | ____________ |

## Children's Menu Assessment (CMA)
## RESTAURANT MEASURES – DATA COLLECTION

Rater ID: |__| |__|

Category: |__| - |__| |__|

Date: |__| |__| / |__| |__| / |__| |__| |__| |__|
M M D D Y Y Y Y

Restaurant ID: |__| |__| |__|

| | Select One | Comments |
|---|---|---|
| 8) Side dishes on the children's menu | | |
| 8a) Are non-fried vegetables or salad offered as a side dish? | ○ yes ○ no/can't tell | ________________ |
| 8b) Are fruits offered as a side dish? | ○ yes ○ no/can't tell | ________________ |
| 8b.1) Does the menu specify that the fruit is without added sugar? | ○ yes ○ no ○ NA | ________________ |
| 8c) Are dairy products (e.g., cottage cheese, yogurt) offered as a side dish? | ○ yes ○ no/can't tell | ________________ |
| 8c.1) Does the menu specify that nay of the dairy products are low-fat? | ○ yes ○ no ○ NA | ________________ |
| 8d) If any healthier side available, does the menu indicate that non-fried vegetable, fruit (with or without added sugar) or a dairy product (regular or low-fat) can be substituted for an assigned side at no extra charge? | ○ yes ○ no ○ NA | ________________ |
| 9) Desserts on the children's menu | | |
| 9a) How many desserts are available on the children's menu? | #________ | ________________ |
| 9b) How many healthy desserts are available on the children's menu? | #________ | ________________ |
| 9c) Is an unhealthy dessert automatically included in a kid's meal? | ○ yes ○ no/can't tell | ________________ |

## Children's Menu Assessment (CMA)
## RESTAURANT MEASURES – DATA COLLECTION

Rater ID: |__| |__|

Category: |__| - |__| |__|

Date: |__| |__| / |__| |__| / |__| |__| |__| |__|
M M D D Y Y Y Y

Restaurant ID: |__| |__| |__|

| | Select One | Comments |
|---|---|---|
| 10) General information | | |
| 10a) If salads are on the children's menu, is reduced-fat, light or reduced-calorie salad dressing available (on the children's menu or on the general menu)? | ○ yes ○ no/can't tell ○ NA | ______ |
| 10b) Is branded marketing used to promote children's menu items or meals? | ○ yes ○ no | ______ |
| 10c) Are toys used to promote children's menu items or meals? | ○ yes ○ no | ______ |