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Dissertation

School-based Nutrition Interventions & Policies: Opportunities to Improve Dietary Intake among Typically Developing Schoolchildren and Youth with Intellectual and Developmental Disabilities

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Abstract

Poor dietary intake among children, with its strong link to obesity, is a major public health concern. Policy and environmental changes in schools may be the most effective strategies to achieve population-level improvements in child dietary intake. Substantial policy efforts have been initiated to improve school food environments including school wellness policy mandates and federal nutrition standards for school meals, competitive foods, and afterschool snack programs. Despite the potential for broad-reaching improvements in dietary intake anticipated by these landmark policy changes, two groups of children may not fully benefit from these school-based initiatives: children who bring lunch and snack from home and youth with intellectual and developmental disabilities (I/DD).

Article 1. What's in Children's Backpacks: Foods Brought From Home. Lunches and snacks brought from home to school by 626 elementary schoolchildren participating in the GREEN Project Lunch Box Study were evaluated using digital photography and a supplemental food checklist. Foods and beverages brought from home were characterized; lunches were compared to National School Lunch Program (NSLP) standards and snacks compared to Child and Adult Care Food Program (CACFP) requirements. Only 28% of lunches and 4% of snacks met federal food-based standards. The typical lunch consisted of a beverage, a sandwich, and a snackfood. The typical snack consisted of a sugar-sweetened beverage, a snackfood, and dessert.

Article 2. The Adaptation of a School-based Health Promotion Program for Youth with Intellectual and Developmental Disabilities: A Community-Engaged Research Process. We undertook a community-engaged process to adapt a Smarter Lunchroom intervention for youth with I/DD aged 9-22 years attending a specialized private residential school. Focus groups and interviews with school staff elicited recommendations for adaptation strategies. Qualitative data were analyzed using NVIVO; themes were reviewed by the Project Advisory Board. Adaptations to Smarter Lunchroom design elements were developed to address needs in three categories: food-related challenges among students, adjusting to change and transition, and social environment factors. Choice and heterogeneity were overarching themes across the adaptation categories.

Article 3. Impact of a Smarter Lunchroom Intervention on Food Selection and Consumption among Adolescents and Young Adults with Intellectual and Developmental Disabilities in a Residential School Setting. We assessed whether a Smarter Lunchroom intervention, adapted for youth with I/DD, would increase the selection and consumption of fruits, vegetables, and whole grains; and reduce the selection and consumption of refined grains. The evaluation employed a pre-post quasi-experimental design in which five days of matched dietary data were compared between baseline and follow-up to assess changes at the individual level. Selection and plate waste of foods at lunch were assessed using digital photography. Consumption was estimated from plate waste. Mixed linear regression models were used to evaluate mean changes in daily servings of fruits, vegetables, whole grains, and refined grains selected, wasted, and consumed, with the individual participant as the unit of analysis. The

intervention resulted in shifts in the sources of calories selected and consumed, with an overall improvement in diet composition, and no decrease in overall energy intake. We observed the following impacts in mean servings: an increase in whole grain selection and consumption; a decrease in refined grain selection and consumption; and an increase in fruit consumption. The percentage of daily fruit and vegetable servings wasted of those selected decreased.

Among typically developing schoolchildren, few packed lunches and snacks from home met federal food-based standards. Further research is needed to understand the multiple determinants of food packing behavior, including constraints faced by families. School wellness policies should consider initiatives that work collaboratively with parents to improve the quality of foods brought from home to school. Among youth with I/DD, results from the adapted Smarter Lunchroom suggest low-cost interventions that create environments in which the healthiest choice is the easiest choice hold great promise to improve the short-term food choices and dietary intake of this vulnerable population. Future research should consider community-engaged approaches for adaptation within school settings so youth with I/DD can participate and benefit from evidence-based nutrition interventions to their maximum potential.

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Chapter 1: Introduction

I. Statement of the Problem

Obesity is a critical public health issue for all children [1]. Children in the United States do not consume diets in accordance with the Dietary Guidelines for Americans [2]. Policy and environmental changes in schools may be the most effective strategies to achieve population-level improvements in child dietary intake necessary to reverse the childhood obesity epidemic [3]. Substantial policy changes have been made to improve school food environments, including school wellness policy mandates and federal nutrition standards for school meals, competitive foods, and afterschool snack programs [4-6]. Despite the potential broad reach anticipated by these landmark policy changes, two groups of children may not be impacted by these initiatives: children who bring lunch and snack from home and youth with intellectual and developmental disabilities (I/DD). The dissertation detailed herein contributes to the evidence base that characterizes schools as a venue for interventions and policies to improve dietary intake of these two groups of children.

Nearly half of schoolchildren bring a lunch and snack from home to school on any given day [7,8], yet few studies have evaluated what is brought. Foods that are not sold in schools but are brought from home are not subject to federal competitive food policies. Little effort has been directed toward improving the quality of foods that children bring from home to eat at school. Foods from home represent additional opportunities to consume energy-dense, nutrient-poor foods and beverages during the school day.

Youth with I/DD are at a greater risk of obesity and poor dietary intake due to their complex medical and psychosocial challenges [9-15]. Little is known about the extent to which they have been included in school-based efforts to improve dietary

intake[16]. Youth with moderate to severe disabilities who receive their education outside of regular education settings may be the most vulnerable to exclusion from school-based initiatives, albeit inadvertently. Traditional school-based nutrition education interventions may have limited efficacy in youth with I/DD with significant cognitive impairments.

An emerging area of intervention research is focused on the creation of food environments that enable healthy foods to be the routine and easy choice in schools. Smarter Lunchrooms alter the presentation of choices to nudge students toward healthier food choices in school environments using techniques that are not dependent on cognitive ability. Targeted enhancements to key environmental cues within school food environments - convenience, attractiveness, and normativeness of healthy food options – have induced improvements in food-selecting behavior among typically developing youth [17]. Smarter Lunchroom interventions have not been tested among youth with I/DD.

Research Aims & Hypotheses

Part A. Foods Brought From Home to School

The following research aims were developed to evaluate foods brought from home to school.

Specific Aim 1: Characterize the types of foods and beverages brought from home to school by third and fourth grade schoolchildren.

Specific Aim 2: Compare the quality of packed lunches to National School Lunch Program standards and snacks to Child and Adult Care Food Program requirements.

Hypothesis: Fifty-percent of packed lunches and snacks meet federal nutrition standards.

Part B. Adaptation, Implementation, and Evaluation of a Smarter Lunchroom Intervention for Youth with Intellectual and Developmental Disabilities in a Residential School Setting

The following research aims were developed to adapt, implement, and evaluate a Smarter Lunchroom intervention for youth with I/DD in a residential school setting.

Specific Aim 3: To adapt Smarter Lunchroom design to the specific needs of youth with I/DD using formative research methods and community collaboration.

Specific Aim 4: To evaluate the effect of the Smarter Lunchroom intervention on the selection and consumption of fruits, vegetables, whole grains, and refined grains among students at meals eaten in the dining hall.

Hypothesis: Students' selection and intake of fruits, vegetables, and whole grains will increase, and selection and consumption of refined grains will decrease at meals eaten in the dining hall.

Chapter 2: Review of the Literature

The literature review is divided into three sections. The first section describes the prevalence and dietary determinants of obesity among typically developing children. School-based interventions and policies to improve dietary intake are summarized for children generally. The second section describes obesity among youth with intellectual and developmental disabilities (I/DD). Findings may be compared to research in the first section (focused on typically developing children) to highlight not only the disparities in obesity prevalence among youth with I/DD, but also the differences in the policy and intervention response. Because few studies have addressed obesity or dietary intake in youth with I/DD, supporting examples were drawn from the adult literature as appropriate. The third section reviews digital photography as a dietary assessment method. The dissertation research includes two novel applications of digital photography in school-based settings: to assess lunches and snacks brought from home to school and to evaluate changes in selection and consumption patterns of youth with I/DD during school lunch. Food photographs are powerful visual tools that can be used to provide behavioral feedback to children, parents, and food service personnel about dietary choices at school.

Part A. Childhood Obesity and School-based Efforts to Improve Dietary Intake among Typically Developing Children

Childhood Obesity

Childhood obesity is a pressing public health problem. Approximately 17% of children and adolescents aged 2-19 years in the United States (U.S.) were obese in 2009-2010 [18]. The prevalence of obesity was higher in adolescents than among preschool aged children [18]. Disparities in obesity prevalence are notable with higher rates among

non-Hispanic black girls, Hispanic boys, and children living in households with lower socio-economic status [1,19]. Childhood obesity prevalence decreases as the education level of the head of household increases, but the relationship is not consistent across race and ethnicity categories [19]. Although the rapid rise in childhood obesity between the 1970s to 2000 appears to have leveled off in the past ten years, obesity among boys increased from 14.0% in 1999–2000 to 18.6% in 2009–2010 [18], and a significant increase in obesity has been found among the heaviest boys [20].

In the short-term, obesity in childhood can lead to psychosocial problems and increases in cardiovascular risk factors such as hypertension, elevated cholesterol, and impaired glucose tolerance [21,22]. Obese schoolchildren are more likely to be the victims or perpetrators of bullying behavior compared to their normal-weight peers [23]. Obese children are more likely to be obese in adulthood and the risk is greatest among children with higher BMI and for children who are obese at older ages [24]. In the long-term, obese children face an increased risk of type 2 diabetes, stroke, heart disease, non-alcoholic fatty liver disease, certain types of cancers, and psychological distress in adulthood [25] and are more likely to face discrimination in the workplace [26].

Obesity prevalence among adults is expected to rise by 33% and severe obesity is projected to increase over two times the 2010 rate of 5% in two decades [27]. The public health and economic burden of obesity is expected to grow as the U.S. population ages [28,29]. Small reductions from these projections by 2030 would result in significant cost savings through the reduction of obesity-attributable medical expenses [27].

Dietary Determinants

At the most basic physiologic level, overweight and obesity arise from positive energy balance, in which energy intake exceeds energy expenditure necessary for normal growth and development [30]. From an ecologic perspective, obesity is the result of the complex interaction of biological, behavioral, social, political, economic and environmental factors that promote positive energy balance. The Centers for Disease Control and Prevention (CDC) has identified the following shifts in food patterns as major dietary contributors to energy imbalance: increased consumption of sugar-sweetened beverages [31,32], increased portion sizes [33,34], more frequent snacking [35,36], increased consumption of meals away from home [37], and reduced fruit and vegetable intake [38-40]. Schoolchildren in the U.S. do not eat recommended amounts of fruits, vegetables, whole grains, and low-fat dairy as defined by the Dietary Guidelines for Americans [2] and consume excessive calories from energy-dense, nutrient-poor foods and beverages [32,36]. Children aged 2-19 consume half of their fruit intake as juice. Sugar-sweetened beverage (SSB) consumption increased among children and adolescents in all age groups between 1998 and 2004, and accounted for 10-15% of total energy intake [32].

Opportunities for Intervention: School Food Environments and School-based Nutrition Policies

Healthy People 2020 objectives set the national agenda for health promotion and disease prevention and include the goal to reduce the prevalence of obesity by 10% among youth aged 2-19 years to 14.6% by 2020 [41]. Preventing obesity requires understanding how environmental and behavioral factors interact with our basic biology

to promote positive energy balance. Targeted behaviors to achieve energy balance in childhood include improving dietary intake, increasing physical activity, decreasing sedentary time or a combination of these efforts. The dissertation detailed herein is focused on schools as a venue for interventions and policies to improve child dietary intake.

Schools offer many important opportunities for the prevention of obesity and other nutrition-related health disparities, and the school food environment has been identified as a venue for focused efforts to improve population-level dietary patterns of children and adolescents [42]. Youth spend more time in school than any other environment outside the home [43]. An estimated 40% of energy intake takes place at school. Therefore, overall diet quality and energy intake among youth is impacted substantially by the foods and beverages available in the school food environment [44].

A recent position paper from the Academy of Nutrition and Dietetics concluded that school-based interventions with nutrition education and physical activity components demonstrated improvement in at least one weight-related behavior such as increased fruit and vegetable intake [45]. In addition, a meta-analysis from the U.S. Agency for Healthcare Research and Quality (AHRQ), found moderate to strong evidence that school-based interventions with diet and/or physical activity components that include activities that stretch into the home and community are effective for obesity prevention [46]. A recent report from the Institute of Medicine, *Accelerating Progress in Obesity Prevention, Solving the Weight of the Nation,* recommends making schools the national focal point for obesity prevention with strategic partnerships between multiple levels of government, education authorities, parents, teachers, and the private sector [3].

Three kinds of foods are present in the school food environment: (1) foods provided by the United States Department of Agriculture (USDA) programs (i.e. National School Breakfast (SBP) and Lunch (NSLP), Child and Adult Care Food Program (CACFP)); (2) competitive foods (i.e. foods and beverages sold in competition with federal meals programs); and (3) foods and beverages not for sale, including those brought from home, and foods used for classroom celebrations and rewards [47]. The Child Nutrition Reauthorization Act (2004) was the first policy effort to improve school food environments [48]. The reauthorization included an unfunded mandate that required schools to establish wellness policies and create standards for all foods on campus to address concerns that competitive foods were compromising the nutritional benefits of federal meals. Although many schools reported the development of nutrition standards for all foods on campus, important gaps between policy and practice were identified [49]. Barriers to the implementation of school wellness policies include inadequate funding, competing priorities, suboptimal support from stakeholders, and insufficient staff training to support the implementation and evaluation of the policies [50].

Despite these challenges, continued scientific research, government calls to action, and public health advocacy provided the catalyst for sizeable federal and state policies in the past five years to improve school food environments [51]. The goal of the Healthy, Hunger-Free Kids Act, 2010 (HHFKA) is to ensure that all foods and beverages available in schools align with the Dietary Guidelines as a critical means of improving children's diets [4]. Foods provided by federal meal and snack programs and competitive foods are the two major targets of HHFKA.

Nearly 95% of public schools participate in federal meals programs [47]. The SBP and NSLP must be implemented on a non-profit basis. Federal standards specify that school lunches provide one-third of the Recommended Dietary Allowances of protein, vitamin A, vitamin C, iron, calcium, and calories, with limits on total and saturated fat [52]. Schools receive federal reimbursement in exchange for meeting the nutrition standards.

Substantial changes to the nutrition standards for foods and beverages provided by the SBP and NSLP programs were implemented in 2011 as a direct result of the HHFKA [53]. Federal standards align lunches and snacks with the Dietary Guidelines for Americans 2010 and emphasize improvements in the provision of fruits, vegetables, and whole grains. Specifically, meals provided must meet age-appropriate minimum and maximum calorie requirements, and must meet daily and weekly minimum requirements for fruits, vegetables, vegetable sub-categories, and whole grains [52]. Nearly 32 million schoolchildren eat a USDA-sponsored lunch each day (2011 data); thus even minor improvements in the nutrient quality of foods and beverages provided by the program have the potential for broad public health impacts [54].

CACFP has the broadest scope of all USDA programs that target vulnerable populations [55]. In 2012, CACFP served more than 3 million children and 114,000 adults with disabilities by providing meals and snacks in child care centers, home based day-care , afterschool programs, adult care facilities, and emergency shelters [56]. Approximately 3.5% of facilities that participate in CACFP are at-risk afterschool programs [56] provided in areas where at least 50% of the children are eligible for free or reduced priced meals based upon school data [55]. Nutrition standards to align meals and

snacks provided by CACFP with the Dietary Guidelines are forthcoming. It is anticipated that these changes will contribute to improved availability of healthy food options in schools, in addition to childcare settings [45].

The USDA defines competitive foods as items sold at school outside of reimbursable school meal and snack programs including the SBP, NSLP and CACFP. They include foods and beverages sold in vending machines, school stores, à la carte offerings, extracurricular activities, and fundraising events. Data from the nationally representative School Health Policies and Programs Survey (SHPPS) indicate that competitive foods are widely available in most schools and the availability generally increases with school level. For example, vending machines are available in 21% of elementary schools, 62% of middle schools, and 86% of high schools [57]. States have the authority to regulate competitive foods, but in 2010 only 28 states had implemented such regulations, and only six of these states had policies rated as strong [58,59]. Results from longitudinal studies indicate that students exposed to consistent, strong competitive food policies have lower gains in BMI and are less likely to remain overweight or obese over time compared to students in schools with no competitive food policies [60].

In June 2013, USDA released Interim Final rules for nutrition standards for competitive foods, to be implemented at the start of the 2014 school year [61]. The *Smart Snacks in Schools* policy states that snacks must be a whole grain rich product; or have a real food as the first ingredient (i.e. fruit, vegetable, protein, or dairy); or be a combination product that provides ¼ cup fruit or vegetables; or contain at least 10% of the daily value of nutrients of concern, as identified by the Dietary Guidelines report (i.e. calcium, potassium, vitamin D, and fiber). Foods must meet calorie, fat, sodium, and

sugar limits. In addition, beverage sales are restricted to water, unflavored low-fat milk, flavored milk meeting SBP/NSLP regulations, and 100% fruit and vegetable juice. Portion sizes for beverages are limited to eight ounces for elementary students and 12 ounces for high school students [61].

Foods that are not sold in schools but are available during classroom celebrations, used as rewards, or brought from home contribute to the overall school food environment, but will not be subject to federal competitive food policies. For example, findings from two recent studies suggest that classroom celebrations offer another opportunity for schoolchildren to consume low-nutrient, energy-dense foods and beverages nearing 25-30% of their daily energy needs [62,63]. With a lack of federal oversight, developing and implementing policies to improve these foods and beverages will be the responsibility of states and school districts.

Forty-one percent of U.S. schoolchildren bring lunch to school on any given day and 45% bring snacks [7,8]. Market research suggests that parent preferences to pack lunches and snacks may reflect biased perceptions based of their own experience with school lunch [64] and the belief that what they pack is healthier (Folta, unpublished data). Little research has evaluated the nutrition quality of foods brought from home to school among U.S. elementary schoolchildren. Objective measures of foods brought from home to school can provide critical data to evaluate the nutritional quality of these foods and thereby inform future nutrition interventions and school policies to improve dietary intake among schoolchildren who may not participate in the NSLP on a regular basis.

The scant extant evidence based on nationally-representative samples and a number of smaller studies indicate that lunches from home are not superior to lunches

provided in federal meals programs. Elementary students who bring a lunch from home consume fewer total fruits and vegetables [65] and less fiber [66], but more total calories per day [67], and are more likely to consume sugar-sweetened beverages (SSB) and snacks high in added sugar and fats [68] while at school compared to NSLP participants [67]. The School Nutrition Dietary Assessment Study III (SNDA-III) found that NSLP participants were more likely to consume milk, fruit, and vegetables during lunch than nonparticipants [69].

Findings of lower diet quality of packed lunches among U.S. schoolchildren are corroborated by evidence from the United Kingdom (U.K) and Australia. A cross-sectional study among schoolchildren in the U.K. found that fewer than 1% of packed lunches met all the food-based standards for school meals in England [70]. A meta-analysis of studies among U.K. schoolchildren found that energy, total sugar, saturated fat and sodium intake were significantly higher among children who brought packed lunches compared to children who consumed school meals [71]. A cross-sectional survey of Australian schoolchildren found that over 90% of packed lunches contained at least one energy-dense, nutrient-poor snack [72].

Supporting Interventions to Improve Dietary Intake at School

The aforementioned AHRQ meta-analysis of school-based interventions for obesity prevention found over 104 published interventions that included a control school [46]. A number of large, multi-site, theory-based, randomized, controlled trials to improve dietary intake have been conducted. The *Planet Health* [73], *Eat Well, Keep Moving* [74], *CATCH* [75], and *Gimme 5* [76] interventions were all based on Social Cognitive Theory (SCT). SCT posits that food choices and eating behavior are the result of the interaction between personal and environmental factors [77]. Individual-level

factors include knowledge, attitudes, beliefs, outcome expectations, self-efficacy and preferences. Environmental factors include physical and social elements. To change personal factors such as knowledge and self-efficacy, these interventions included the development of classroom-based nutrition curricula that were implemented by teachers over 2 to 4 years, depending on the study. These interventions found modest improvements in dietary intake [73-76]. Two of these studies (i.e. *CATCH* and *Planet Health)* were deemed cost-effective based on estimates of adult obesity prevented [78,79]. However, burden on school staff, sustainability challenges, and lack of demonstrated cost-effectiveness for multi-component school-based interventions have fueled the development of less costly and less labor-intensive designs to attempt to improve short-term dietary intake within specific environments on the school campus.

Offering foods of better nutrient quality in the NSLP is an important step to improve dietary intake. However, the provision of healthier foods does not guarantee that they will be selected and consumed. Characteristics of the eating environmental (e.g. atmosphere, effort, social facilitation, distractions) and the food environment (e.g. salience, structure, size, stockpiling, and shape of foods) may have a stronger effect on food choices more than tastes and preferences [80]. Food psychology research shows that the same forces which tend to promote overconsumption in our environments can be highly effective at reducing consumption and altering consumption patterns [81].

The majority of health behavior change models and traditional economic theories are cognitively based and assume that individuals are rational actors who optimize their situation based on the available information, resources, and preferences. Empirical data suggest that people do not always exhibit rational decision making processes [82].

According to a dual process model of behavior, decisions represent the influences of two distinct systems. The reflective system is a goal-oriented system which requires significant cognitive capacity [83,84]. In contrast, the automatic, affective system is driven by feelings in response to the environment [85,86]. Food decisions are often based on emotion rather than on reasoning [87]. The power and influence of environmental cues on our decisions may override reason [88]. The primary determinant of which process predominates is the availability of processing resources [87]. Choosing less healthy foods may be more likely in situations where an individual's "processing" ability is low due to limited time, stress, or dealing with other decisions [89]. The presence of stressors (lighting, noise level) or distractions (shapes of food, sizes and shapes of containers) in the food environment can impact decisions including how much food is eaten [87].

The *Smarter Lunchroom Movement* redesigns the physical and social aspects of cafeteria environments to nudge students toward healthier choices [90]. In contrast with an SCT-based intervention, the choice architecture approach operates solely on changes to the environment rather than personal factors. Targeted enhancements to key environmental cues within school food environments - convenience, attractiveness, and normativeness of healthy food options – have induced improvements in fruit and vegetable selection and consumption among typically developing youth [17,90]. The six principles of Smarter Lunchroom design include: (1) manage portion sizes, (2) make healthy choices more convenient, (3) improve visibility of healthier foods, (4) enhance taste expectations, (5) utilize suggestive selling (prompts), and (6) use smart pricing and bundling strategies [91]. Smarter Lunchrooms can be used as an adjunct to the nutrition

policies enacted by the HHFKA, and broaden the available options to improve dietary intake of youth in school settings [87].

Results from similar interventions indicate that typically developing youth respond to environmental cues when making food choices in school lunchrooms. A change of prompts by foodservice workers yielded a significant positive effect on selection and consumption of fruits at lunch among schoolchildren [92]. Peeling and slicing oranges to improve the accessibility of fruit increased the percentage of children selecting and consuming oranges in an elementary school cafeteria [93]. When offered a choice between carrots or celery instead of a requirement to take them, a greater proportion of junior high students consumed their vegetable [94]. A Chef's Initiative intervention to improve the availability of healthy foods in Boston Middle Schools resulted in significant improvements in the proportion of students choosing whole grains and vegetables and the total amount of these foods consumed [95].

Part B. Childhood Obesity and the Adaptation of School-based Interventions to Improve Dietary Intake among Youth with Intellectual and Developmental Disabilities

Higher Rates of Obesity among Youth with Intellectual and Developmental Disabilities

Developmental disabilities (DD) affect a significant proportion of children in the U.S. Estimates from the 2008 National Health Interview Survey (NHIS) indicate ten million children (15%) aged 3 to 17 years have a DD [96]. Among the developmental disabilities, autism spectrum disorder (ASD) and intellectual disability (ID) each affect approximately 1% of children. The prevalence of DD increased by 17% from 1997 to 2008, with the largest relative increase in autism [96]. An estimated 6.5 million youth

(2008 data) receive services under the Individuals with Disabilities Education Act (IDEA) and 3% are educated outside of regular education settings, including residential programs [96,97]. Increases in DD prevalence have a direct bearing on the need for specialized health, education, and social services [96].

The two nationally representative surveys that are used for overall prevalence estimates of childhood obesity in the U.S. most commonly are the National Health and Nutrition Examination Survey (NHANES) and the Youth Risk Behavior Survey (YRBS). However, the extent to which youth with I/DD are included in these surveys and the derived prevalence estimates is unknown [16]. Studies utilizing data from nationally representative surveys have found a higher prevalence of overweight among youth with physical limitations and girls with learning disabilities [9], and elevated rates of obesity in children with ASD [11]. In studies based on smaller non-representative samples, a higher prevalence of obesity has been reported among youth with spina bifida [98], cerebral palsy [99,100], Down syndrome [101], and ID [102]. Between 2004-2010, the prevalence of overweight and obesity among youth aged 8 to 18 years with I/DD participating in Special Olympics was 30% [13]. The highest rates of overweight and obesity were found among North American girls (54%) and boys (48%) compared to Special Olympics athletes from other world regions [13]. Collectively, these studies indicate that obesity prevalence is high among a vulnerable population of youth who already experience health disparities.

The prevalence of obesity among youth with I/DD has serious public health implications. As life expectancy has increased for people with I/DD [103], the potential for chronic disease associated with excess adiposity (e.g. diabetes, cardiovascular

disease) is a significant concern. Obesity may present an even greater threat of developing secondary conditions associated with a primary disability including: mobility limitations, fatigue, pain, pressure sores, depression, and social isolation [104]. Obese individuals may also require more costly therapies and support, which in the long-term, may threaten their ability to live independently, and limit future opportunities for employment [105].

Furthermore, obesity may contribute to health disparities that youth with I/DD may experience when they reach adulthood [106,107]. Health disparities experienced among working adults aged 18-64 years with disabilities are similar or exceed in magnitude those experienced by members of racial and ethnic minority groups in the U.S. [106]. Data from the Behavioral Risk Factor Surveillance System (BRFSS) indicate that nearly 20% of the adult population in 2008 had a disability; and those reporting disabilities had the least desirable prevalence rates for 10 of 14 selected health indicators as compared to other minority groups [106]. Notably, 40% reported their health status as fair or poor, 37% reported no recent exercise, and 38% were obese [106]. A recent study using six waves of NHANES data found a significantly higher prevalence of obesity and extreme obesity among adults with disabilities compared to those without disabilities [108]. Adults with disabilities in all weight categories (i.e. healthy weight, overweight, obese, extreme obesity) were significantly more likely to have hypertension, diabetes, or elevated cholesterol and to be prescribed an antihypertensive or lipid-lowering medication compared to adults without disabilities [108].

Little research has investigated obesity risk factors among youth with I/DD, and the majority of studies that have been conducted focus on individual-level factors rather

than environmental factors. The available evidence suggests that some modifiable risk factors for obesity are shared with their typically developing peers, including inadequate physical activity [109,110] and excessive sedentary time [111], while other risk factors are likely not shared with the general population. The etiology of unique obesity risk factors in youth with I/DD reflects the heterogeneity of the population and the complex medical and behavioral problems that accompany many conditions.

At the individual level, non-modifiable obesity risk factors include alterations in body composition or energy expenditure that accompany conditions such as spina bifida [112], Down syndrome [113,114], and cerebral palsy [99]. Although pharmacotherapy on its own is unlikely to be responsible for obesity in youth with I/DD, many of the medications commonly prescribed in this population have been associated with weight gain (e.g. psychotropics, atypical antipsychotics, antidepressants, and neuroleptics) [14,15,115]. A study of 1,120 youths and young adults with ID attending special education schools in France found that among males, the odds of overweight for those taking psychotropic medications was twice that of males not on psychotropic medication [116].

In addition, several individual-level factors unique to youth with I/DD may render them more vulnerable to poor diet quality, irrespective of weight status. A recent meta-analysis of 17 prospective studies found that children with ASD experienced significantly more feeding problems (i.e. food selectivity, food refusal, and behavioral rigidity during meals) than typically developing children [117]. The causes of feeding problems among children with ASD are thought to be multifaceted, and represent a mix of physiologic (e.g. oral-motor problems, sensory processing issues, gastrointestinal problems) and

behavioral etiologies (e.g. repetitive and ritualistic behaviors) that are difficult to disentangle [118]. Results from a study of 29 children with I/DD aged 2-13 years enrolled in Special Olympics of Canada highlight the unique nutrition challenges faced by this population. The study authors found that over half the sample scored as being at "high nutrition risk" based on feeding challenges, oral-motor problems, food allergies and intolerances, gastrointestinal problems, dietary supplement and prescription medication use reported by parents using a validated nutrition screening tool for children with special health care needs [12].

No nationally representative data exist that evaluate dietary intake in youth with I/DD in the U.S. population. A cross-sectional study that analyzed nationally representative data in Taiwan found that youth with I/DD consumed less dairy, fruits, and vegetables than their typically developing peers [119]. In addition, authors found that lower family income was associated with unhealthy dietary intake [119]. Several studies based on non-representative samples have evaluated dietary intake of youth with ASD compared to typically developing youth. Youth with ASD in one study were found to consume more servings of sugar-sweetened beverages and fewer servings of fruits and vegetables compared to typically developing peers [120]. Results are supported by studies of dietary intake among adults with ID that have found fruit and vegetable intake well below recommended levels set by the Dietary Guidelines for Americans [121].

There is a paucity of data regarding environmental factors associated with dietary intake and the development of obesity among youth with I/DD. However, there is reason to believe that the environmental factors common among families, social networks, communities and the physical spaces in which youth with I/DD live, learn, work, and

play may also disproportionately compromise their nutrition status. The use of food as a positive reinforcer [122,123] may contribute to the development of obesity. The demands that often accompany caring for youth with I/DD can be a source of substantial family stress. Healthy eating may not be a priority for families and caregivers [124]. Additionally, fast food restaurants are common job sites for school and community-based vocational training programs for youth with I/DD and often become places of long-term employment as youth transition out of educational settings [125].

In contrast, the role of the environment in the development of obesity and other chronic diseases is well documented in studies of adults with disabilities. In the U.S., adults with ID residing in smaller, less supervised settings (group homes, family households) have higher rates of obesity than those living in larger, more supervised settings [126-130]. These individuals also tend to have inadequate diets and poor nutrition status [131-134]. Data from adults with ID living in group homes indicate that the food environments within these settings are compromised by high staff turnover [135-137], inadequate training [133], and lack of nutrition knowledge and food preparation skills by staff [138].

Adaptation of School-based Interventions to Improve Dietary Intake for Youth with Intellectual and Developmental Disabilities

Health promotion efforts are critical for people with disabilities, as their quality of life and independence are related to their ability to maintain good health [106,139-141]. Government calls to action [41,142,143] have resulted in a substantial expansion in health promotion programs targeted to adults with disabilities [144], yet very little published research has documented successful health promotion interventions among

youth with I/DD. There is a pervasive absence of interventions and policies that address obesity among youth with I/DD, despite a national focus on the need to address the childhood obesity epidemic [145].

There are 6.5 million students with disabilities served through IDEA in the United States. Under IDEA, the right to a free and public education in the *least restrictive environment* provides that the majority of students with disabilities receive their education in regular education settings (i.e. inclusive settings) and separate schooling in private programs occurs only when the nature or severity of the disability is such that education in regular classes cannot be achieved satisfactorily. Approximately 3%-4% of students who receive services under IDEA are served in private specialized day and/or residential programs (2008 data) [97] .

Because obesity arises from complex interactions between the individual and their social, economic, political, and physical environment, calls to action encourage systems approaches in the development of solutions [146]. The systems that influence the development of obesity in youth with I/DD may differ from those that influence typically developing youth. Schools have been identified as the optimal venue to deliver obesity prevention interventions and policies for children generally [42]; yet the inclusion of youth with I/DD in these initiatives presents challenges. Of central importance to this dissertation is the question of whether the system of a school – inclusive or not – works for or against health outcomes for youth with I/DD. Results from the few studies that have examined participation in school-based health promotion activities suggest that youth with I/DD are not participating to their maximum ability nor at levels comparable to typically developing youth [147,148]. Interviews with special education teachers

participating in the *Shape Up Somerville* intervention [149] indicated that they had limited ability to integrate the nutrition curricula and program elements into their classrooms in the absence of tailored materials and adapted resources [16].

Given the widespread absence of programs and the urgency to address obesity among this vulnerable population, disability researchers have been left to create a new paradigm – and focus on the adaptation of existing evidence-based programs that can meet the needs of both youth with and without disabilities in inclusive settings - rather than creating separate programs [145]. Inclusion of youth with I/DD in school-based nutrition interventions in both residential and regular education settings requires understanding of how to adapt evidenced-based programs to their needs, maximize their participation, and support self-determined health behaviors [145].

There is a paucity of information available to researchers detailing *how* to adapt existing evidence based programs to the unique needs of youth with I/DD. Ironically, a fortunate consequence of this lack of data may be the requirement that researchers turn to the communities that serve youth with I/DD as the experts to provide the information necessary to make adaptations to programs and implement them effectively. Although community-engaged research designs for health-promoting interventions are somewhat commonplace in the literature focused on typically developing populations, the use of such approaches with youth with I/DD is in its infancy. Two consensus papers from disability researchers outline recommendations for the effective engagement of persons with disabilities in community-engaged research interventions [150,151]. The authors note that empirical evidence for health interventions is lacking, yet argue this deficit should not impede research teams from designing and implementing interventions based

on the *best available evidence*. This recommendation is similar to the recommendations made by the Institute of Medicine to address childhood obesity in the general population [42].

Few nutrition intervention studies have been conducted among youth with I/DD. The Behavioral Intervention, Exercise and Nutrition Education to Improve Health and Fitness (BENEfit) study was a 16-week nutrition and physical activity program tested among 20 adolescents aged 11-18 years with spinal cord dysfunction [152] and a range of cognitive function. This clinic-based program was modeled after *Shapedown*, a family-based obesity program, and adapted to address the health, nutrition, and fitness needs of adolescents with mobility impairments. Six of 20 adolescents dropped out of the program for a variety of reasons, including heterogeneity of cognitive abilities and social skills among participants [152].

We are aware of only two school-based nutrition interventions for youth with I/DD with noted adaptation strategies. Hinckson et al. modified the 10-week Mind, Exercise, Nutrition…Do It! (MEND) program for youth with I/DD with moderate to high support needs aged 7-13 in two special needs schools in New Zealand (n=22) [153]. Substantial adaptations were made to the original MEND program to accommodate the range of physical, cognitive, and communication impairments of students. The authors posited that schools represent the optimal venue for the delivery of nutrition programs for youth with I/DD, but remarked on the labor-intensive aspects of the collaboration which included a reliance on the special education teachers to adapt and implement the program [153].

A multifactorial school-based intervention (i.e. nutrition policies, daily physical activity, lunch intervention with a modified plate model, home newsletter, yearly school camp) was implemented at an upper secondary school for students with I/DD aged 16 to 21 years in Sweden [154]. Researchers modified the Plate Model from the Swedish National Food Administration as the pedagogical tool to teach students what foods and proportions should be on their plate at lunch. The lunch intervention was not reliant on nutrition education; authors noted that the relative advantage of this intervention strategy was the lack of demand placed on the otherwise crowded school curricula [154].

Part C. Digital Photography as a Dietary Assessment Method

The accurate measurement of dietary intake is a long-recognized challenge in nutrition research. Dietary intake data provide invaluable information for the planning of health promotion programs and interventions to reduce the burden of childhood obesity. There is a pressing need to develop methods and systems for measuring dietary intake in school settings among both typically developing youth and youth with I/DD in order to assess the impact of school-based interventions.

There are two general types of dietary assessment methods: retrospective (e.g. 24-hour recalls, food frequency questionnaires) and prospective (e.g. weighed or estimated food records) [155]. The choice of assessment method is dependent upon the target population and the specific research questions. Common assessment methods used in school-based studies include direct observation, weighed food selection and plate waste measures, and 24-hour recalls. Direct observation in school settings involves using trained observers to record the type and quantity of foods selected and consumed by children [156]. Direct observation minimizes self-report problems related to memory and

inaccuracy but is tedious and expensive to conduct with large samples of children and the results may not be generalizable if the usual behavior of the subject is impacted by the observer [156]. Other methods to estimate consumption in school settings is to measure plate waste by actually weighing the food in grams [157].

The 24-hour recall consists of a structured interview in which a trained interviewer asks the child and/or parent/caregiver to list all foods and beverages consumed during a specified 24-hour time period [158]. It is estimated that children less than 12 years of age have limited ability to provide recall data due to narrow retention interval, incomplete knowledge as to how foods are prepared, and difficulty estimating portion sizes [159-161]. Yet, by the age of 8 years, there is a rapid increase in the ability of children to participate in unassisted recalls if the retention period is limited to the previous meal or past 24 hours [161,162]. Parents are used as proxy reporters for their child's dietary intake and have been found to provide reliable reports of intake in home settings, but may not know what their children consume outside the home (e.g. school) because they are not present during the school day [163].

The assessment of diet among adolescents is also problematic. Challenges to obtain accurate dietary information among adolescents differ from those for school-aged children. Underreporting of dietary intake among adolescents is well documented [161,164,165] and poor acceptance of traditional dietary assessment methods has been observed [166]. Youth with I/DD are unlikely to provide accurate dietary intake information via traditional methods for reasons identified among their typically developing counterparts. In addition, problems with comprehension, memory, literacy and communication make obtaining dietary intake measures through both retrospective

and prospective methods even more challenging. Additionally, adolescents and young adults in residential education settings are monitored by multiple direct care staff throughout the day. Obtaining an accurate proxy-assisted 24-recall for these adolescents and young adults is a significant burden to direct care staff.

There is no validated dietary assessment method for adults with ID [167]. Digital photography has been validated among adults with ID as a method to assess general food quality [168]. Pilot tests of digital photography among adults with ID living in community settings indicate that food photographs from meals taken pre and post consumption, used as communication supports and memory prompts, improved the reliability of participants' reports of what and how much was consumed via interview-assisted 24-hour recalls [169].

Digital photography has also emerged as a highly accurate, reliable, and cost-effective tool to estimate consumption of school cafeteria meals [170,171]. Specifically, the Digital Photography of Foods Method captures food selection and plate waste of cafeteria meals using digital cameras. Photographs of weighed standard portions of foods served are collected, and the photographs are linked to custom recipes or analyses from nutrient databases [172]. Trained raters later compare food selection and plate waste to the standard reference portion. Portion size estimates for food intake correlate highly with weighed portion sizes [173] and the inter-rater agreement (based on energy intake) is greater than 90% [174]. Digital photography is well-suited to assess the impact of food environment changes because of its ability to discriminate between what is offered, selected, and wasted by students [175]. This technology has the potential to reduce

reporting burden and provide behavioral feedback to users. Increases in efficiency, quality, and lower costs are potential benefits for researchers [176].

Chapter 3: Methods

Additional Methods for Chapter 4: GREEN Project Lunch Box Study

The GREEN Project Lunch Box Study was a block-randomized controlled trial in 12 schools in 6 school districts located within the greater Boston Area. The three-year study was funded by the Eunice Kennedy Shriver National Institute of Child Health & Human Development and was supported by the Boston Nutrition Obesity Research Center. School districts where no more than 30% of children were eligible for free lunches and 10% for reduced price lunches were selected for this study. Third and fourth grade students from 84 classrooms in 12 schools were enrolled. The goal of the intervention was to test the effect of a school-based communications campaign that combined healthy eating with eco-friendly messages on the nutritional quality of foods brought from home to school by third and fourth grade students. The primary outcomes of interest were changes in servings of fruit and vegetable intake, sugar-sweetened beverages, and energy dense snack foods. The analyses presented in Chapter 4 utilize the baseline data for the study, collected from late October to early December 2011.

Additional Methods for Chapter 5 and 6: COMETS Study

The research described in Chapter 5 and 6 was part of the COMETS (Cushing Opportunities for Meals Eaten Together at School), a one-year study supported by a grant from the Deborah Munroe Noonan Memorial Research Foundation. The formative work and intervention took place at a private, specialized residential school for youth with intellectual and developmental disabilities (I/DD) in Eastern Massachusetts between September 2011 to June 2012. The school served 120 students (88 residential and 32 day) aged 9 - 22 years with I/DD and a range of secondary physical, emotional, and behavioral conditions including autism spectrum disorder (ASD). Two characteristics

that unified this diverse student population were cognitive impairments and behavioral problems.

Based on the published literature, previous lunchroom studies in schools using digital photography as the dietary assessment method among typically developing children were deemed eligible for a waiver of consent by the Institutional Review Board [93]. The initial COMETS study timeline provided limited time for recruitment because we assumed our study would also be eligible for a waiver of consent due to the minimal risk aspects of digital photographs of lunch trays. However, we faced numerous challenges to complete this research related to the regulations in the licensing policy of the school. The school's license clearly required parent/guardian consent for any research that involved students at the school.

We undertook the following approach to meet the requirements of our IRB and those of The Cardinal Cushing School. The school entered an Interagency Agreement (IAA) with Tufts University to conduct the research, with Tufts University designated as the IRB of record. The school's Vice President of Student Programs and Services agreed to take responsibility for the research being conducted at the school. He and several members of the Cushing staff completed the educational requirements for the responsible conduct of research promulgated by the U.S. Office of Human Research Protection in order to serve as on-site research team members. These activities led to delays in our timeline, but served to engage many of the Cushing staff in the project in a deeper way than likely would have occurred without these stipulations.

The research aspects of the intervention were limited to the outcome evaluation, which used food photography data for the pre-post evaluation of the selection and plate

waste of foods at lunch. The personal information collected about students enrolled in the research aspects of the intervention were limited to age and sex. At the school administrators' request, all students participated in the intervention to avoid disruptions in daily routines.

Parent/guardian permission and child assent was obtained for participants less than 18 years of age and adult participants who had a legal guardian. Assent was obtained in classrooms with the assistance of the classroom teachers and onsite research team. Children were shown pictures of lunch trays from a 2-day pilot study as a visual learning tool to help them recall and understand the picture-taking process. Picture Communication Symbols™ for "yes" and "no" were available to students with communication impairments to provide assent. Informed consent was obtained for adult participants who were their own legal guardian, with the option of sharing this information with their parent/guardian. Student services coordinators at the school assisted with the consent process for adult students who were their own legal guardian. Twenty students at the school were considered wards of the state of Massachusetts, under the Department of Children and Families, and were not allowed to participate in the research aspects of the intervention. All recruitment materials for the COMETS study are included in the Appendices.

Taste-Testing Activities

Classroom-based taste-testing activities complemented the Smarter Lunchroom intervention through the promotion of fruits, vegetables, and whole grains to all vocational and educational classrooms. Our formative research indicated that taste-testing activities could not be completed safely in the dining hall due to choking concerns

and food allergies. A small committee comprised of research team members and school teachers drafted recipes and reviewed them for appropriateness based on the allergies, chewing/swallowing needs, and abilities of students. Classroom teachers reviewed recipes with students and voted on the recipe and taste-test they would like to complete at a subsequent session. All classrooms (20) completed three hands-on cooking and taste-testing activities (60 total sessions) to promote consumption of the dietary targets. A 1:1 or 2:1 student to teacher ratio was optimal for completing the taste-testing activities. Dietetic interns and graduate students worked as assistants during the taste-testing activities. A sample taste-testing recipe that was "translated" for students with cognitive impairments using Picture Communication Symbols™ is included as Appendix P.

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Chapter 4

Research Article 1:

What's in Children's Backpacks: Foods Brought from Home

Kristie Hubbard, Aviva Must, Misha Eliasziw, Sara Folta, Jeanne Goldberg

ABSTRACT

Background: Forty-one percent of elementary schoolchildren bring lunch to school on any given day. Forty-five percent bring snacks. Surprisingly, little is known about the foods and beverages they bring, or the factors that affect it.

Objective: The present study sought to: (1) characterize foods and beverages brought from home to school by elementary schoolchildren, (2) compare the quality of packed lunches to National School Lunch Program (NSLP) standards and packed snacks to Child and Adult Care Food Program (CACFP) requirements, and (3) determine if level of maternal education was associated with lunches and snacks meeting federal nutrition requirements.

Methods: Lunches and snacks from 626 elementary schoolchildren were assessed and analyzed using digital photography and a supplemental food checklist.

Results: Food and beverage types most likely to be provided for lunch were sandwiches (59%), snackfoods (42%), fruit (34%), desserts (28%), water (28%) and sugar-sweetened beverages (24%). Twenty-eight percent of lunches met at least three of five NSLP standards. At snack, snackfoods (62%), desserts (35%) and sugar-sweetened beverages (35%) were more common than fruits (20%), dairy foods (10%), and vegetables (3%). Only 4% of snacks met two of four CACFP standards. Women with higher maternal education levels were twice as likely to pack a healthy lunch ($p=0.007$), but no association was found with snacks ($p=0.85$).

Conclusions: Few packed lunches and snacks met federal food-based standards. Further research is needed to understand the multiple determinants of food packing behavior, including constraints faced by families. School wellness policies should consider initiatives that work collaboratively with parents to improve the quality of foods brought from home.

Introduction

Schoolchildren in the United States (U.S.) do not eat recommended amounts of fruits, vegetables, whole grains, and low-fat dairy as defined by the Dietary Guidelines for Americans [1] and consume excessive calories from energy-dense, nutrient-poor foods and beverages [2,3]. Potential consequences of these unhealthy dietary patterns in childhood include diminished academic performance [4], obesity [5], and chronic disease in adulthood [6].

The obesity epidemic among U.S. schoolchildren [7] has resulted in both federal and state policies to improve school food environments [8]. As a direct result of the Healthy, Hunger-Free Kids Act of 2010 [9], substantial changes have been made to foods provided by the National School Lunch Program (NSLP). In contrast, little effort has been directed toward improving the quality of foods that children bring from home to eat at school. Foods from home represent additional opportunities to consume energy-dense, nutrient-poor foods and beverages during the school day.

Although 41% of U.S. schoolchildren bring lunch to school on any given day [10] and 45% bring snacks [11], few studies have evaluated the diet quality of these packed lunches and snacks. The existing data suggest that elementary students who bring a lunch from home consume fewer total fruits and vegetables [12] and less fiber, [13] but more total calories per day [14] and are more likely to consume sugar-sweetened beverages (SSB) and snacks high in added sugar and fats [15] while at school compared to NSLP participants [14].

Limited research has examined the factors associated with packed lunch and snack choices. Studies of packed lunches and snacks in Australia primary schools found that children of lower socioeconomic status were more likely to have high-energy snacks

[16]. However, maternal education level is generally recognized as a more consistent and reliable measure for predicting health behavior compared to other indicators of socioeconomic status, including income and employment status [17-19] and has emerged is an important indicator of the food habits of children [20,21]. Women with higher education model more healthful eating behaviors in front of their children [22], provide greater access to healthful foods in the home [23], and manifest food-related parenting styles and food rules that facilitate the development of healthful eating habits [17].

To the authors' knowledge, data that describe foods and beverages brought from home exclusively for snacks have not been published and the influence of maternal education on the quality of packed lunches and snacks has not been evaluated. Therefore, the primary aim of the present study was to characterize the types of foods and beverages brought from home to school by elementary schoolchildren, and to compare the quality of packed lunches to NSLP [24] standards and snacks to Child and Adult Care Food Program (CACFP) requirements [25]. The secondary aim was to examine the association between maternal education with packed lunch and snack quality. We hypothesized that the majority of schoolchildren in the study would not meet federal standards for a healthy lunch or snack, and higher levels of maternal education would be associated with packed lunches and snacks that met federal standards.

METHODS

Setting and Participants

Our analysis utilizes baseline data collected for the GREEN Project Lunch Box Study, an intervention designed to influence foods brought from home [26]. Participants in grades three and four were recruited in Spring 2011 from six Eastern Massachusetts

public school districts. School districts where no more than 30% of students were eligible for free lunches and 10% for reduced price lunches were selected for this study. Participants were recruited using backpack fliers, available in English and Spanish. Parents and participants provided written informed consent and assent, respectively. The study protocol was approved by the Tufts University Institutional Review Board.

Measures

Socio-Demographic Data

Parent and child demographic data were obtained from a self-administered, 16-item survey. Maternal education was based on parental report and aggregated into 5 groups: less than high school education, high school graduate or equivalent, 2 years or less of college, 4 year college degree, and advanced degree. Child race/ethnicity was parent-reported based on the categories of the National Institutes of Health [27] and aggregated into four groups: white/Caucasian, black/African American, Hispanic, and other/multi-racial. Families were classified as below the federal poverty level, at the federal poverty level, and above the federal poverty level according to federal poverty guidelines [28] based on household size and family income as an indicator of socioeconomic status (SES).

Dietary Data Collection

Dietary data were collected from late October to early December 2011 by trained graduate student research assistants. The date of the data collection visit was arranged in advance with teachers; participants and parents were not informed of the date to prevent biases in packing behaviors. Data collection took place in each school cafeteria and was scheduled for the morning, prior to any eating events [29,30]. All packed lunches and

snacks of participants in the same class were examined on a single day unless the participant was absent. In cases of absences, data collectors returned to the school on a subsequent, pre-arranged date, again without informing participants or parents. Justification for the collection of one day of dietary data for each participant was supported by a pilot study of 55 participants in three schools conducted during Spring 2011 over five random days. Day-to-day consistency with which participants brought either a snack or lunch and snack was moderate (intraclass correlation coefficient [ICC]=0.51). The median number of food items brought from home was two, ranging from 1 to 8 (ICC=0.66). The day-to-day variability in servings was moderate (ICC=0.59) with some variability by food type.

Digital photography and a supplemental food inventory checklist (FIC) were used as the dietary assessment method. This technique has been used as an efficient and accurate alternative to traditional direct observation in school settings [31-33]. The protocol did not permit the data collectors to touch participants' foods and beverages. Participants emptied the contents of their lunch boxes or bags on to an 11 by 17 inch placemat that had a unique study ID and a 1-inch square grid background. Participants placed foods and beverages intended to be consumed at snack on the left side of the placemat (labeled "1") and those intended to be consumed at lunch on the right side of the placemat (labeled "2") (Figure 1). Participants were instructed to take lids off of containers, unwrap opaque packaging (aluminum foil, paper towels) and to orient brand names of packaged food forward. Angle (35 degrees) and aerial (20.5 inches) photographs were taken of each participant's placemat. Separate snack and lunch photos

were taken when the number of items brought from home exceeded the space available on one placemat.

The photograph was considered the primary source of data. To supplement these data, research assistants recorded detailed information regarding eight major food and beverage categories (beverages, fruits, vegetables, sandwiches, leftovers, snackfoods, desserts, and condiments) on the FIC. Participants were asked whether beverages in reusable containers were 100% juice and about other foods or beverages (e.g., milk) they planned to purchase at school. Data collectors recorded this information on the FIC, along with sandwich fillings. Each participant repacked their lunch and snack after the photographs and checklist were complete.

Photo Coding

The first step in the analysis of packed items was to identify foods and beverages in the photographs. The portion sizes of commercially packaged foods and beverages were obtained directly from the packaging and entered by weight. For foods and beverages not in commercial packaging, estimation of portion sizes involved a comparison of the item in the photograph to standard reference photos in a reference manual developed for the study. The manual included 1200 food and beverage photographs, divided into the eight major food and beverage categories corresponding to the FIC. Each page of the manual contained six reference photos of the food or beverage; two photos (one angle and one aerial view) for each small, medium, and large portion size. Angle and aerial photos were taken at the same specifications used for data collection to allow for an exact comparison of the photo data to the standard reference photos. Reference photos of foods were taken in plastic sandwich bags and different

container shapes, since foods that were not commercially packaged were packed in this manner. Small, medium, and large portions were based on reference weights (grams) provided by the Nutrition Data System for Research (NDSR, University of Minnesota). For cases in which NDSR did not provide guidelines for portions, one-half of the FDA serving size defined small, the FDA serving size defined medium, and 1.5 times the FDA serving size defined large.

Two independent coders classified portion sizes as small, medium, and large. Discrepancies of one category (e.g. small versus medium, medium versus large) were considered disagreements. Discrepancies of two categories (e.g. small versus large) were assumed to be errors and were re-evaluated by the coders. A certainty rating (i.e. pretty sure, quite sure) was used to expand the three-point scale to a five-point scale (i.e. small, small/medium, medium, medium/large, large). The method met validity and reliability criteria, with coders correctly ranking the portion sizes more than 80% of the time.

Dietary Assessment

Portion size estimates for all foods and beverages were linked to gram weights corresponding to those represented by each photo in the reference manual. The gram weight for the portion size of each item was divided by the FDA serving size to determine number of servings. Gram weights were anchored by the small, medium, and large portion sizes. The average gram weight between small and medium or medium and large was used for the two estimates between the anchors – small/medium and medium/large.

The characterization of foods and beverages packed for lunches and snacks involved aggregating items within each of the major original groups on the FIC

(beverages, sandwiches, leftovers, snackfoods, desserts, fruits, vegetables, and condiments) based on typology. The final major food and beverage categories and subcategories are defined in Table 1. Condiments were excluded from the analyses.

The quality of lunches was evaluated by comparing the servings of foods and beverages in each packed lunch to NSLP standards [24]. Federal standards align lunches and snacks with the Dietary Guidelines for Americans 2010 and emphasize improvements in the provision of fruits, vegetables, and whole grains. Federal standards specify that school lunches provide one-third of the Recommended Dietary Allowances of protein, vitamin A, vitamin C, iron, calcium, and calories, with limits on total and saturated fat [24]. The following five standards were used:

(1) ½ cup of fruit (excludes fruit juice)

(2) ¾ cup of vegetables (excludes vegetable juice and vegetables "carried" in another item such as lettuce on a sandwich because the contribution to total vegetable portion size is negligible)

(3) one ounce of grains from bread, rice, pasta, cereal, and granola (excludes grains from snackfoods and desserts)

4) one ounce meat/meat alternate (from sandwiches with protein filling, nuts/seeds, eggs, peanut/nut butter, hummus, leftover meat, cheese, and yogurt)

(5) one cup fluid milk

Participants received "credit" (1 point) for each standard by meeting the minimum quantity indicated. Participants received credit for milk if they had one cup fluid milk on the lunch side of their placemat or if they indicated intent to purchase milk at school. Participants received credit for grains whether the item was whole grain or made from

refined grains because the photographic method did not allow us to accurately distinguish between them. It was assumed that all sandwiches with protein fillings contained at least one ounce of protein. These assumptions were conservative relative to our hypothesis. The final lunch evaluation score ranged from zero (met no standards) to five (met five standards).

The quality of snacks was evaluated using CACFP criteria for after-school snacks for this age group [25]. The following four CACFP food-based standards were used:

(1) ¾ cup fruit or vegetable (includes 100% fruit and vegetable juice)

(2) one ounce of grains from bread, rice, pasta, cereal, granola (grains from snackfoods and desserts were excluded)

(3) one ounce meat/meat alternate (from sandwiches with protein filling, nuts/seeds, eggs, cheese, cooked dry beans or hummus, yogurt)

(4) one cup fluid milk

For snacks, participants received credit for each standard by meeting the minimum quantity indicated. The intention to purchase milk at school was not counted towards the milk minimum in the snack analysis because milk was not available for purchase for snacks. The final snack evaluation score ranged from zero (met no standards) to four (met four standards).

Statistical Analyses

Descriptive statistics were used to summarize the most common food and beverage types and the proportion of lunches and snacks that met federal nutrition standards. Healthy lunches were defined as meeting three or more NSLP standards and healthy snacks were defined as meeting at least two CACFP standards. Thresholds for

healthy lunches and snacks aligned with federal reimbursement guidelines. Generalized linear models with a logit link were used to evaluate the relationship between level of maternal education and lunches and snacks meeting federal standards. We compared snacks among participants who brought a snack with and without a lunch. All analyses were adjusted for clustering at the school level.

For all logistic regression analyses, maternal education was aggregated into two categories: less than 4-year college degree and 4-year college degree or higher. Child age, race/ethnicity (white versus non-white), child gender, grade in school, SES, maternal employment status and total number of items were considered as potential confounders if they changed the magnitude of the association between maternal education and healthy packed lunches and snacks by 15% or more [34]. We tested for the presence of effect modification by SES, race/ethnicity, maternal employment and total number of items by including an interaction term in the models. All statistical analyses were conducted using SAS version 9.2 (SAS Institute, Cary, NC, USA) with p-values less than 0.05 considered statistically significant. As the statistical test of effect modification is known to be underpowered, p-values less than 0.20 were considered to be statistically significant [35].

RESULTS

Study Participants

A total of 662 third and fourth grade students from 84 classrooms in 12 schools within 6 school districts were enrolled. Among them, 32 did not bring a lunch or snack on the day of data collection, and four participants brought snacks that contained water only, resulting in a final sample size of 626 participants. The mean (standard deviation) age of the study participants for the analyses was 9.1 (0.6) years, 58% were female, 74%

were non-Hispanic white, and 83% of mothers completed post-secondary education (Table 2).

Lunch and Snack Contents

Forty-eight percent of participants (n=301) brought a lunch from home. Among the lunches, 291 were brought by participants with a snack and 10 were brought without a snack. The median number of items brought for lunch was three (range 1-7), consisting of two foods (range 1-6) and one beverage (range 1-3). The typical lunch consisted of water, a sandwich, and a snackfood (Figure 1). The most common lunch foods provided were sandwiches (59%), snackfoods (42%), fruit (34%), and dessert (28%). Less common lunch foods included leftovers (17%), dairy foods (17%), and vegetables (11%). Seventy-three percent of lunches contained a beverage. The most common lunch beverage was water (28%) followed by SSB (24%) (Figure 2A). Three percent of lunches included milk, and another 11% of participants planned to buy milk at school. The margin of error in the lunch estimates, which accounted for clustering at the school level, did not exceed 9.3%, except for fruit which was 16.9%.

Of the 616 snacks analyzed, 325 were from participants who brought a snack only and planned to buy their lunch at school. The other 291 snacks were from participants who also brought lunch. Overall, the median number of items brought for snack was two (range 1-7), consisting of one food (range 1-6) and one beverage (range 1-3). The typical snack consisted of a SSB, a snackfood, and a dessert (Figure 1). Snackfoods (62%), desserts (35%) and SSB (35%) were more common than fruits (30%), dairy foods (10%), and vegetables (3%) at snack (Figure 2B). The margin of error in the snack estimates, which accounted for clustering at the school level, did not exceed 8.1%.

Lunch and Snack Evaluation

Participants with missing data on maternal education (n=18) were excluded from all analyses evaluating lunch and snack quality, resulting in a sample size of 296 lunches and 598 snacks. Because child age, race/ethnicity, child gender, grade, SES, maternal employment status, and total number of items were not deemed to be confounding factors in the multivariate analyses, the results for lunches and snacks that met federal standards according to level of maternal education are simply presented as percentages and prevalence ratios.

The frequency distribution for lunches meeting NSLP standards is shown in Table 3A. Overall, 27.7% of lunches met the definition of a healthy lunch. Women with four or more years of college education were almost twice as likely to pack a healthy lunch compared to women with less than four years of college education (32.6% versus 17.0%, p=0.007).

The frequency distribution for snacks meeting CACFP standards is shown in Table 3B. Overall, 4.2% of snacks met the definition of a healthy snack (Table 3B). The likelihood of packing a healthy snack did not differ significantly by maternal education among participants who brought a snack only (3.1% versus 3.4%, p=0.85) or among participants bringing both snack and lunch (4.9% versus 5.4%, p=0.80) (Table 3B).

Because only 25 (4.2%) of participants met the CACFP threshold of two standards, we also examined differences between maternal education at the level of meeting one standard. At the threshold of meeting one or more standards, women with four or more years of college education were equally likely to pack a healthy snack whether it was alone or packed along with a lunch (44.4% versus 42.4%, p=0.97). However, women with less than four years of college education were less likely to pack a

healthy snack when it was packed alone compared to when it was packed with lunch (30.8% versus 43.1%, p=0.12, test for interaction, p=0.13).

DISCUSSION

To the authors' knowledge, the present study is one of the few to examine the contents of packed lunches among U.S. schoolchildren from a food-based perspective and is the first to characterize and evaluate the quality of packed snacks intended to be consumed in the classroom during the school day. The novel use of digital photography and the supplemental FIC as the dietary assessment method facilitated the evaluation design. In the past ten years, digital photography has emerged as a highly accurate, reliable, and cost-effective tool to measure actual consumption of school cafeteria meals [33,36]. The present study builds on this previous work by extending digital photography methodology beyond closed eating environments with limited menu offerings (i.e. cafeterias, restaurants) to free-living environments. Objective measures of foods brought from home to school provide critical data to inform future nutrition interventions to improve dietary intakes among schoolchildren who may not participate in the NSLP on a regular basis and may not fully benefit from the policy changes enacted for this program.

Research with adolescents indicates a strong preference for dietary assessment methods that incorporate technology versus classic 24-hour recalls and food records [37], and the age of 11-14 years as the stage in which they lose interest in providing and recording self-reported dietary intake [38]. Although the average age of participants in the present study were slightly younger than 11 years, given current trends, they are likely equally engaged with technology in school and at home. The use of technology-

based dietary assessment methods such as digital photography may enhance their engagement with the activity more than traditional methods [37].

Lunches and snacks in this study were revealed to lack many of the fundamental elements of a healthy diet for school-aged children. Results indicate that 72% of lunches failed to meet NSLP criteria for a healthy lunch and 96% of snacks failed to meet CACFP criteria for a healthy snack. The use of 2012 federal benchmarks allowed a direct comparison of packed lunches and snacks to the requirements that schools are expected to follow [24,25]. Twenty-four percent of lunches did not contain a primary entrée (sandwich or leftover) and the majority did not provide an alternative source of protein, such as would be provided by foods such as yogurt, cheese, peanut butter, or beans. Although the focus of the present study was on foods rather than nutrients, the scarcity of dairy foods and milk raises concerns about the adequacy of dietary calcium. SSB were found in 24% of lunches and 35% of snacks, suggesting a need to focus on reducing consumption of these beverages and promotion of water and low-fat milk as healthier beverage options during the school day.

The impact of maternal education was more complex than expected. Maternal education was positively associated with packing healthy lunches, but this practice did not carry over to packing healthy snacks. Among the 291 participants who brought a lunch and snack, 78 (27%) had a healthy lunch. Only three of these 78 participants (4%) with a healthy lunch also brought a healthy snack. These data indicate that when healthier foods were present, the participant indicated plans to consume them at lunch and to eat less healthy foods with snack. Additionally, for women with lower education levels, packing the lunch was associated with a greater percentage of healthier snacks at

the threshold of one CACFP standard. Possible explanations for the differences in the relationship between higher maternal education and lunch versus snack quality may be that the snack-only children participate in NSLP and parents may be less aware of healthy snack options, may have perceptions that highly processed snacks are less expensive, or may feel the need to "make it up" to their child [39] by providing more desirable energy-dense, nutrient poor foods and beverages for snack.

Mothers with higher educational attainment may be more knowledgeable about the components of a healthful lunch, but may view "snack time" as an eating occasion in which providing junk food is permissible. Qualitative research in Australia found the lunchbox to be a "site of negotiation" between parents and children; parents acknowledged necessary compromises such as packing some unhealthy foods because of child preferences, convenience, and other factors [40]. Parent preferences to pack lunches and snacks may reflect biased perceptions based of their own experience with school lunch [41] and the belief that what they pack is healthier (unpublished data).

Our findings relative to overall lunch quality are consistent with other studies that have examined the quality of packed lunches. The nationally representative School Nutrition Dietary Assessment Study-III found that NSLP participants were more likely to consume milk, fruit, and vegetables during lunch than nonparticipants [42]. Similar trends have been observed in the United Kingdom, where less than 1% of packed lunches met all the food-based standards for school meals in England [43] and a meta-analysis of studies among schoolchildren found that energy, total sugar, saturated fat and sodium intake were significantly higher among children with packed lunches compared to children consuming school meals [44]. A cross-sectional survey of Australian

schoolchildren found that over 90% of packed lunches contained at least one energy-dense, nutrient-poor snack [16]. Results of these studies highlight the global pervasiveness of energy-dense, nutrient-poor packaged foods.

The present study has a number of important limitations. Actual food consumption was not measured. It is possible that more foods and beverages were packed for participants than they consume [40], and that part of what is packed is thrown out, shared, or returned home at the end of day. The quality of what is packed suggests that there is considerable room for improvement, regardless of how much the participant actually consumes. Furthermore, it is unlikely that the more healthy foods are consumed in favor of the less healthy ones. Additionally, participants in this study were not asked who had the primary responsibility to pack their lunch or snack. During data collection, participants were instructed to place foods intended to be consumed at snack on a different side of the placemat from items intended to be consumed at lunch. It should be acknowledged that the participant's response to this question when they were not the person packing the lunch, may not reflect the packer's intent.

Our results may have limited generalizability. In Massachusetts elementary schools, the decision to hold a mid-morning snack period in the classroom is left to the school district, and then to the discretion of the classroom teacher (unpublished data). The extent of this practice within the state or nationally is unknown. The evidence suggests that considerable variability exists at the state level, at least with regard to competitive food policies, which until recently have been under state rather than federal jurisdiction [45,46]. The use of a convenience sample from school districts in which no more than 30% of participants were eligible for free lunches and 10% for reduced price

lunches resulted in a study sample with a relatively high maternal education level and SES, which may further limit the generalizability of the results.

Few districts have implemented regulations for competitive foods, foods consumed in classroom activities or those brought from home [47] despite requirements by the Child Nutrition and WIC Reauthorization Act of 2004 [48] for schools to establish wellness policies that create standards for all foods on campus. This paper provides the first evidence of the types of foods and beverages schoolchildren bring for classroom snacks. Results indicate that classroom snacking offers yet another opportunity to consume energy-dense, nutrient poor snacks and SSBs during the school day. SSBs brought from home were primarily portion-packed juice drinks in packages attractive to children. Our findings make a timely contribution to federal and state food policy discourse focused on improving school food environments and child dietary intake. School wellness committees should consider developing policies that specifically address foods from home, as the forthcoming federal rules for competitive foods in schools will not include regulations for these practices.

CONCLUSION

Our findings indicate that packed lunches and snacks do not meet federal standards. Higher maternal education was associated with lunch quality but not snack quality. Results may reflect parental attitudes toward nutrition, parental nutrition knowledge, food preparation skills, perceived time and cost constraints, and the types of foods available to the family in the home environment. Considerable policy efforts have been made at the federal and state level to improve school food environments. These

initiatives have yet to consider packed lunches and snacks from home; which will continue to be brought by an estimated half of schoolchildren.

Understanding the multiple determinants of parental food packing behavior, including the role of maternal education, child preferences, and the constraints faced by families, is a critical next step. Future research should also examine the extent to which children are responsible for packing their own lunches and snacks for the school day and effective approaches to modify their choices of what to pack and eat. School wellness policy efforts should consider initiatives that work collaboratively with parents to improve the quality of foods brought from home to eat at school.

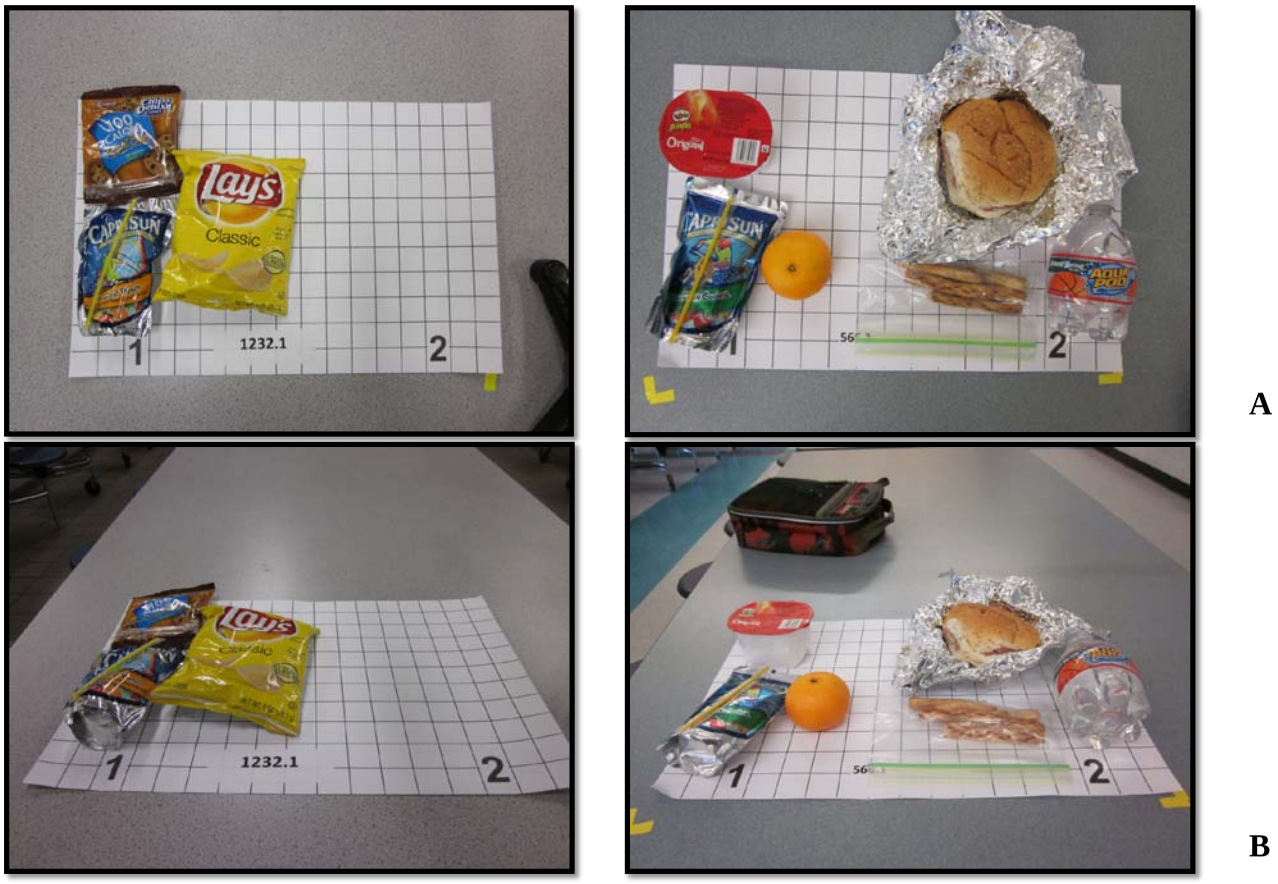

Figure 1. Typical Snacks and Lunches Brought from Home by Elementary Schoolchildren
Aerial View (1A) and Angle View (1B) of Typical Snack Contents: SSB, dessert, and snackfood
Aerial View (2A) and Angle View (2B) of Typical Snack and Lunch Contents. Snack Contents (Labeled "1): SSB, snackfood, and fruit. Lunch contents (Labeled "2"): water, sandwich, and snackfood

Table 1. Food and Beverage Categories

Food and Beverage Category	Description
Beverages	
Water	bottled or brought in a reusable container only; excludes sparkling water, flavor enhanced water, or water with added vitamins or electrolytes
Juice	100% fruit or vegetable juice
Milk-based	range of non-fat to whole milk, plain and flavored, and yogurt-based drinks
Sugar-sweetened	fruit punch, fruit cocktail, sweetened iced tea, sports drinks, lemonade
Calorie-free	diet drinks with artificial sweeteners, water with enhancements
Sandwiches	
Protein filling	Sandwich filling from proteins including meat, poultry, cheese, eggs, fish, nut butters
Carbohydrate or fat-based filling	Sandwich filling from carbohydrate or fats (jam, jelly, chocolate spread, cream cheese) with no protein filling present
Leftovers	
Pizza	Pizza and calzones; pizza-based hot-pockets
Grains	Pasta, rice, couscous, macaroni and cheese (may have added vegetables)
Meat/protein	Leftover meat that was not part of a sandwich; includes separately packed eggs and beans
Mixed dish	Soup, stew, chili (may have added vegetables); ethnic dishes (burritos, tacos)
Snackfoods	
Salty snacks	Puffed snacks, snack/party mix, popcorn, pretzels
Chips	Potato chips, corn chips, tortilla chips
Crackers	Crackers (plain & flavored), sandwich crackers
Nuts/seeds	Nuts, seeds, trail mix
Desserts	
Cookies	All cookie varieties
Baked goods	Cakes, muffins, dessert-style bread, doughnuts, pastries, pie
Candy	Chocolate candy, non-chocolate candy, gummy fruit, fruit leather
Other desserts	Pudding, gelatin, marshmallows, sugar-coated pretzels, dessert-style popcorn
Fruits	
Fresh	Includes apples, bananas, grapes, citrus fruits, melon, peaches, berries
Canned	Applesauce, other pureed fruits, canned fruits (all juice and syrup pack)
Dried	All dried fruits, 100% fruit leathers; excludes yogurt or chocolate covered dried fruit
Vegetables	
Green/orange/red	Includes carrots, tomatoes, red peppers, spinach
Starchy/other vegetables	Includes potatoes, corn, peas, cucumbers, celery
Dairy foods	
Yogurt	Yogurt (plain & flavored); yogurt with topping
Cheese	String cheese, cheese slices and cubes

Table 2. Characteristics of 626 Participants in the GREEN Project Lunch Box Study

Characteristic	n	%
Age, mean (std)	9.1 (0.6)	
Grade		
3rd grade	333	53%
4th grade	293	47%
Sex		
Male	262	42%
Female	364	58%
Race/Ethnicity		
Non-Hispanic white	453	74%
Hispanic	90	15%
Black/African American	21	3%
Multiracial/Other	48	8%
Socio-economic Status†‡		
Below Federal Poverty Line	60	10%
Meets Federal Poverty Line	94	15%
Above Federal Poverty Line	392	63%
Maternal Education‡		
Less than high school education	19	3%
High school graduate or equivalent	74	12%
2-year college degree	208	33%
4-year college degree	163	27%
Advanced degree	144	23%

† adjusted for number in household.

‡ sample sizes vary due to missing data

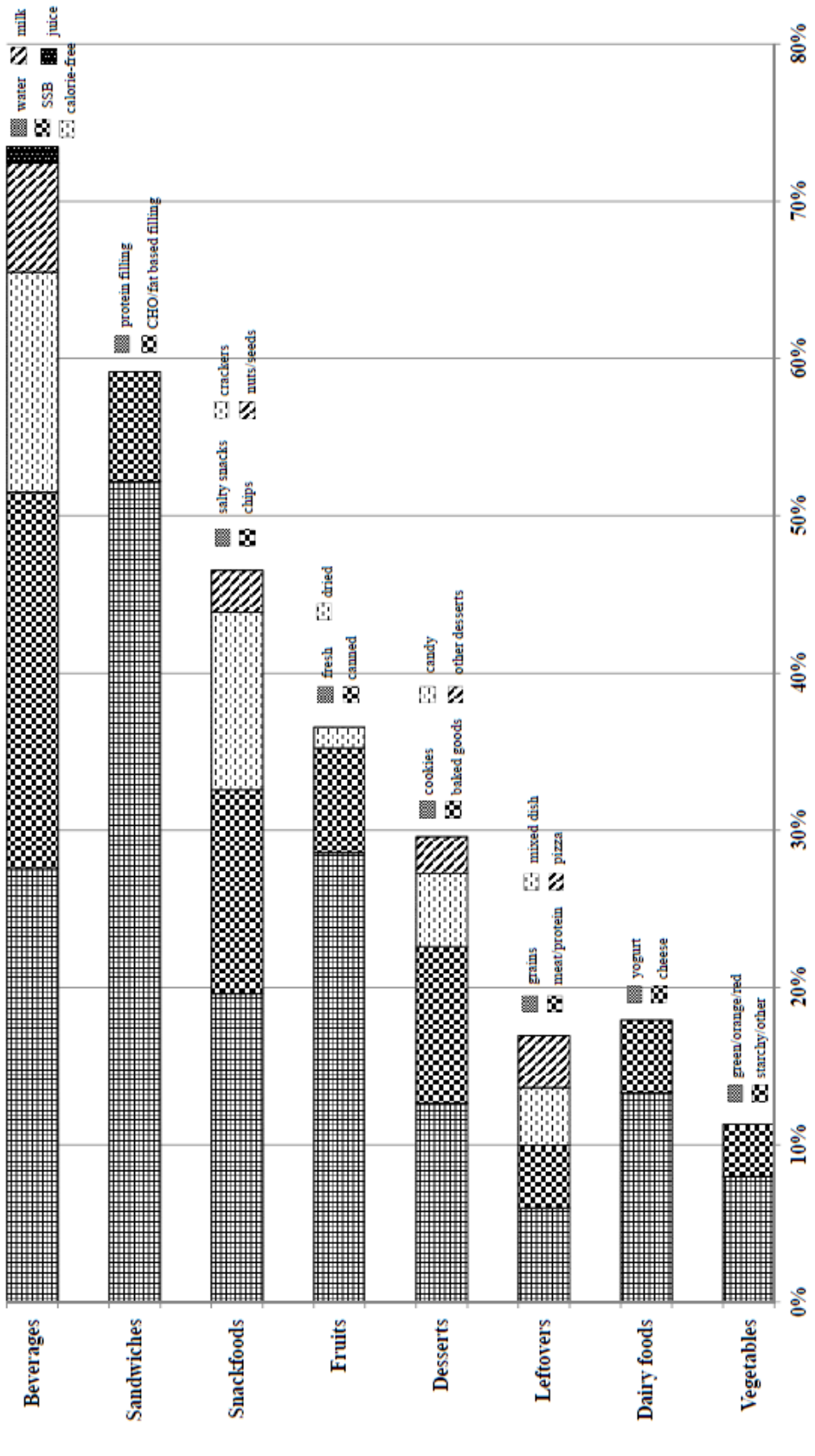

Figure 2A. Proportion of Lunches Containing Items from Food and Beverage Groups

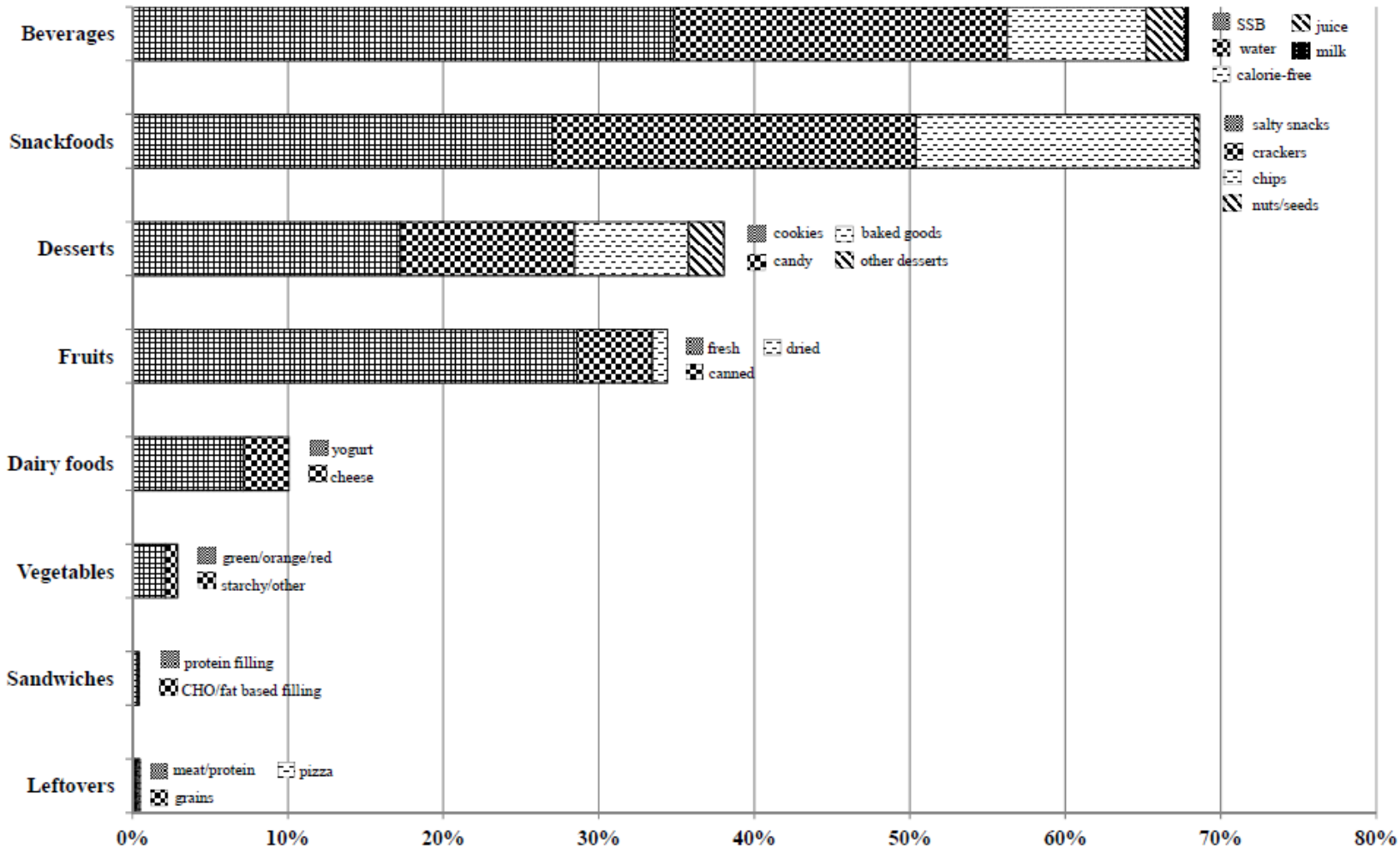

Figure 2B. Proportion of Snacks Containing Items from Food and Beverage Groups

Table 3A. Percentage of Lunches Meeting Federal Nutrition Standards by Maternal Education

	Maternal Education		
	< 4 years college education (n=106) n (%)	**≥4 years college education (n=190) n (%)**	**Total (n=296) n (%)**
Standards*			
Fruit (1/2 cup)	20 (19%)	73 (38%)	93 (31%)
Vegetables (3/4 cup)	6 (6%)	11 (6%)	17 (6%)
Grains (1 ounce)	65 (61%)	130 (68%)	195 (66%)
Protein (1 ounce)	68 (64%)	127 (67%)	195 (66%)
Milk (1 cup)‡	13 (12%)	30 (16%)	43 (15%)
Lunch Evaluation			
Number of standards met			
0	18 (17%)	24 (12%)	42 (14%)
1	23 (22%)	36 (19%)	59 (20%)
2	47 (44%)	68 (36%)	115 (39%)
3	17 (16%)	49 (26%)	66 (22%)
4	1 (<1%)	13 (7%)	14 (5%)
5	0 (0%)	0 (0%)	0 (0%)
Healthy Lunch† Met 3 or more standards	**18 (17.0%)**	**62 (32.6%)¶**	**82 (27.7%)**

*recommended serving size provided in parentheses

†healthy lunch defined as meeting at least 3 of 5 National School Lunch Program Standards

‡ includes participants who indicated they planned to purchase milk at lunch

¶p=0.007

Table 3B. Percentage of Snacks Meeting Federal Nutrition Standards by Maternal Education

	Snack Evaluation Participants with Snacks and Lunch (n=286)		Snack Evaluation Participants with Snack Only (n=312)		Total (n=598)
	Maternal Education		Maternal Education		
	< 4 years college education (n=102) n (%)	≥4 years college education (n=184) n (%)	< 4 years college education (n=195) n (%)	≥4 years college education (n=117) n (%)	n (%)
Standards*					
Fruit/juice/veg (1/2 cup)	41 (40%)	74 (40%)	53 (27%)	44 (38%)	212 (35%)
Grains (1 ounce)	0 (0%)	2 (1%)	1 (<1%)	1 (<1%)	4 (<1%)
Protein (1 ounce)	12 (12%)	21 (11%)	17 (9%)	15 (13%)	65 (11%)
Milk (1 cup)	1 (1%)	1 (<1%)	2 (1%)	1 (<1%)	5 (<1%)
Snack Evaluation					
Number of standards met					
0	53 (52%)	96 (52%)	129 (66%)	61 (52%)	339 (57%)
1	44 (43%)	78 (42%)	60 (31%)	52 (44%)	234 (39%)
2	5 (5%)	10(5%)	5 (3%)	3 (3%)	23 (4%)
3	0 (0%)	0 (0%)	1 (<1%)	1 (<1%)	2 (<1%)
4	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Healthy Snack† **Met 2 or more standards**	**5 (4.9%)**	**10 (5.4%)**	**6 (3.1%)**	**4 (3.4%)**	**25 (4.2%)**

*recommended serving size provided in parentheses

†healthy snack defined as meeting at least 2 of 4 Child and Adult Care Food Program Standards

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Chapter 5

Research Article 2:

The Adaptation of a School-based Health Promotion Program for Youth with Intellectual and Developmental Disabilities: A Community-Engaged Research Process

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Running Title: Adaptation of a Smarter Lunchroom for Youth with Disabilities

Keywords: adolescence, health promotion, intellectual disability, developmental disability, nutrition

ABSTRACT

Background: Evidenced-based health promotion programs for youth with intellectual and developmental disabilities (I/DD) are notably absent. Barriers include a lack of understanding of how to adapt existing evidence-based programs to their needs, maximize inclusion, and support mutual goals of health and autonomy.

Methods: We undertook a community-engaged process to adapt a school-based nutrition intervention in a residential school for youth with I/DD. Focus groups and interviews with school staff elicited recommendations for adaptation strategies; these were then reviewed by an expert panel.

Results: Adaptations were developed to address needs in three categories: food-related challenges among students, adjusting to change and transition, and social environment factors. Choice and heterogeneity were overarching themes across the adaptation categories.

Conclusions: Future research should consider community-engaged approaches for adaptation so youth with I/DD can participate and benefit from evidence-based health promotion programs to their maximum potential.

Introduction

Health promotion efforts are critical for people with disabilities, as their quality of life and independence are related to their ability to maintain good health (Drum, Krahn *et al.*, 2005; Drum, McClain *et al.*, 2011; Rimmer, 2002; Smith, 2000). Health and wellness are key factors that help people with disabilities to fully benefit from progress in education, employment, health care, independent living, and community integration (United States Department of Health and Human Services, 2005). Government calls to action (U.S. Department of Health and Human Services, 2002, 2010; United States Department of Health and Human Services, 2005) have resulted in a substantial expansion in health promotion programs targeted to adults with disabilities (Seekins, Kimpton *et al.*, 2010); yet very little published research has documented successful health promotion interventions for youth with intellectual and developmental disabilities (I/DD). A higher prevalence of obesity (Bandini, Curtin *et al.*, 2005; Curtin, Anderson *et al.*, 2010; Curtin, Bandini *et al.*, 2005; Emerson, 2009; Rimmer, Yamaki *et al.*, 2010) and cardiovascular risk factors (Wallen, Mullersdorf *et al.*, 2009) has been found among youth with I/DD compared to their typically developing peers. Even small efforts to improve their lifestyle behaviors can have a significant long-term impact not only on their health and quality of life, but on their ability to be independent and productive members of society (Ipsen, Ravesloot *et al.*, 2012).

Health promotion is arguably an ecological process (Ravesloot, Ruggiero *et al.*, 2011). Individual level factors among youth with I/DD (i.e. medication use, cognitive impairments, eating problems) may render them more vulnerable to poor diet quality (Bandini, Anderson *et al.*, 2010; Steele, Kalnins *et al.*, 1996). The social and physical environments in which youth with I/DD live, learn, work, and play can interact with these

individual level factors to facilitate health promotion or impede it. Life course theory, a public health framework used by the Maternal and Child Health Bureau of the Department of Health and Human Services, is consistent with integrative models for conceptualizing disability and emphasizes that the biologic, physical, and social environment largely determine the capacity to be healthy over the life course (Fine & Kotelchuck, 2010). The World Health Organization's *International Classification of Functioning, Disability, and Health* recognizes that physical and social environments can in themselves be disabling (World Health Organization, 2001).

Public health efforts to improve health promotion practices among youth have traditionally focused on schools as the optimal environment for the delivery of such programs and policies (Story, Nanney *et al.*, 2009); however little is known about whether school environments work for or against health outcomes for youth with I/DD. Barriers to the inclusion of youth with I/DD in school-based health promotion efforts include a lack of understanding of how to adapt existing evidence-based programs to their needs, maximize their participation, and support self-determined health behaviors (Rimmer, 2011).

We sought to learn whether food choices and dietary intake could be improved among students in a school serving youth with I/DD through adaptations to evidence-based food environment strategies successful in regular education settings. The intervention was modeled after the *Smarter Lunchroom Movement*, in which social and physical aspects of cafeteria environments are designed to nudge students toward healthier choices, often termed choice architecture (Hanks, Just *et al.*, 2013). We chose this intervention method because it preserves autonomous choice and aligns with the

social approach to disability, both of which are central tenets of health promotion for youth with I/DD (Drum, 2003; Rimmer, 2011).

Typically developing youth respond to environmental cues when making food choices within school settings. Targeted enhancements to key environmental cues within school food environments - convenience, normativeness, and attractiveness of healthy food options – have induced improvements in food-selecting behavior among typically developing youth (Wansink, 2013, 2014). Although the social and environmental supports required for healthy food choices in schools for youth with I/DD have not been considered, we hypothesized that their food choices would be influenced to a similar or even greater degree by these environmental cues. This paper describes the formative work and community-engaged adaptation process for the design and implementation of a Smarter Lunchroom intervention in a school for youth with I/DD.

Methods

Setting

The formative research and intervention took place at a school for students with I/DD in Eastern Massachusetts between September 2011 to June 2012. The school served 120 students (88 residential and 32 day) aged 9 - 22 years with I/DD and a range of secondary physical, emotional, and behavioral conditions including autism spectrum disorders (ASD). Students aged 9-18 years were enrolled in the education program and grouped into classrooms by age and functional ability; students aged 18-22 were enrolled in the vocation program to focus on job training and grouped according to job site. The student to teacher ratio was 3 to 1.

Theoretical Basis of the Intervention

The goal of the Smarter Lunchroom intervention was to improve the food selection and consumption behaviors of students at lunch for four dietary targets: fruits, vegetables, whole grains, and refined grains. Table 1 outlines three categories of Smarter Lunchroom intervention strategies (convenience, attractiveness, and normativeness) and corresponding design principles with demonstrated effectiveness among typically developing student populations (Wansink, 2013, 2014). Adaptations to classic Smarter Lunchroom strategies were deemed necessary due to the characteristics of the study population including: cognitive impairments, sensory processing impairments, communication disorders, oral-motor impairments, and mobility limitations. The implementation of the intervention required adaptations to achieve maximum participation by students and staff and to accommodate social environment factors within the lunchroom. For example, in classic Smarter Lunchroom interventions, the time allotted to formative work before implementing changes is relatively brief (Wansink & Just, 2011), and students are not given advanced warning of the impending changes. However, given the importance of patterns and routines, the implementation plan was adapted so that students could anticipate the changes.

Adaptation Process

Research Team and Reflexivity

Figure 1 provides a broad overview of the adaptation process. The formative research and intervention were guided by a Project Advisory Board comprising the research team (7), school staff (9), parents (2), and community partners (2). Expert panels have been used by disability researchers to develop guidelines for the

implementation of health promotion programs (Drum, Peterson *et al.*, 2009) and for the adaptation of community-based strategies for obesity prevention for youth with disabilities (Rimmer, 2011). Two senior research team members (AM & LB) had a pre-established relationship with the school prior to the intervention. More than 20 hours per week of direct observation occurred between September - December 2011 by a research team member (KH). This participant-as-observer approach included participation in the delivery of the lunch meal to obtain a direct understanding of student and staff behaviors (Crabtree B & Miller W, 1999). Informal meetings with school administrators, teachers and clinical services team members provided additional information about the students and school culture. Observations and field notes were shared with the Project Advisory Board. Findings informed the development of the topic guides for focus groups and interviews.

Focus Groups & Interviews

Participant selection for the focus groups and interviews was purposeful (Malterud, 2001). We specifically chose to involve teachers and food service staff because our observations verified that they held the most influential roles in the dining hall at lunch. Focus groups were chosen as the data collection method for education and vocation program teachers to encourage group interaction and explore both shared and diverse perspectives (Morgan, 1988). The focus group topic guides were designed to explore four key content areas: (1) perceptions, attitudes, and beliefs about the nutritional health of students and staff role modeling; (2) perceptions of the overall food environment and students' ability to make healthful food choices; (3) experience assisting students during lunch; and (4) feedback on the dining hall intervention proposal,

including how to best prepare students for change, maximize student inclusion, and maintain the integrity of the research.

Food service staff were interviewed individually to help elicit candid responses. It should be noted that food service staff interacted with students only in the dining hall and food preparation area, and interview guides were developed with this in mind. The topic guides for the interviews were designed to elicit feedback in three key content areas: (1) perceptions, attitudes, and beliefs about student food choices in the lunch line; (2) perceptions regarding student selection and consumption of fruits, vegetables, and whole grains; (3) feedback on dining hall intervention proposal including concerns for job duties, communicating change to students, and maximizing student inclusion. Focus group and interview topic guides were pilot-tested prior to data collection.

Participants were recruited via announcements at meetings, fliers, and email. Focus groups and interviews were audio-recorded, and conducted in a semi-structured format to allow the interviewer (KH) to adjust the order, precise wording, probes, and the level of language to meet the needs of the participants (Crabtree B & Miller W, 1999). A trained research assistant took field notes and provided logistical support for the focus groups. Focus groups were 45 minutes in length, ranged in size from four to seven, and included a mix of male and female participants. Interviews were 45 to 60 minutes. Verbal consent was obtained from all focus group (n=21) and interview participants (n=4). Subjects received a $10 gift card for participation. The study protocol was approved by the Tufts Institutional Review Board.

Qualitative Data Analyses

Digital audio recordings were transcribed verbatim. For the first cycle of coding, we used an editing organizing style of analysis in which transcripts were read line by line and coded based on their literal content. Coding began by identifying the information most pertinent to the research goals and informed by the topic guide, then extended to new categories, representing a mix of deductive and inductive approaches (Berg, 2007). Visualization of categories led to the second cycle of coding in which an interpretive reading style was used to understand the deeper meaning of the text (Crabtree B & Miller W, 1999). Coded excerpts from the first cycle were re-organized and coded according to their underlying meaning. The results reported here are limited to the themes and categories related to the development of adaptations. All qualitative data analyses were conducted using NVIVO 10 (QSR International, Inc).

Findings

Conceptual Framework for Adaptations

Coded data were organized into three broad categories related to the design of adaptations: food related challenges among students, adjusting to change and transition, and social environment factors unique to the setting. Social environment factors further included three supporting subcategories: vocation student workers, division of responsibility, and ethical dilemmas related to supporting health and autonomy. Choice and heterogeneity (i.e. "*they all respond differently*") were overarching themes across the three adaptation categories. The overarching themes, adaptation categories and subcategories are depicted as the conceptual framework (Figure 2).

Choice

Choice was the dominant overarching theme in the focus groups and interviews.

Teachers and food service staff acknowledged that providing meaningful opportunities to make choices was a fundamental aspect of school culture but students had limited practice making food choices. A female education teacher shared that the school was gradually moving towards a model of "*independent choice time*" to give students opportunities to make structured choices in the classrooms. She thought that this classroom technique could be reinforced in other environments and that it would be beneficial to provide additional opportunities to make food choices at lunch.

> *"And in some ways [food] is what they can control…for the most part… It is a time that they get to choose…We are moving towards a different [classroom] method…which is based on choices…and even when they are given a choice for something that they can have…it is really powerful for them…because they don't get to choose a lot of things. They don't have a lot of control and power over their day. It is very structured." (ED, R8)*[1]

Although providing additional opportunities to practice making food choices initially seemed beneficial, the discussion led to the following questions: How many choices are optimal? Are students capable of making more food choices in a short period of time? Is there adequate staffing to support more choice points in the serving area? Although most teachers were in favor of providing more choice-points along the serving line, food service staff were more cautious, citing concerns that students would get overwhelmed with more choices and that time was a major limiting factor.

> *"I don't know if you have enough time out there [to offer more choices]… they are making so many decisions there and some of them just look [and don't make a decision]…I could see that would be nice to be able to make your choices like all these colleges that have these stations with your own choices, like 'Do you want your seafood today or pasta?' I know we could never have anything like that. I think [more choices] would take some getting used to, and it would involve the staff, certainly, more, and it would require a lot more patience on the other side*

[1] ED=education, VOC=vocation, FS=food service, R=respondent

> *from the servers. You can't say, 'Make a choice, move on.' I would hate to see that happening." (FS, R24)*

Teachers and food service staff perceived that most students could correctly identify healthy food choices in the context of a class lesson but were not capable of making good dietary decisions due to cognitive limitations and impulse control. Students' difficulty in generalizing from one social context to another, coupled with their lack of practice making choices in real-world situations, were identified as major barriers.

> *"I think it depends on the student…the lack of the ability to generalize…like they can make a healthy choice when talking about food but when it actually comes to going through the line and choosing it…and then the fact that when the kids are residential students all the meals are essentially planned for them, they don't really have a choice… and even for lunch it is one or two options, it is not like you are at a restaurant, and you can pick the fried chicken or the grilled chicken. So I think the lack of practice that they have is…kind of prevents them from actually being able to do it [make a healthy choice] on a regular basis."(VOC, R12)*

Heterogeneity

The second overarching theme was the heterogeneity in disabilities among students. When discussing whether hypothetical intervention strategies would be effective or acceptable to students, the teachers often disagreed with each other saying "*my class is not like that*" or "*I don't have that problem.*" Teachers talked about "*having to know their students*" to successfully anticipate how they might respond and answered questions as they applied to the students in their particular class rather than making generalizations about the entire student population. A male vocation teacher described his recommendations for understanding the food-related challenges among such a heterogeneous group of students.

> *"Some of them have different allergies. And not all staff know every student's allergy, too. And look at each student, what their diagnosis is, why they function a*

> *certain way and why they react a certain way, either offering food, or taking food away…goes along with their diagnosis. Some of them copy each other…but they are all going to act differently. They all have their own issues. Some of the diagnoses are the same, but they deal with their issues differently…two autistic kids will deal with their problems differently."*
> *(VOC, R18)*

Food-Related Challenges among Students

Medication use, unusual food practices, and eating problems are documented risk factors for poor nutrition status among persons with I/DD (American Dietetic Association, 2004; Draheim, Stanish *et al.*, 2007; Hennequin, Allison *et al.*, 2005; Holland, Treasure *et al.*, 1995). Teachers and food service staff provided vivid descriptions of the food-related challenges among students that illustrate the diverse characteristics of the student population: impulse control, hoarding, impairments in cognitive processing, social aspects of eating, rigid eating habits, food selectivity (i.e. picky eating), eating pace, and hyper and hypo sensitivities in sensory processing. Teachers identified medication use and physical disabilities as additional challenges. Selected quotes that describe each food-related challenge are provided in Table 2. Narratives detail teachers' experiences eating with students and highlight the strategies they used to help students overcome challenges. Lunch was a particularly stressful time to juggle competing student needs in the face of limited staffing. A male education teacher expressed his frustration with the inability to adequately support multiple students in his class with varied food-related challenges during the lunch period:

> *"Some students have physical issues…like carrying the tray. A lot of the kids [have]…just attention issues…it is hard…you have 100 things to look at…and there is a huge line before you and behind you of kids who want to eat. And god forbid if it takes you more than two minutes to set up your tray, people are like 'come on, come on, hurry up' and it stresses out the kids."*
> *(ED, R6)*

Adjusting to Change and Transition

Smarter Lunchrooms designed for typically developing youth are implemented without an announcement of the changes. According to the theoretical underpinnings, since most food choices are made "mindlessly" subtle changes to the environment will likely go undetected. Withholding an announcement may also prevent student backlash (Just & Wansink, 2009). Proposed changes to the dining hall were subtle, yet teachers expressed concern that some students would experience major stress and anxiety if not prepared for the changes in advance. Teachers and food service staff advised that they be informed of the changes ahead of time to allow adequate time to prepare individual students who would require additional support. Teachers saw themselves as the gatekeepers of information and as responsible for developing strategies to address anticipated problems. The discussion regarding students' anticipated difficulty adjusting to change and transition echoed the heterogeneity theme.

> *"It [making changes in the dining hall] could cause an issue with some kids. You have to know your kids. Some are really in tune with that, others are not. I think we…got to figure out, 'This child will not be happy with this.' So we have to find a way of preparing them. I guess if that is a real issue with them, and for some – it isn't…for some food is not an issue. For some food is an issue. You have to know what's coming. Not that you always do. But I have a couple that lunch means a lot...Others could care less – they don't even eat half the lunch."(ED, R1)*

In contrast, food service staff and teachers in classrooms with the most impaired students commented that the changes would likely go unnoticed if they were not announced. A differing perspective related to this topic was the belief that students were resilient. Some teachers argued that students would find a way to adapt to the changes over time, even though it would be tumultuous in the beginning. Other teachers thought that, relative to other adjustments, adjusting to the lunchroom changes would not be

difficult.

> *"It might change the routine a little bit, just a little bit, but they'll get used to it. The students deal with changes, but more than lunchroom changes…have staff their whole life that leaves…get switched to another unit constantly. They have to deal with a lot bigger changes than changes to the lunchroom, so they can get used to it." (VOC, R18)*

Social Environment Factors Unique to the Setting

Vocation Students Working in the Serving Area

Vocation students worked in the serving area of the dining hall for their culinary training. Those with significant coordination, fine motor, or cognitive impairments were noted to have difficulty with the job skills required (i.e. chopping fresh fruits and vegetables, salad assembly). Food service staff expressed the inability to implement some of the proposed dining hall changes in light of the fact that their work was supported by vocation students.

> *"I don't know if we could really go through with it [offering more fruit and vegetable side dishes]. Just preparing all of this stuff is a lot. Like that particular day, we had to prepare the Caesar salads and some of the students are not the brightest light bulbs, but you try hard with them because that is why they are here, it is a learning program. We had to do that and then we had to fill in the fruit cups and we had to do all that stuff plus getting the deli ready so it would be like getting three meals together rather than two." (FS, 25)*

Critical questions surfaced in these discussions: How to produce food with improved nutritional quality in the face of an ever-changing student worker population? How to prepare student workers for changes in their job routine? Teachers noted the impact of changing the routine for vocation students who worked on the serving line.

> *"But on the serving side of things…if we are serving food a different way, some of the routine kids, some of the autistic kids might have an issue at first…because he [works at] the peanut butter & jelly station…he is so used to being in the same spot, giving the same amount of peanut butter and jelly to the students he*

> *knows…but just like the routine thing - he'll get used to it. We have changed his routine a few times." (VOC, R18)*

Division of Responsibility

In the dining hall, the perceived division of responsibility over food choices was highly variable, and resulted in inconsistent responses by food service staff and teachers. Most food service staff thought that the classroom teacher should take primary responsibility for overseeing the students' food choices at lunch, whereas teachers talked about their reliance on the servers to police the students' food choices. Mixed responses led to student confusion or, in some cases, allowed the student to manipulate the situation to achieve a desired outcome. A food service worker shared her perspective:

> *"We can't say 'you cannot have dessert today' you know, to that student. We don't know them all that well. You don't want to set a student off by saying something like that. I think it should be the responsibility of their classroom staff when they come through." (INT, R24).*

Compared to regular school settings, teachers and food service staff took on responsibilities related to food that would otherwise be under the purview of parents. Staff assumed greater roles in relation to food choices as evidenced by the way they talked about students that implied guardianship or a parent-child relationship with phrases like "*my student*" or "*my kids.*" Staff illustrated the tension between their roles versus parental roles with phrases like "*if they were my children.*" One noted that "*Our kids are our responsibilities, but not our children.*" Teachers described the desire to provide "*a home-like environment*" for the students and expressed that home-prepared foods were one way to share an aspect of "*normal"* life.

Ethical Dilemmas: Supporting Health and Individual Autonomy

Teachers and food service staff noted myriad ethical dilemmas related to competing goals to support student health and individual autonomy. Many recognized that food was highly motivating for students. Students were said to "*gravitate towards*" sweet foods and beverages and eating was perceived to be deeply satisfying and enjoyable in comparison to other activities. All staff seemed to be aware of the long-term concerns for overweight and obesity in this population; nonetheless they struggled with setting food limits, even for students on medically prescribed diets. One said "*How can I say no to them?*" then changed her mind mid-conversation, highlighting the conflict that she "*wants them to be healthy, too.*" Ethical dilemmas were most burdensome on staff when the rules were not clear. In the worst-case scenarios, setting limits resulted in physical confrontations or aggressive behavior initiated by students.

> *"There is one student who punched me in the face! Because I would not give him something. I did not even say he could not have it – his staff said he could not have it – and he took his fist and he smacked me in the face. He is on those [healthy] menus and [now] I let him have what he wants because I don't want to get smacked in the face anymore. There are times when you have to be careful." (FS, R25)*

Key Adaptations Identified For Intervention

The information from the focus groups and interviews, representing the themes and adaptation categories summarized herein, were reviewed by the Project Advisory Board to develop the adaptation strategies. This phase of the analysis served to corroborate our interpretations (Crabtree B & Miller W, 1999). The Project Advisory Board endorsed final recommendations for the policy and environmental changes, specific alterations to the serving line, approaches to maximize student inclusion, and how to support students through the change process.

Intervention elements and the data collection protocol are detailed elsewhere

(Hubbard, Bandini *et al.*, 2013). Table 3 outlines the key adaptations identified by the Project Advisory Board and used in the intervention. To address concerns related to change and transition, students were prepared for the impending changes through social stories ™, instructional videos, student lunch advisory committee activities, and a 2-day pilot to become familiar with the data collection procedures. A student volunteer was featured in the instructional video to illustrate serving line changes and the collection of data using digital photography of the students' lunch trays. The video was used in classrooms as an instructional tool. Researchers shared de-identified food photos from the pilot test with classrooms prior to the baseline data collection to explain how the food photos would be used.

The majority of serving line changes came directly from staff recommendations. The research team planned for all changes to occur at once, rather than a slow introduction of changes to facilitate swift adjustments in routines and to establish new patterns. Teachers had reported that students had trouble understanding the posted lunch menu due to sophisticated language, lengthy descriptions, and generic illustrative photos. For the intervention, the menu was communicated to students using real food photos in addition to augmentative and alternative communication systems that featured Picture Communication Symbols ™ (PCS). We provided a larger menu board to feature the food photos and for larger print to accommodate students with visual impairments. We created signs with real food photos and PCS™ to indicate choices. An easy-to-eat fruit option was available daily for students who had difficulty eating raw fruit due to chewing/swallowing issues or inability to peel citrus fruits due to fine motor impairments. We introduced an additional choice point by unbundling fruit and

vegetable side dishes from the entrees. Teachers were trained to instruct students to make an autonomous choice between the two options. Prior to the intervention, dessert was served at eye level two days per week by a vocational student. To preserve choice, we retained the availability of dessert two days per week, but moved it behind the counter. Students were informed about all of the dining hall changes except two: portion size reduction of desserts to 75% of their original size and the change of peanut butter and jelly sandwiches from white to wheat bread.

The most significant adaptation to classic Smarter Lunchroom design was the decision to hold taste-testing activities in the classroom rather than the dining hall. A subpanel of research staff and Project Advisory Board members reviewed recipes and adapted recipe instructions to include more pictures. Each classroom chose among four recipes. Students voted for the recipe to prepare and taste together as a class and a second recipe for tasting only. The voting mechanism greatly enhanced student participation. The activities provided multisensory learning experiences with the dietary targets, additional opportunities for choice-making related to food and mitigated safety concerns. Lastly, it served as a collaborative environment for researchers, teachers, and students to work together on common goals.

The final key adaptation to the implementation process was maintaining the integrity of the social environment of the research. Specifically, because a portion of the dining hall operations were staffed by students, we monitored their ability to serve the food consistently in the intervention layout plan. Dining hall operations were observed by a research team member throughout the intervention and constant communication with teachers and food service staff was maintained to monitor the acceptance of the

intervention and to provide support to staff.

Discussion

Evidenced-based health promotion programs for youth with I/DD are notably absent. Youth with I/DD have not been included broadly in school-based nutrition interventions despite the likelihood that many will become obese and face diet-related chronic diseases in adulthood (Bandini, Curtin *et al.*, 2005; Chen, 2009; Curtin, Anderson *et al.*, 2010; Curtin, Bandini *et al.*, 2005). An important strategy to address disparities in health outcomes and to increase the availability of effective interventions is to adapt existing evidenced-based programs (Rimmer, 2011).

We are aware of only one other school-based nutrition intervention for youth with I/DD with noted adaptation strategies. Hinckson et al. modified the Mind, Exercise, Nutrition…Do It! (MEND) program for youth with I/DD aged 7-13 for moderate to high support needs in two special needs schools in New Zealand (Hinckson, Dickinson *et al.*, 2013). Substantial adaptations were made to the original MEND program to accommodate the range of physical, cognitive, and communication impairments of students. Authors posited that schools likely represent the optimal venue for the delivery of nutrition programs for youth with I/DD, but remarked on the labor-intensive aspects of collaboration which included a reliance on the special education teachers to adapt and implement the program (Hinckson, Dickinson *et al.*, 2013). Our qualitative research builds upon the work of Hinckson et al. and highlights a variety of factors for researchers to consider when adapting evidenced-based programs for youth with I/DD. Many of these factors are relevant across implementation settings (i.e. schools, communities, clinics).

Social supports required for healthy food choices have not been widely considered for youth with I/DD, but the adult literature provides evidence for the unique role of staff to support health-promoting behavior (Elinder, Bergstrom *et al.*, 2010; Marks, Sisirak *et al.*, 2013). We found that staff who serve youth with I/DD face two potentially conflicting duties – to protect students and to support their autonomy – often at odds in the context of health promotion. This observation is consistent with the adult literature (Bergstrom & Wihlman, 2011; Hawkins, Redley *et al.*, 2011). Staff perceptions did not reflect evolving perspectives of disability as a social construct or one of many determinants of health (Drum, 2003; Iezzoni & Freedman, 2008; Krahn & Campbell, 2011). Rather, staff beliefs about students' ability to make self-determined choices reflected the tendency to focus on the individual in isolation rather than on the interaction of the individual's capabilities in the context of environmental barriers; this is also consistent with the adult literature (Melville, Hamilton *et al.*, 2009).

Understanding and addressing the beliefs, practices, and values of staff was critical to this research as they shaped the social environment in meaningful ways. Staff oversaw the "moment-to-moment" food intake decisions (Humphries, 2004). As the gatekeepers to health, staff should be supported for this aspect of their role. In our focus groups, teachers described a range of food-related challenges experienced by students and the innovative methods used to support healthy and safe food intake.

For a "simple" intervention, a considerable amount of time and effort to community-building activities and processes was dedicated. We engaged school leaders, teachers, and staff during the planning stages while writing the funding proposal and relied on these partnerships for advice and guidance throughout the intervention and

evaluation. Staff recommendations for adaptations led to an intervention that was well-accepted by students. No behavioral problems were reported as a result of the intervention. Students were resilient and many appeared to readily adopt new patterns of behavior such as choosing a fruit or vegetable side dish. Close collaboration with staff to prepare students for change likely contributed to the overall acceptance of the intervention.

Engaging with research participants is an inherent aspect of the qualitative research process, rendering personal bias unavoidable (Tong, Sainsbury *et al.*, 2007). The primary author was integrated in the school setting for the duration of the project and developed relationships with the interviewees, focus group participants, and students that potentially bias the interpretation of the qualitative data. Steps were taken to mitigate potential bias. Transcripts were coded using qualitative software. The interpretations were confirmed by the Project Advisory Board, which adds credibility to our findings. Detailed information regarding the background of the authors was provided to give readers the opportunity to assess how these factors influenced the researchers' understanding of the phenomena under study (Elder & Miller, 1995).

This qualitative study has a number of limitations. The research was conducted with one residential school, and the authors acknowledge that generalized conclusions are thus not possible. However, the findings are relevant for youth with I/DD in other contexts. Health promotion efforts with youth with I/DD will likely encounter similar themes of heterogeneity, the importance of choice, staff conflicts between supporting autonomy and health, and food-related challenges among students that increase nutrition risk. Social supports to enhance health-promoting behavior among youth with I/DD

should be identified in all settings. We also argue that our process of developing adaptations based on community-engagement, qualitative methods, and expert panel consensus is highly generalizable to other community settings in which youth with I/DD live, learn, work and play.

The benefits of community-engaged research are well-documented among typical populations and include the design of more culturally sensitive programs which may enhance sustainability by the community and ultimately improve their capacity to promote health (Israel, Schulz *et al.*, 1998). The use of community-engaged research models is growing in the disability field (Ravesloot, Seekins *et al.*, 2007). Client-centered research in community settings is viewed as an extension of patient-centered planning in the health sector (Drum, Peterson *et al.*, 2009) and aligns with principles of self-determination - that people with disabilities and their families should control all aspects of their lives (Seekins & White, 2013), with research as no exception.

The staged adaptation process involved all stakeholders and facilitated collaboration between research partners, students, and the school community. The formative work led to the production and sustainability of an intervention with measurable benefits to students, confirming our hypothesis that the food habits and dietary intake of youth with I/DD could improve through enhancements to the social and physical aspects of their food environment (Hubbard, Bandini *et al.*, 2013). The intervention resulted in other benefits that were not measurable, but were of importance to the school community, including student engagement, exposure to new foods, and renewed pride in job responsibilities. Results contribute to the sparse evidence base of health promotion strategies for youth with I/DD. Future research should consider

community-engaged designs for health promotion among youth with I/DD in other settings.

Table 1. Smarter Lunchroom Intervention Categories & Principles

Category	Principle	Implementation Examples from Typical Populations
Convenience: Improve the convenience of fruits, vegetables, and other healthy foods		
	Make healthy choices more convenient	Slice fresh fruit instead of serving whole Fresh fruit located near cash register "Healthy convenience line"
Attractiveness: Improve the attractiveness of fruits, vegetables and other healthy foods relative to other options		
	Improve visibility of healthier foods	Fresh fruit displayed in bowls or tiered stands Lunch menu posted Write "Today's Fruit Specials" on menu board Attractive lighting for healthy foods
Normativeness: Make the selection of fruits, vegetables, and other healthy foods seem normative		
	Utilize suggestive selling (prompts)	"Last Chance for Fruit" sign displayed next to fruit basket at register "Would you like to try...?" (verbal prompt by cafeteria staff) Taste-testing promotions in lunchroom
	Manage portion sizes	Reduce size of desserts Smaller plates, bowls, glasses
	Use smart pricing and bundling strategies	Bundle healthy item with less healthy item (i.e. bundle chocolate chip cookies with milk) Change default options (i.e. all sandwiches come with vegetable side)

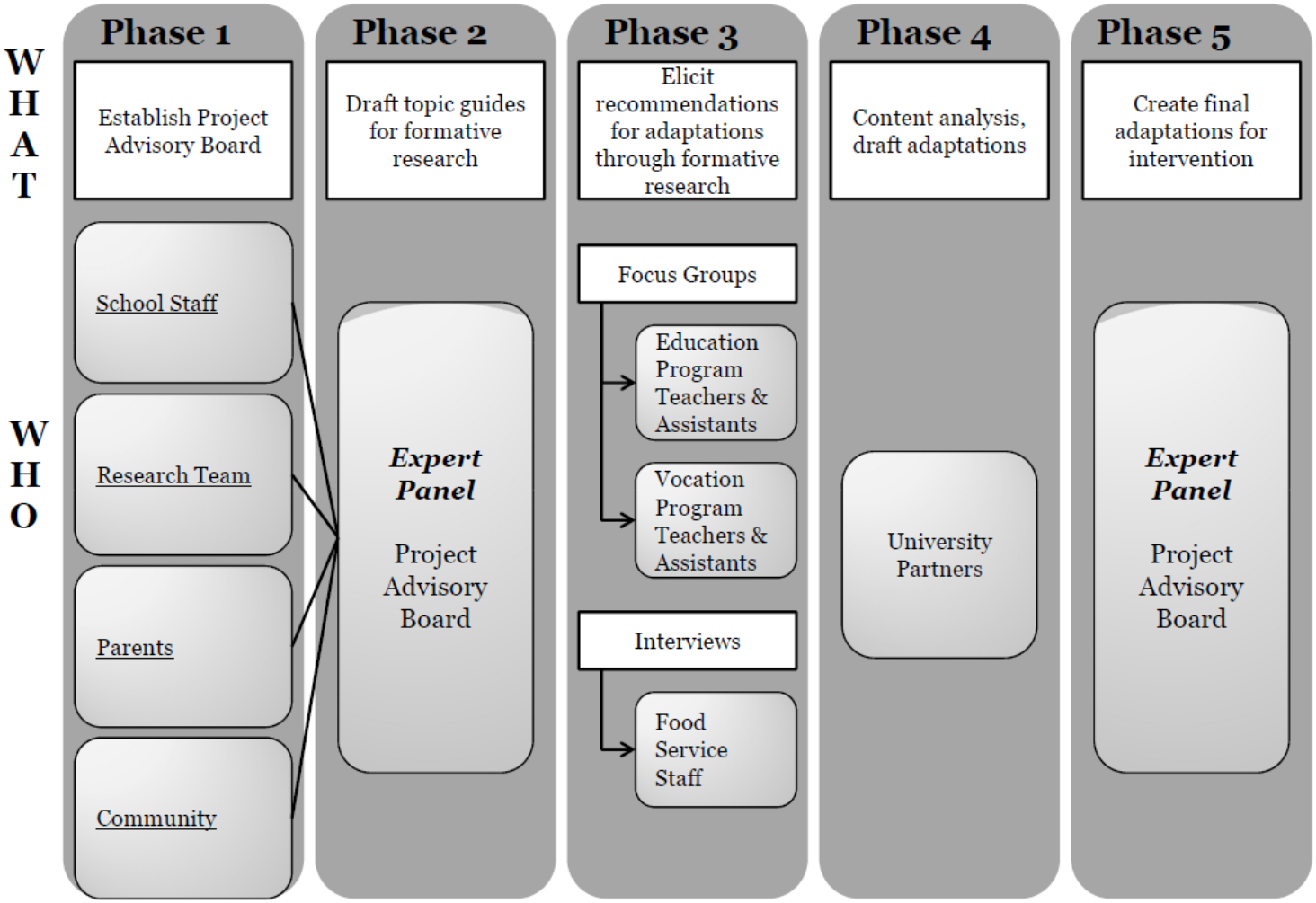

Figure 1. Adaptation Process Model

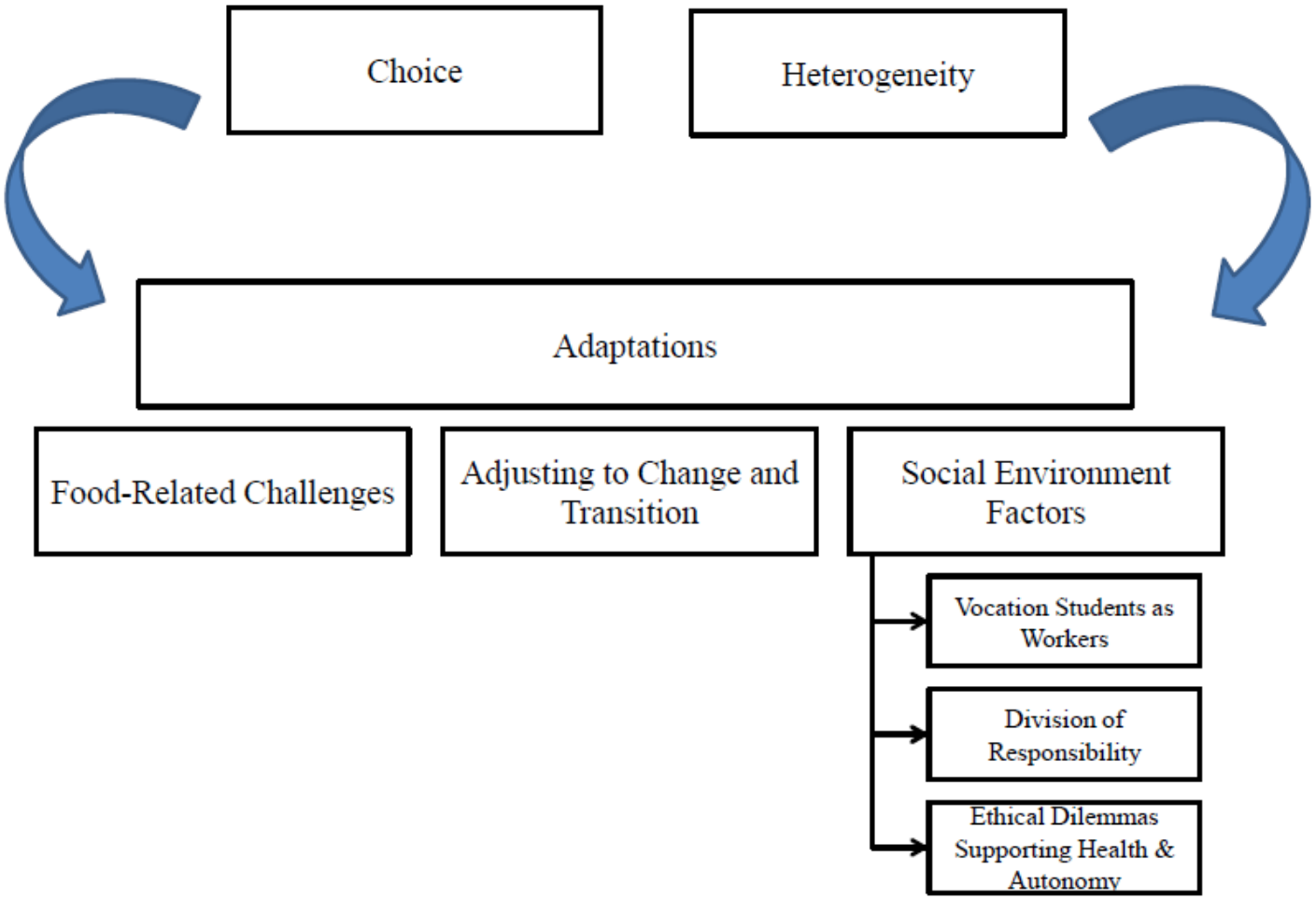

Figure 2. Conceptual Framework. Three categories emerged for designing adaptations: food-related challenges among students, adjusting to change and transition, and social environment factors unique to the setting. Choice and heterogeneity were overarching themes across the adaptation categories.

Table 2. Food-Related Challenges: Selected Quotes from Focus Groups and Interviews

Concept		
Impulse Control	I think a lot of it has to do with impulse control, too. In the moment…it is there. They see it. They want it. It tastes good. (ED, R8)	I would say that 50% of the time [he] gets stuck because he touches and we tell him "Don't touch. Don't touch," but he can't help it. (ED, R10)
Hoarding	Students take one of everything…They will take the soup, the entrée, take a fruit, they will take dessert, they will take a blue milk and they will take a yellow milk…One of everything…you know a blue milk and a yellow milk. Not two blues. Not two yellows…just one of each. (ED, R2)	They want to make sure they get one of everything. These are the kids that were probably neglected at some point in their lives. I've never seen it not be. That's trusting that they've had this chance and they are going to take everything they can. (ED, R1)
Cognitive	Not only do they look at it on the board…but a lot of them do not know what "Panini" means or certain names of cheeses or when you make chicken a certain way or "sautéed." They may not know what that word means, or anything like that. "Marinade" - these are difficult words for them. (VOC, R18)	Many of the kids will just kind of stop and then look and then you say, "pick one of these" and you might have to verbally say what they are. They might be standing there and looking at the person serving the food instead of the food that is sitting in front of them waiting for something to come up. Maybe they are looking for a bigger one. I don't know what they are looking for…maybe they are unaware that the food is sitting right in front of them. Who knows? (VOC, R13)
Social Aspects of Eating	Table manners is a big thing…just eating properly and just using a napkin and not spreading everything everywhere. Like my student tends to take everything off of her tray and it ends up all over the table. I try to bring her back in. "You can keep everything here. You have plenty of room right on your tray. You don't have to smear everything over the table." I try to keep her contained. That is what I do. (VOC, R14)	I go back to the behaviors…I mean my class …although it is changing…tends to be higher functioning, more social, more drama oriented, and some days in the lunchroom it is just chaos, so sometimes my job is more managing the gossip and the drama. (VOC, R15)
Rigid	They know what is good for them…but it is a matter of getting them to try it… is hard…because they are fixated on what they like and don't want to try anything new. (ED, R4)	They are very rigid. And so are we. I think it is "he likes this" and we give them what they like so we don't have to battle. (ED, R7)
Food Selectivity	Some [students] are just taking a couple of bites and then that's it. You have to stay on them, "Try to eat it." He [the student] did not want anything in the line. He	A lot of my students will ask "I don't want vegetables." Like yesterday, there was hamburgers or cheeseburgers…and he said "I don't like pretzels" and put them back. I think a lot of

	tried the sliders and tried like half of a bite and I came over. I saw him. I tried to cue him… "Just try it…you've got to try it…get some ketchup…throw something on it…disguise it." But it did not work for him and he did not eat anything. (VOC, R16)	my students are picky eaters. They know what they like and that's what they take. (ED, R9)
Eating Pace	You have a half an hour to eat your lunch. One of our students had a hard time so he had a timer. He knew…how much a half an hour is…he knew his time was up. We don't really use the timer anymore, because we say "look at the clock" and he knows what time everything is done and he is usually good with a few cues. (VOC, R18)	I don't know it if is useful, but I talk about the speed of eating. Like, "Don't take another bite until you put the first one down and you are done chewing." I may have to say it constantly but at least they listen…they will take a bite and they put what they are eating down before they can pick it up and take another bite just to monitor how much food is in their mouth at one time (VOC, R12)
Sensory	There's one girl, I usually tell her she's finished…but the rest of them eat like….I have to remind them to eat…and focus…because they are…so focused on surroundings…so you have to bring it back to eating. (ED, R7)	Yes, and that adds to the noise and the behaviors…cause there is so much going on. [The dining hall] can be over-stimulating (VOC, R14).

Table 3. Key Adaptations Used in the Intervention

Area	Specific Adaptation	Purpose
Prepare Students for Changes to the Dining Hall	Social Story	Minimize anxiety related to change and transition
	Instructional video	Provide visual learning tool
	2-day pilot of data collection (food photos)	Provide opportunity to practice data collection process
	Choice boards	Provide students with tool to indicate choices
Student Involvement	Food inspired artwork	Multisensory learning experiences with dietary targets
	Classroom based taste-testing activity	Provide tactile experiences with dietary targets Address safety concerns
	Student Lunch Advisory Committee activities	Increase student participation
Policy/Environment	Schedule adjustment	Reduce overcrowding in eating environment
	Acoustic panels	Reduce noise and overstimulation in eating environment
	Chair gliders	Reduce noise
Serving Line	Real food photos	Visual learning tool, exact match of food served
	Signs to indicate choices using Picture Communication Symbols	Support autonomous choices
	Revised menu board	Communicate choice options using symbols rather than words for students with limited reading ability
	Choose sides – introduce one extra choice point	Provide additional opportunity to make choice Encourage consideration of vegetable side item
	Blank Placemat	Neutral visual learning tool for tray assembly
	Separate fruit baskets	Improve accessibility Ease decision-making
	Peanut butter and jelly sandwiches available by request	Decrease accessibility of less desired entrée and encourage consideration of other entrée options Improve visibility of alternative choices
	Easy to Eat Fruit Option	Texture modification for students with chewing/swallowing concerns or impairments in fine motor skills
	Move desserts behind the counter	Decrease accessibility of less healthy foods

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Chapter 6

Research Article 3: Impact of a Smarter Lunchroom Intervention on Food Selection and Consumption among Adolescents and Young Adults with Intellectual and Developmental Disabilities in a Residential School Setting

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Ethics: This study was approved by the Tufts Institutional Review Board.

Introduction

Population based data from the United States (U.S.)[1-3] and Australia[4] indicate that youth with intellectual and developmental disabilities (I/DD) are at an increased risk of obesity. A higher prevalence of obesity has been reported among non-representative samples of youth with spina bifida [5], cerebral palsy [6, 7], Down syndrome [8], and intellectual disability (ID) [9-12]. Obesity among youth with I/DD may undermine their ability to live independently, limit future opportunities for employment, and may contribute to health disparities in adulthood [13].

Youth with I/DD are more vulnerable to poor diet quality compared to typically developing children due to their complex medical, physical, and behavioral challenges (i.e. medication use, cognitive impairments, eating problems)[14-16]. Compared to typically developing peers, youth with I/DD, including children with autism spectrum disorder (ASD), consume less daily servings of fruits and vegetables[17, 18] and these outcomes have a positive association with lower family income[18]. Schools represent ideal environments for public health interventions to improve population-level dietary patterns of children and adolescents[19]. Little is known about the extent to which youth with I/DD have been included in school-based efforts to improve dietary intake[20].

Behavioral economics and principles of behavioral science that guide recent efforts to "steer students to better choices by making low or no-cost changes to the cafeteria environment" – are termed the *Smarter Lunchroom Movement*. When redesigning lunchrooms to be smarter, *how* food is served and presented to students is modified rather than emphasizing extreme changes to *what* foods are served[21]. This approach preserves autonomous choice – a central tenet of health promotion for youth

with I/DD [22]. The six principles of Smarter Lunchroom design include: 1) manage portion sizes, 2) make healthy choices more convenient, 3) improve visibility of healthier foods, 4) enhance taste expectations, 5) utilize suggestive selling (prompts), and 6) use smart pricing and bundling strategies [23]. Smarter Lunchroom interventions have improved fruit and vegetable selection and consumption among typically developing high-school students [24]; but these strategies have not been tested specifically among youth with I/DD. Furthermore, no published research has addressed whether youth with I/DD in residential education settings can benefit from adaptations to evidenced-based health promotion strategies that have proved successful among typically developing youth in regular education settings.

The present study adapted these Smarter Lunchroom principles to meet the needs of students with I/DD enrolled in a residential school. Outcomes of interest, established a priori, aligned with new federal nutrition standards for school lunch [25], addressed dietary deficits common among youth, and included improvements in the selection and consumption of fruits, vegetables, whole grains, and refined grains based on number of servings. The evaluation employed a pre-post quasi-experimental design in which five days of matched dietary data were compared between baseline and follow-up to assess changes at the individual level [26]. We hypothesized that the intervention would increase students' selection and consumption of fruits, vegetables and whole grains; and decrease their selection and consumption of refined grains over a three-month period.

Methods

Setting

Of the 6.5 million students with disabilities served through the Individuals with Disabilities Education Act (IDEA) in the United States, 3.4% are served in private specialized day and/or residential programs (2008 data)[27]. Under IDEA, the right to a free and public education in the *least restrictive environment* provides that separate schooling in private programs occurs only when the nature or severity of the disability is such that education in regular classes cannot be achieved satisfactorily. The intervention was implemented in Massachusetts at a private specialized residential school for students with I/DD between December 2011 and June 2012. The school served 120 students aged 9 - 22 years with I/DD and a range of secondary emotional, mental health, and behavioral conditions including ASD. Eighty-eight students lived at the school (i.e. residential) and 32 attended the day program only. Eighty percent of students' families were at or below the federal poverty level. Students aged 9-18 years were enrolled in the education program and grouped into classrooms by age and functional ability; students aged 18-22 were enrolled in the vocation program to focus on job training and grouped according to job site. The student to teacher ratio was 3 to 1.

Recruitment

This study was conducted according to the guidelines established in the Declaration of Helsinki and all procedures involving human subjects were approved by the [ ] Institutional Review Board. At the school administrators' request, all students participated in the intervention to avoid disruptions in daily routines. The research aspect was limited to the pre-post evaluation of the selection and plate waste of foods at lunch using digital photography. The licensing policy of the school stipulated students classified as wards of the state (n=20) were ineligible to participate in the research

aspects of the intervention. Recruitment letters were sent to the families of the remaining eligible students (n=100). Written parental permission to participate in the research aspect (evaluation) was received for 51 students. Assent to participate in the evaluation was obtained from participants via classroom visits. Participants were told that pictures would be taken of their tray before and after they ate lunch to help us learn more about students' eating habits. Participants were aware that they could stop participating at any time and were free to decline having the food photographs taken of their lunch tray on each day of data collection.

Baseline Conditions

Formative research was conducted between December 2011 and February 2012 and is described elsewhere [28]. Baseline data were collected in February 2012 prior to any dining hall layout changes. The school participated in the National School Breakfast and Lunch programs, with breakfast and dinner provided in the residential housing units. The intervention focused on the lunch meal, served daily in the dining hall from 10.45 to 12.00 hours. School food service followed a seasonal three-week cycle menu. Table 1 displays week 1 of the baseline menu. The order of choices in the serving line at baseline was as follows: (1) peanut butter and jelly sandwiches on white bread served with a corresponding side of pretzels, (2) soup, (3) main entrée option 1 with a corresponding side dish, (4) main entrée option 2 with corresponding side dish, (5) fresh fruit (apples, oranges, bananas offered daily), (6) yogurt, (7) dessert or canned fruit, (8) milk (skim, 1%, and Lactaid - white milk only). The main entrée was provided by the head server to ensure standard portion sizes. The remaining items were pre-portioned in separate dishes

by food service staff in advance because vocational students participated in the lunch service.

Prior to the intervention, the menu was communicated to students through words and Picture Communication Symbols™ (Dynavox Mayer-Johnson LLC, Pittsburgh, PA, USA) for foods. Picture Communication Symbols™ are visual representations of concepts and ideas that reinforce meaning. They are used as an alternative method of communication for youth with cognitive impairments or communication disorders [29]. A placemat used as a tray liner depicted the lunch elements and included a picture highlighting dessert. The peanut butter and jelly sandwiches were available daily to accommodate students who had very limited food repertoires. Side dishes (i.e. pretzels and vegetable side dishes) were "bundled" with the entrée. Students were permitted to refuse the side dish that was automatically plated with the entrée in accordance with NSLP rules for offer-versus-serve, but were not permitted to switch side dishes. A fruit bowl containing apples, oranges, and bananas was kept behind the counter. Dessert was served on the eye-level counter by a vocational student. Canned fruit was offered on Tuesday and Friday, when dessert was not offered.

Students arrived to the dining hall by classroom, including primary teacher and teaching assistants. Students had 30 minutes to choose and eat lunch. The lunch periods assigned to classrooms were staggered to avoid overcrowding. Teachers selected their own food from the serving line and ate lunch with their students to provide them with the support and supervision they required due to their cognitive, behavioral, and physical challenges. No monetary transactions took place because student meals were included in yearly tuition.

Intervention Planning

Adaptations to classic Smarter Lunchroom strategies were necessary due to physical and social factors within the lunchroom environment and the unique characteristics of the study population including: cognitive disabilities (low literacy and comprehension, impairments in reasoning and decision-making); sensory sensitivities (both auditory and oral); communication disorders; oral-motor impairments (all students are considered high risk for choking); and mobility limitations. Youth with I/DD, particularly those with ASD, may experience anxiety and exhibit disruptive behavior in response to change and transition. Additionally, many students had communication challenges and language-based disabilities. Students were prepared for the impending changes through social stories™, videos, student lunch advisory committee activities, and a 2-day pilot to practice data collection procedures. Social stories™ describe situations, relevant social cues, and common responses in a specific format on the premise that an improved understanding of the situation will lead to the desired behavioral response [30].

Dining Hall Layout Changes

The intervention capitalized on environmental changes to enhance the students' experience of making choices in the serving line for all three weeks of the menu cycle (Figure 1). The goal was to induce improvements in students' food choices through "nudging" rather than menu changes. Communication of the menu choices was enhanced by supplementing the Picture Communication Symbols™ with real food photos. In our formative work teachers described real food photos as the optimal visual aids because they were more accurate and descriptive compared to Picture Communication Symbols™. For example, students were confused if the entrée-sized salad on the lunch

menu was taco salad with multiple toppings but the Picture Communication Symbol™ featured a plain lettuce salad. The placemat was revised to present a non-directive (no foods pictured) instruction for food placement on the tray.

Peanut butter and jelly sandwiches were moved to the back counter and made available only by request to encourage students to at least consider the two main entrée options. Fruit was moved to the beginning of the serving line. Apples, bananas, and oranges were separated into attractive and easy-to-reach baskets to improve accessibility. An easy-to-eat fruit option (e.g. applesauce) was available by request daily near the fresh fruit. The healthiest entrée (i.e., meeting the greatest amounts of the dietary targets) was placed earlier in line, followed by side dishes. A critical change was the unbundling of side dishes and entrées, made in response to formative research which indicated students were confused by the inability to change side dishes, and our desire to support autonomous choice. Teachers were trained to support autonomous student choices in the serving area. Desserts were kept behind the counter, rather than serving them at eye-level. Milk and yogurt were not targeted for improvement because formative research suggested that almost all students selected dairy daily. The menu was altered in two instances. One menu change was to serve peanut butter and jelly sandwiches on wheat bread rather than white; a second change was to reduce the portion sizes of desserts to 75% of their original size. The two menu changes were a result of our community-engaged formative research; teachers unanimously asked for these two changes during the planning stage.

Activities to support the intervention included 1) prompting by "celebrity servers," 2) the creation of fruit and vegetable inspired artwork for the dining hall, 3)

classroom-based taste-testing activities, and 4) logo-naming and branding activities. Fidelity to the layout changes was monitored on three non-consecutive days for the first four weeks of the intervention, followed by weekly observations in months 2 and 3. Specifically, vocational students that worked in the serving area required support to adjust to their new roles. We monitored the ability of students and staff to serve the food as delineated in the layout plan.

Measures

The digital photography of foods method [31, 32] was used to measure food selection and plate waste at lunch for five consecutive days (Monday through Friday) at baseline in February 2012 and five consecutive days (Monday through Friday) at follow-up in June 2012 on the same week of the menu cycle to allow for direct comparison. Digital photography methodology has been validated in school cafeteria settings in comparison to weighed and visual estimation of portion sizes [32]. Two camera stations were located near the exit of the serving area to capture selection and at the waste disposal station to capture plate waste. Trays were lined with a paper placemat that contained a unique ID to link selection and plate waste photos to the individual participants each day. Two angle (41 degrees) and two aerial (16 inches) photographs were taken of each tray to assess selection and plate waste, for a total of four photographs per participant per day.

Portions of each available item were weighed in triplicate at baseline and follow-up to ensure no changes in serving sizes (with the exception of desserts) occurred. Standardized recipes and nutrient content of each available item were analyzed by a registered dietitian (KH) using Nutrition Data System for Research (NDSR) (University

of Minnesota, MN, USA, 2011). Each food was linked to macronutrient and micronutrient information from NDSR. Food selection and plate waste were estimated using a triple screen computer set-up that simultaneously displayed photographs of the reference portion, food selection, and plate waste. A trained research assistant coded selection as "yes/no" of each available item followed by quantity, because for certain items, such as milk, participants were permitted to take more than one. Selection was verified by a registered dietitian when plate waste was coded.

Photographs of weighed standard reference portions were captured for all available items. A registered dietitian estimated consumption by comparing the plate waste photograph to the standard reference photograph. Consumption was coded on a five-point scale (0%, 25%, 50%, 75%, 100%). Consumption estimates for fruits with cores and peels included the edible portion only. Consumption estimates were entered and linked to the NDSR nutrient analyses based on gram weights. Servings of fruits, vegetables, whole grains, and refined grains of each available item selected, wasted, and consumed were calculated from the standardized recipes in NDSR. In addition to servings, counts of all available items selected and consumed were generated.

Data Analysis

Three different analyses of the data were conducted. First, for the primary analysis, mixed linear regression models were used to evaluate mean changes in servings of fruits, vegetables, whole grains, and refined grains selected, wasted, and consumed with the individual participant as the unit of analysis. The models included two fixed within-participant factors that were crossed, visit (baseline versus follow-up), and day-of-the-week. Random participant intercepts were used to induce the within-participant

correlations. Day-to-day variability was assessed using a likelihood ratio test comparing the log-likelihood of full models that included the interaction terms to partial models with no interaction terms.

Second, the percentage of selected foods that were wasted was examined. Overall plate waste was assessed by calculating the percentage of total kilojoules and total gram weight of foods selected that were wasted. The plate waste of fruits and vegetables was assessed by calculating the percentage of the servings selected that were wasted. The mean percentage of plate waste (for total kilojoules, total gram weight, and total fruit and vegetable servings) was calculated for each participant and averaged across all participants.

Third, Poisson regression was used to evaluate changes in item count of foods selected and consumed. Counts were used to examine the relative contribution of changes in selection of foods targeted in the intervention (i.e. whole fruit, canned fruit, vegetable side dishes, soup side dishes, entrée-sized salads, desserts, and peanut butter and jelly sandwiches) to the changes in servings of fruits, vegetables, whole grains, and refined grains selected (expressed as a rate: per 100 student-trays). We used the same approach to examine the relative contribution of changes in consumption. Rates of milk and yogurt selection and consumption were examined for potential unintended shifts away from these foods. All statistical analyses were conducted using SAS version 9.2 (SAS Institute, Cary, North Carolina, USA); p-values less than 0.05 considered statistically significant.

Results

Enrollment

Fifty-one participants were enrolled in the research study. For each participant, a complete data record would contain 20 observations, consisting of selection and plate waste photos on each of five days at both baseline and follow-up. Dietary data were excluded from six participants with completely missing baseline or follow-up data (due to hospitalizations), from one participant who had no matching pre-post intervention days, and from one participant who followed a gluten-free diet sent from home. These exclusions yielded a final sample size of 43 participants. Of the 860 possible observations for the 43 participants, 196 were missing (23%) leaving a total of 664 observations (332 selection, 332 consumption) for the analyses. Reasons for missing data consisted of classroom field trips, illness, off-campus job locations, and transient refusal to participate in data collection. Each day, one to three participants refused to participate in the pre or post photograph. The mean age (standard deviation) of the participants in the analyses was 18.3 (2.5) years (range 11 – 22); 51% were female; 72% were residential students; and 53% were enrolled in the education program.

Selection

Daily mean kilojoules and mean gram weight of foods and beverages selected did not change over the study period (Table 2). Significant benefits of the intervention were observed for daily selection of whole grain and refined grain servings (Figure 2A). Daily selection of whole grains increased by a mean of 0.44 servings (from 1.62 to 2.06 servings) and refined grains decreased by a mean of 0.33 servings (from 0.82 to 0.49 servings). Daily selection of fruit and vegetable servings did not change. Significant variability in daily mean serving changes was observed for vegetable selection

(likelihood ratio test, $p < 0.001$) but was not significant for the selection of fruit ($p=0.16$), whole grains ($p=0.05$), and refined grains ($p=0.07$).

Rates of selection of whole fruit, canned fruit, vegetable side dishes, soup side dishes, entrée-sized salads, desserts, and peanut butter and jelly sandwiches are shown in Table 3. The rate of canned fruit selection more than doubled. No significant changes were observed in rates of whole fruit selection. Raw vegetable side dishes and soup side dishes were grouped together to examine the changes in rates of selection for all vegetable side dishes. The rate of selection of all vegetable side dishes did not significantly change from baseline to follow-up. Total vegetable side dishes were divided into raw vegetable sides and soup sides to determine whether the form of the vegetable impacted the rate of selection. The rate of soup selection significantly increased by 28%, while the rate of selection of raw vegetable sides significantly decreased by 46%. The rate of dessert selection did not change.

Consumption

Daily mean kilojoules and mean gram weight of foods and beverages consumed did not change over the study period (Table 2). Significant benefits of the intervention were observed for daily consumption of fruit, whole grain, and refined grain servings (Figure 2B). Daily consumption of fruits increased by a mean of 0.18 servings (from 0.39 to 0.57 servings), whole grains increased by a mean of 0.38 servings (from 1.44 to 1.83 servings), and refined grains decreased by a mean of 0.31 servings (from 0.68 to 0.37 servings). Daily vegetable servings consumed did not change. Significant variability in daily mean serving changes was observed for vegetable consumption

(likelihood ratio test, p=0.008), but not for fruit (p=0.27), whole grain (p=0.05), and refined grain (p=0.28) consumption.

Plate Waste

Participants at baseline wasted a mean of 17.5% of the total kilojoules selected and a mean of 21.4% of the total gram weight of foods and beverages selected. Overall plate waste did not significantly change over the intervention period (17.6% of the total kilojoules post and 19.5% of the total gram weight post). The change in the percentage of total kilojoules wasted differed significantly across days (likelihood ratio p=0.02), but did not differ significantly for percentage gram weight wasted (p=0.15). Significant benefits of the intervention were observed for fruit and vegetable plate waste. The mean percentage of fruit servings wasted from those selected decreased by 9.4% (p=0.04) and the mean percentage of vegetable servings wasted from those selected decreased by 9.0% (p=0.03) (Figure 3). The percentage of fruit and vegetable servings wasted from those selected did not differ across days (fruit p=0.97, vegetable p=0.05).

Discussion

To our knowledge, this study is the first to investigate food-environment intervention approaches based on behavioral economics and principles of behavioral science in a population of students with I/DD. Our findings are consistent with studies employing behavioral economic approaches in lunchroom environments among typically developing students. Verbal prompts from foodservice workers to encourage fruit selection resulted in significant improvements in selection and consumption of fruits at lunch among schoolchildren [33]. Peeling and slicing oranges to improve the accessibility of fruit increased the percentage of children selecting and consuming oranges in an

elementary school cafeteria[34]. When offered a choice between carrots or celery instead of a requirement to take them, a greater proportion of junior high students consumed their vegetable[35]. A Chef's Initiative intervention to improve the availability of healthy foods in Boston Middle Schools resulted in significant improvements in the proportion of students choosing whole grains and vegetables and the total amount of these foods consumed[36].

The intervention resulted in shifts in the sources of kilojoules selected and consumed, with an overall improvement in diet composition, rather than a decrease in overall energy intake. We observed no overall increase in plate waste, nor did the intervention cause unintended shifts away from selecting and consuming healthy foods. These results suggest that the intervention was effective for improving dietary intake, but may not directly affect positive energy balance or obesity. The cumulative impact of these relatively small changes at one eating occasion translate to an increase in 1.0 fruit serving, an increase of 2.2 whole grain servings, and a decrease of 1.7 refined grain servings for one individual over a 5-day school week. The observed improvement in whole grain consumption could be achieved by substituting ½ slice of whole grain bread for ½ bag of pretzels (refined grain) daily. The intervention resulted in a decrease in fruit and vegetable plate waste, supporting the hypothesis that students will consume a greater percentage of the fruit and vegetable side dishes when given the opportunity to make an autonomous choice. A reduction in fruit and vegetable plate waste could lead to significant cost savings for schools. The favorable impact was achieved through subtle "nudge" mechanisms that preserve autonomous choice, were accepted by students, and

carry a high potential for long-term sustainability due to the low implementation cost and potential for savings related to lower food waste.

Changes in the rates of particular menu items selected and consumed offer additional insights for the mechanisms by which changes in overall servings selected and consumed were achieved. Decreased rates of dessert selection and consumption, although non-significant, accounted for approximately 12% of the decrease in daily mean refined grain servings selected.

Changing peanut butter and jelly sandwiches from white to wheat bread, accounted for 30% of the increase in daily mean whole grain servings selected.

Observed shifts in selection towards canned fruits and soup suggest that processed forms of fruits and vegetables may be preferred over raw forms by students with I/DD. Though we observed a significant increase in the percentage of fruit servings consumed and rates of canned fruit selection and consumption, the magnitude of the behavior change was not adequate to observe an overall increase in mean servings of fruit selected at the individual level. The power to detect these changes may have been limited by our small sample size.

Changes in vegetable servings selected should be interpreted with caution because the vegetable side dishes were automatically placed on trays at baseline; making it difficult to isolate true selection of these items at this time point. The unbundling of raw vegetable side dishes caused a shift towards soup side dishes. The soups contained 0.5 to 1 serving of vegetables per 6 ounce portion - less than the vegetable servings provided by raw vegetable side dishes; this may explain the increase in the percentage of vegetable

sides consumed from those selected, but no significant increase in mean vegetable servings consumed.

The student population in this study was heterogeneous with respect to primary and secondary diagnoses, medication use, cognitive ability, and severity of behavioral and emotional challenges. The licensing policy of the school, designed to protect this vulnerable population, limited the ability to obtain additional information about the students beyond age and sex. Although it may have been beneficial to attempt to evaluate these and other potential modifying factors, the small sample size did not support the investigation of differential effects by student-level characteristics, even had they been available.

Two important limitations of this study were its small sample size and the lack of a control school to help rule out the potential influence of secular trends or events that may have occurred outside of the study. To the best of our knowledge, the school did not implement any other changes in campus environments outside the dining hall that could impact food selection and eating habits at the lunch meal. Nonetheless, findings should be replicated in a larger population, and a comparison school, if possible.

Schools have been identified as the optimal venue to deliver nutrition interventions and policies for children and should support the inclusion of youth with I/DD. Interventions to improve dietary intake need to address barriers at the individual and environmental levels that are perceived or experienced by youth with I/DD and their caregivers [37]. In our experience, the community-engaged research process facilitated a broad and rich discussion of health promotion opportunities for youth with I/DD and led to an intervention that incorporated values of foremost importance to the school

community. No students were excluded based on their disability and because the intervention did not rely on reasoning, those with significant cognitive impairments were not disadvantaged. Students readily adapted to layout changes, data collection procedures, and the switch of peanut butter and jelly sandwiches from white bread to wheat. There were no reports of behavioral problems.

Although the specific intervention elements may have limited generalizability, we believe the approach to the intervention design which focused on the process of developing adaptations based on formative research and engaging the school community is highly generalizable and makes an important contribution to the growing literature highlighting the need for the adaptation of evidenced-based health promotion strategies [38]. Evidence from interventions with adults with ID support the involvement of caregivers in the research process as well as the consideration for the context of the lived disability experience [39]. The time required for the formative research and adaptation process was substantially greater compared to similar studies designed for typically developing students. A major impetus for a careful approach was to ensure student and teacher safety and to prevent unintentional cognitive or emotional stress.

Conclusion

A Smarter Lunchroom intervention, based on behavioral economics and adapted for students with I/DD, significantly increased whole grain selection and consumption, reduced refined grain selection and consumption, increased fruit consumption, and reduced fruit and vegetable plate waste. Results suggest that low-cost interventions that create environments in which the healthiest choice is the easiest choice hold great promise for improving the short-term food choices and dietary intake of this vulnerable

population. Future studies are needed to evaluate whether dietary changes are maintained long-term and if the effects are replicated in regular education settings.

Table 1. Menu at Baseline

		Monday	Tuesday	Wednesday	Thursday	Friday
Entrée 1 with bundled side	Entrée	Asian chicken salad	Veggie burger on whole wheat bun	Steak and blue cheese salad with whole wheat roll	Sausage gumbo over brown rice	Tuna caprese salad with flatbread crackers
	Bundled side dish		Mediterranean mix (tomatoes, cucumbers, feta cheese)			
Entrée 2 with bundled side	Entrée	Grilled mozzarella cheese sandwich on whole wheat bread	Barbeque turkey tips with corn bread	Popcorn chicken	Roasted turkey wrap with spinach and tomato	Pizza on whole grain crust
	Bundled side dish	Baby carrots	Baby spinach side salad with cucumbers and grape tomatoes	Cucumbers and carrots with dip	Whole grain goldfish	Garden greens side salad
Soup		Turkey wild rice cranberry soup	Vegetable soup	Tuscan soup	Chicken noodle Florentine soup	Roasted garlic rosemary chowder
Dessert		Chocolate pudding with whipped topping		Yellow cake with chocolate frosting	Homemade trail-mix	
Canned Fruit			Canned peaches			Fruit cocktail
Whole Fresh Fruit		Apples Bananas Oranges	Apples Bananas Oranges	Apples Bananas Oranges	Apples Bananas Oranges	Apples Bananas Oranges
Yogurt		4 ounce low-fat	4 ounce low-fat	4 ounce low-fat	4 ounce low-fat	4 ounce low-fat
Milk		Skim, 1%, Lactaid (white only)	Skim , 1%, Lactaid (white only)	Skim , 1%, Lactaid (white only)	Skim , 1%, Lactaid (white only)	Skim , 1%, Lactaid (white only)
Alternate entrée with bundled side dish		Peanut butter and jelly sandwich on white bread with side of pretzels	Peanut butter and jelly sandwich on white bread with side of pretzels	Peanut butter and jelly sandwich on white bread with side of pretzels	Peanut butter and jelly sandwich on white bread with side of pretzels	Peanut butter and jelly sandwich on white bread with side of pretzels
Condiments		Saltine crackers Ketchup Mustard Mayonnaise Butter Margarine	Saltine crackers Ketchup Mustard Mayonnaise Butter Margarine	Saltine crackers Ketchup Mustard Mayonnaise Butter Margarine	Saltine crackers Ketchup Mustard Mayonnaise Butter Margarine	Saltine crackers Ketchup Mustard Mayonnaise Butter Margarine

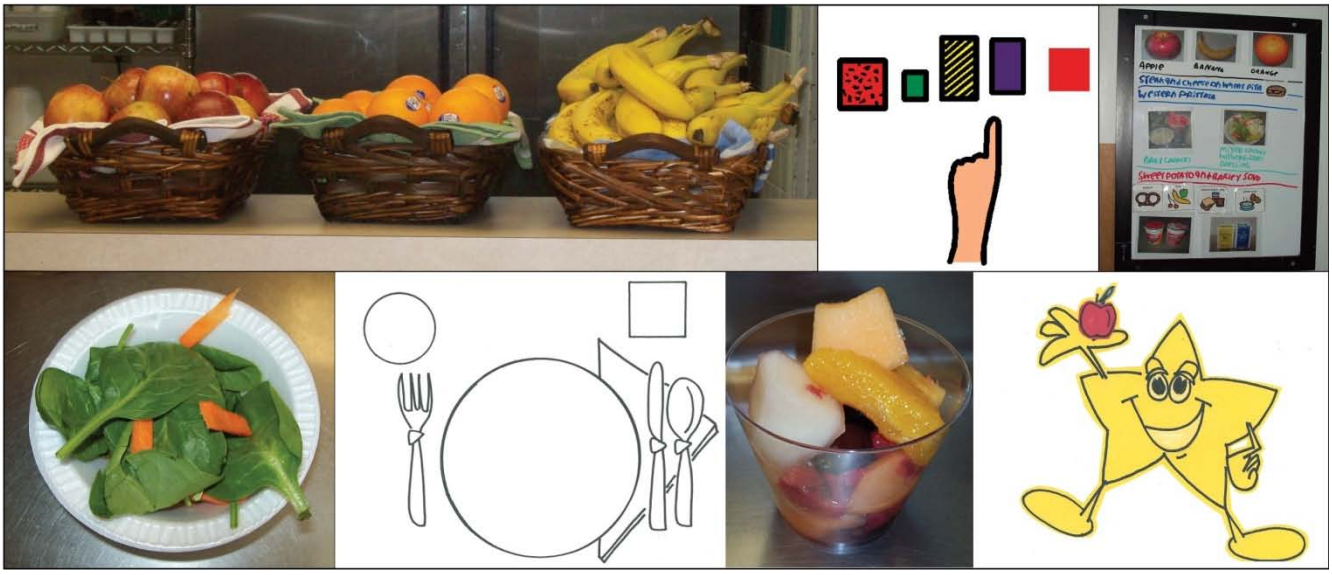


Figure 1. Intervention Elements

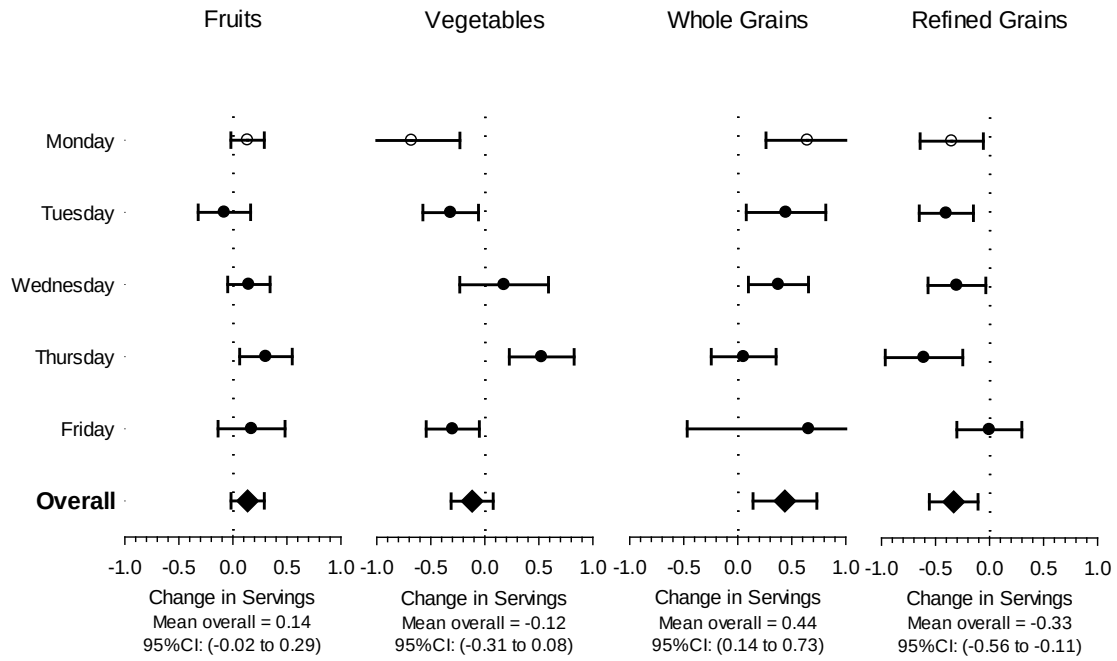
From Left to Right: Easy-to-reach fruit baskets, Picture Communication Symbol™† for "choose", menu board featuring food photographs, baby spinach side dish, non-directive placemat, fruit salad side dish, intervention logo

Table 2. Daily Mean Kilojoules and Mean Gram Weight of Food Selected and Consumed

		Baseline		Follow-Up	
		Mean	95% CI	Mean	95% CI
Selection	Kilojoules	3636	(3381, 3895)	3707	(3448, 3962)
	Gram Weight	784	(696, 873)	791	(702, 878)
Consumption	Kilojoules	3025	(2757, 3288)	3054	(2787, 3322)
	Gram Weight	610	(532, 689)	637	(558, 716)

Figure 2. Mean Change (95% Confidence Interval) in Servings of Fruits, Vegetables, Whole Grains, and Refined Grains (A) Selected and (B) Consumed, From Baseline to Follow-up, by Day of the Week and Overall

(A)



(B)

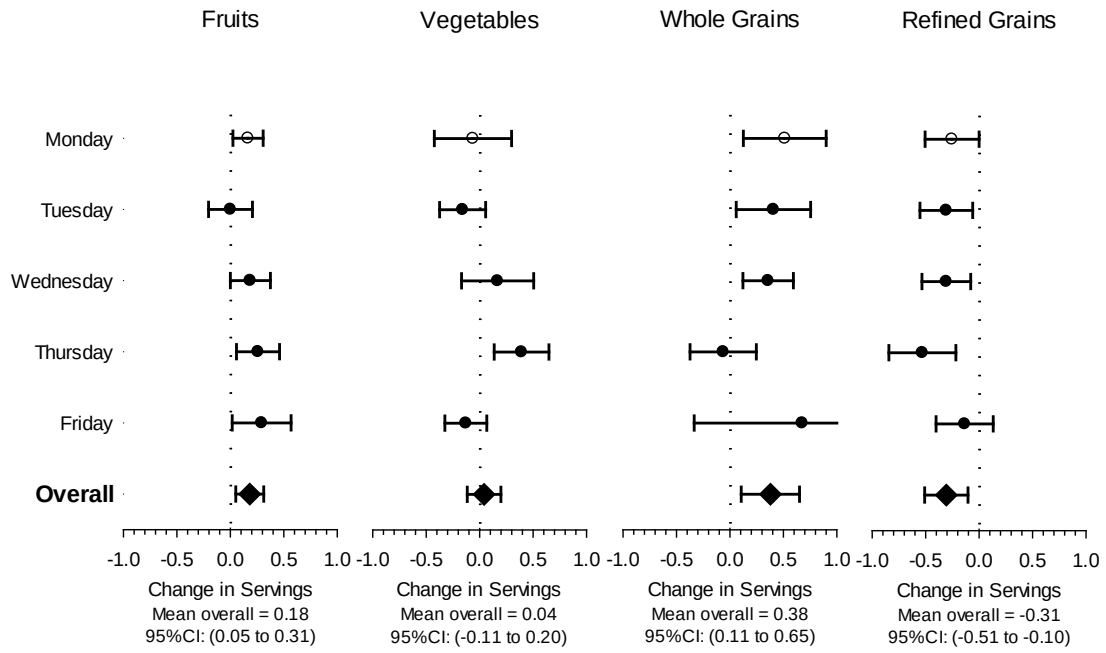
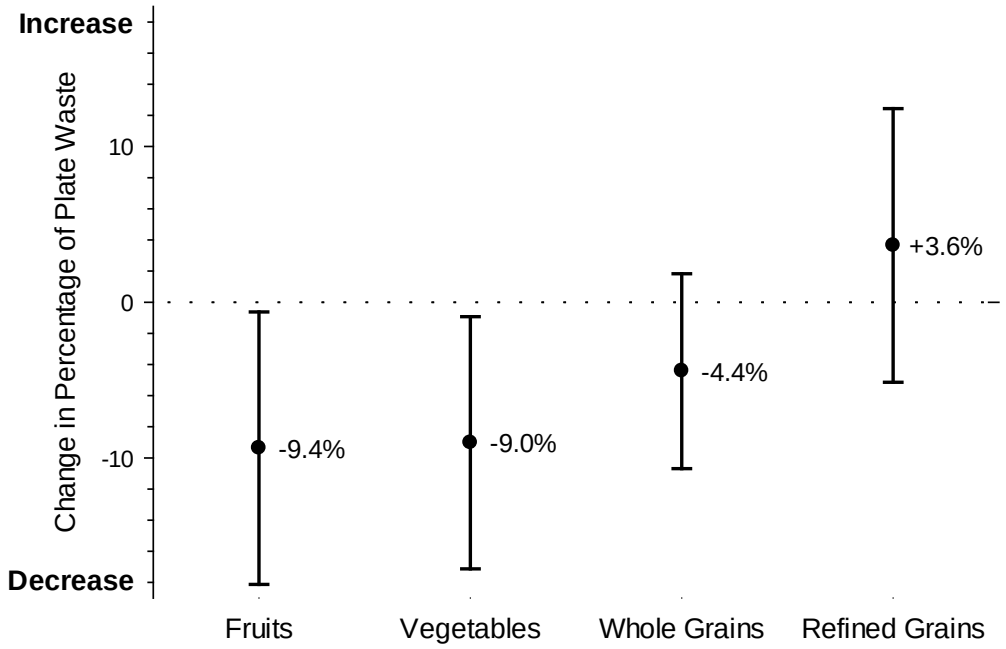


Figure 3. Mean Change in Percentage of Fruit, Vegetable, Whole Grain, and Refined Grain Servings Wasted of Those Selected from Baseline to Follow-up



Means and 95% confidence intervals

Table 3. Estimated Differences in the Rates of Selection and Consumption of Menu Items at Baseline and Follow-up

Measure	Time point	Sample observations (student trays)†	Baseline Rate (per 100 student-trays)	Follow-up Rate (per 100 student-trays)	Rate Ratio	95% Confidence Interval	P-value
Canned Fruit	Selection	332	21.69	31.32	2.37	1.11 to 5.08	0.03
	Consumption	332	18.07	30.72	2.55	1.18 to 5.54	0.02
Whole Fruit	Selection	332	28.91	34.93	1.18	0.81 to 1.71	0.39
	Consumption	332	25.90	30.72	1.20	0.80 to 1.80	0.38
All vegetable side dishes	Selection	332	97.59	92.77	1.00	0.85 to 1.18	0.95
	Consumption	332	77.11	84.33	1.16	0.95 to 1.41	0.14
Raw vegetable side dishes	Selection	332	53.61	36.74	0.54	0.41 to 0.70	<0.001
	Consumption	332	38.55	33.13	0.68	0.49 to 0.95	0.02
Soup side dishes	Selection	332	43.98	56.02	1.28	1.02 to 1.60	0.03
	Consumption	332	38.55	51.20	1.37	1.06 to 1.76	0.02
Entrée-sized salads	Selection	204	7.83	5.42	0.75	0.31 to 1.82	0.53
	Consumption	204	7.22	5.42	0.95	0.35 to 2.55	0.92
Desserts	Selection	140	34.93	27.71	0.87	0.70 to 1.08	0.20
	Consumption	140	34.93	25.90	0.81	0.65 to 1.02	0.07
Peanut butter and jelly sandwiches	Selection	332	13.25	15.66	1.16	0.53 to 2.51	0.70
	Consumption	332	13.25	15.66	1.16	0.53 to 2.51	0.70
Milk & yogurt	Selection	332	149.39	140.96	0.94	0.81 to 1.10	0.44
	Consumption	332	138.00	133.73	0.96	0.82 to 1.13	0.64

†Entrée-sized salads and desserts not offered daily, resulting in differences in sample size

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Chapter 7: Summary and Discussion

This research addressed substantial gaps in knowledge about opportunities to improve dietary intake through school-based interventions and policies for two groups of children that may not fully benefit from federal and state policy efforts to improve school food environments. The first group is children who bring packed lunches and snacks from home. The second group is youth with intellectual and developmental disabilities (I/DD). Four research aims were pursued. First, we characterized foods and beverages brought from home to school by elementary schoolchildren and compared the quality of packed lunches and snacks to federal benchmarks set by the National School Lunch Program (NSLP) and Child and Adult Care Food Program (CACFP). The secondary goal of our evaluation was to determine if level of maternal education was associated with lunches and snacks meeting federal nutrition requirements. Baseline data from the GREEN Project Lunch Box Study was used for these analyses. Third, we used community-engaged formative research methods to elicit recommendations from school staff to adapt a Smarter Lunchroom intervention for adolescents and young adults with I/DD attending a residential school. An expert panel, which included representatives from the school community and researchers with expertise in health promotion for individuals with I/DD, devised the final strategies used in the intervention. Fourth, we implemented a three-month Smarter Lunchroom intervention and evaluated the impact on the selection and consumption of four dietary targets: fruits, vegetables, whole grains, and refined grains. Digital photography was used as the dietary assessment method in both research projects.

Specific Aim 1

To our knowledge, the research presented in Chapter 4 represents one of the few studies to examine the contents of packed lunches among United States (U.S.) schoolchildren from a food-based perspective and is the first to characterize and evaluate the quality of packed snacks intended to be consumed in the classroom during the school day. Results indicate that 72% of lunches failed to meet NSLP criteria for a healthy lunch. Food and beverage types most likely to be provided for lunch were sandwiches (59%), snackfoods (42%), fruit (34%), desserts (28%), water (28%) and sugar-sweetened beverages (24%). Ninety-six percent of snacks failed to meet CACFP criteria for a healthy snack. At snack, snackfoods (62%), desserts (35%) and sugar-sweetened beverages (35%) were more common than fruits (20%), dairy foods (10%), and vegetables (3%). The use of 2012 federal benchmarks allowed a direct comparison of packed lunches and snacks to the requirements that schools must meet [6,177]. At the time the analyses were conducted (2013), the United States Department of Agriculture (USDA) had not released Interim Rules for *Smart Snacks in Schools*, which will apply to competitive foods. Our findings make a timely contribution to federal and state food policy discourse focused on improving school food environments and child dietary intake.

Results from our secondary hypothesis indicated that women with higher maternal education levels were twice as likely to pack a healthy lunch, but maternal education did not appear to impact the quality of packed snacks. Possible explanations for this differential association include that the snack-only children participate in NSLP and parents may be less aware of healthy snack options, parents may have perceptions that highly processed snacks are less expensive, or may view “snack time” as an eating

occasion in which providing less healthful foods is permissible. Parents participating in qualitative interviews in Australia described the lunchbox to be a "site of negotiation" and acknowledged necessary compromises such as packing some unhealthy foods because of child preferences, convenience, and other factors [178].

Future research to understand the multiple determinants of parental food packing behavior, including the role of maternal education, child preferences, and the constraints faced by families is a critical next step. Examination of the food photographs suggests that typologies or patterns of food packing behavior exist among parents. For example, the majority of photographs revealed lunches and snacks largely composed of individually-packaged, processed energy dense, nutrient-poor foods and beverages. However, a smaller proportion of lunches and snacks appeared to contain all healthful items or a mixture of both healthy and less healthy items**.** A systematic content analysis of food photos could be conducted to establish a preliminary set of parental food packing typologies.

One compelling advantage of digital photography as a dietary assessment method is the opportunity to provide behavioral feedback to users – in this case, parents and children – about their dietary intake. Images are powerful. Sharing the food photographs with parents and children in focus groups and/or interviews could be an innovative and informative technique to learn more about their thought process when packing lunches and snacks and to identify the drivers of their behavior (i.e. health, time, cost, and food safety). Although yet to be published in the peer reviewed literature, researchers in Texas are using digital photography in school lunch programs to monitor food selection and consumption. Food photographs shared with parents provide behavioral feedback in an effort to influence foods provided in the home setting.

Children from single-parent or economically disadvantaged households likely have more responsibility for packing their own lunches and snacks given the additional stressors on the family. Future research should also examine the extent to which children are responsible for packing their own lunches and snacks for the school day and explore effective ways to influence their choices of what to pack.

Future research should also attempt to understand whether the findings summarized in Chapter 4 are generalizable to other school districts and other states – particularly for snacks. The School Health Programs and Policies Study (SHPPS) assessments of school food environments currently do not include questions regarding foods and beverages brought from home. Additional questions could be added to the survey to determine whether schools hold mid-morning classroom snack-time, whether they have developed nutrition guidelines for foods and beverages from home, as well as the nutrition education programs implemented that include outreach to parents.

Moreover, research is needed to establish the prevalence of classroom-based eating occasions such as celebrations and daily snack-time across school levels and the extent to which these practices contribute to total caloric intake, with potential impact on positive energy balance and obesity. Since federal rules for competitive foods will not include regulations for foods and beverages brought from home or classroom eating occasions, school wellness policies and supporting programs represent the most appropriate opportunity to provide education and support to parents to improve the quality of foods brought from home.

Specific Aim 2 & 3

The goals of the research were to identify opportunities to adapt evidence-based nutrition interventions for youth with I/DD and to determine the impact of the Smarter

Lunchroom nudges on their selection and consumption behaviors. To accomplish these goals, we engaged the school-community (researchers, parents, school staff, and parent advocacy groups) as research partners and to serve as the expert panel to provide critical feedback for the intervention design.

Focus groups with education and vocation program teachers, key informant interviews with food service staff, direct observation, and informal meetings with school staff provided key insights for the intervention adaptations. Specifically, we learned that students have complex food-related challenges that render them vulnerable to poor diet quality, and the characteristics associated with their disability (i.e. cognitive impairments, emotional problems, sensory disorders, oral-motor impairments, behavioral rigidity) make it challenging to design effective strategies to improve their dietary intake.

Moreover, the social, physical, and policy environments as the *systems of influence* over dietary choices within the school setting were not designed to make the healthy choice the easiest choice for students. These important insights are relevant for youth with I/DD in other contexts. Health promotion efforts with youth with I/DD will likely encounter similar themes of heterogeneity, the importance of choice, staff conflicts between supporting autonomy and health, and food-related challenges among students that increase nutrition risk. For example, low cognitive ability and heterogeneity of needs among students were identified by school nurses as barriers to health promotion in a survey of health promotion practices in special education schools in Greece [179].

Adaptations to typical Smarter Lunchroom design elements were made to address myriad food-related challenges, help students adjust to change and transition, and to mitigate factors within the social environment that were a potential threat to the fidelity of the intervention. Although the exact adaptations made may not be generalizable to

other settings (due to the inherent underlying variability of the type and severity of disability experienced by youth), the *process* of developing adaptations is generalizable in other settings (including regular education and community settings), and makes an important contribution to the growing literature highlighting the need for the adaptation of evidenced-based obesity prevention strategies.

Health promotion programs must be acceptable to the target population to be efficacious. Interventions to promote healthy lifestyle behaviors, such as dietary intake, need to address barriers at the individual and environmental levels, as perceived or experienced by youth with I/DD or their caretakers. In our experience, the community-engaged research process facilitated a broad and rich discussion of health promotion needs for youth with I/DD. Evidence from interventions with adults with ID support the involvement of caregivers in the research process as well as the consideration for the context of the lived disability experience [180]. Thus, we argue that our process of developing adaptations based on community-engagement, qualitative methods, and expert panel consensus is highly generalizable and should be considered in the development of health promotion programs in other community settings in which youth with I/DD live, learn, work and play.

The Smarter Lunchroom intervention, based on behavioral economics and adapted for students with I/DD, significantly increased whole grain selection and consumption, reduced refined grain selection and consumption, increased fruit consumption, and reduced fruit and vegetable plate waste. Results suggest low-cost interventions that create environments in which the healthiest choice is the easiest choice hold great promise for improving the short-term food choices and dietary intake of this

vulnerable population. Moreover, youth with I/DD in regular education settings will likely benefit from intervention designs that use Smarter Lunchroom principles.

The intervention design we used is advantageous in both regular and residential education settings for several reasons. Of foremost importance, is that no child had to be excluded from the intervention based on their disability. All youth participated in the intervention equally. Second, since the intervention elicits change in behavior through mechanisms that do not rely on reasoning, youth with significant cognitive impairments were not at a disadvantage. In addition, since the intervention was not based on nutrition education, there was comparatively less burden on teachers who may be left on their own to manage the adaptation of existing nutrition curricula typically used in many education-based interventions. Given these advantages, more research is needed to evaluate whether dietary changes are maintained long-term and if the effects are replicated in regular education settings.

Although we observed significant positive impacts from the intervention for a number of dietary outcomes, and the intervention was well-accepted by students, it is important to acknowledge aspects of health promotion that are crucial to youth with I/DD that could not be addressed by the Smarter Lunchroom research. The majority of students at the school and those enrolled in the evaluation were of transition age. *Transition* (i.e. the time period when youth with I/DD transition out of the structure of school environments into less structured "adult" environments) is considered a crucial life-stage to teach youth with I/DD how to be healthy, productive members of society. We found that *selling* the concept of the Smarter Lunchroom was rather difficult in a setting dedicated to the mission of educating youth with I/DD of transition age. A critical question was raised about the long-term impact the nudges have on food choices and

overall health if students have not actually learned anything. That is, if improvement in food choices and dietary intake were the result of alterations to the environment and not the result of understanding what foods are healthy or unhealthy, the intervention may have narrow reach and limited ability to impact dietary intake in the long-term.

We believe that the adoption of new behavioral routines in relation to making food choices in the Smarter Lunchroom setting will result in habit formation [181], but these notions have not been empirically tested. Further, since the students were described by staff as having difficulty generalizing from one context to the next, even if healthy habits are formed it is questionable whether habits and routines established in the Smarter Lunchroom setting will carry over to other settings where the students eat. The classroom based taste-testing activities provided the opportunity for students to have experiential learning opportunities and tactile experiences with the food we promoted in the lunchroom. The taste-testing was not based on nutrition education. Because we were interested in the effects of the nudge, we did not alter the menu in the lunchroom to incorporate any of the foods that were featured in the taste-testing activities. Future research could bridge the education-environment gap and consider designs that combine nutrition education programming with nudge approaches in multiple food environments on campus including the lunchroom and the residential units.

Another consideration for future research is to assess the differential impact of medication and of food selectivity on the intervention outcomes. We anticipated that dietary behaviors of some students would not be positively impacted by the intervention. Among these students are those who were likely taking multiple prescription medications to treat their complex medical, emotional and behavior problems. Another group of students may not have been impacted by the intervention due to food selectivity. Two

aspects of food selectivity are food refusals and limited food repertoire [182]. The constraints we faced to collect relevant medical and demographic information about the students impeded our ability to evaluate the prevalence of food selectivity among the students. The director of clinical services noted that 70 out of 120 students were receiving services from occupational therapy or speech therapy for food-related challenges. We do not know how many students in the study sample experienced such challenges.

Of note, is that many of the principles of Smarter Lunchrooms happen to align with feeding recommendations for youth with food selectivity [118]. For example, common suggestions given to families to improve mealtime experiences are to provide youth with structured choices and to present new foods along with familiar foods [118]. Establishing new mealtime routines for youth with I/DD is a recognized strategy for addressing repetitive behavior patterns that impact food choice and dietary intake [118]. While understanding the differential uptake of this intervention signifies an important research question, we believed it was beyond the scope of this effort, which represented the first step in a new area of research. Future research could address the role of food selectivity in this environment and could also examine whether these therapeutic feeding techniques shared with Smarter Lunchroom principles aid in the acceptance of new foods for youth with demonstrated food selectivity and whether the impact depends on the severity of food selectivity experienced by the particular student.

Most youth with I/DD will live in community settings as adults [183]. Appropriate tools to assess diet in community settings are needed [167]. We are aware of two studies with adults with ID and one school-based study with youth with I/DD that used digital photography as the dietary assessment method. Although we experienced

transient refusal to participate in the food photography data collection, use of technology-based dietary assessment methods with youth with I/DD may enhance their engagement with the activity compared to more traditional methods. Research with typically developing adolescents indicates a strong preference for methods that incorporate technology versus 24-hour recalls and food records [166]. It has been suggested that adolescence is the transitional time in which compliance with self-monitoring and recording of dietary intake declines due to factors such as unstructured eating patterns, consumption of food away from home, and general disinterest to comply with authority [161]. Dietary assessment methods perceived by adolescents as more efficient and less burdensome may improve compliance. Youth with I/DD are multisensory learners and documented users of adaptive technology [184]. Future research should examine the ability of youth with I/DD to use technology to capture dietary intake.

Food photographs may have practical applications to speech, occupational, and behavioral therapists that work with youth with I/DD to overcome feeding problems. To our surprise, the pre- and post-meal food photographs in the Smarter Lunchroom intervention revealed unexpected clues about eating behavior and corroborated the reports of food-related challenges by teachers and food service staff. The majority of students consumed nearly all the foods and beverages that they selected; however a smaller portion of students only ate a few bites. Specific eating behaviors of interest reported by school staff and corroborated by the food photographs included a few students who consistently chose one "yellow" milk and one "blue" milk; evidence of students separating mixtures (e.g. mixed nuts) into piles of the individual components; and entire trays with no colorful foods.

Broad Implications for Disability Research

The public health perspective regarding disability has evolved over the past 25 years from primary prevention of disability to an emerging view of disability as one of many social determinants of health [185]. The World Health Organization's *International Classification of Functioning, Disability, and Health* defines disability within the context of the environment [186]. Life course theory, another integrative model for conceptualizing disability used by the Maternal and Child Health Bureau of the Department of Health and Human Services, emphasizes that the biologic, physical, and social environment largely determine the capacity to be healthy over the life course [187]. These evolving views of disability have allowed public health researchers and disability advocates to champion health promotion efforts within a health disparities framework [185]. Yet, despite these theoretical notions, in practice, it is recognized that the field of disability and public health has not yet fulfilled its obligation to fully include people with disabilities in its purview of surveillance, epidemiology, health promotion, and prevention [185]. Three crucial areas to advance the health for persons with disabilities have been identified: implementing population scale interventions, societal participation as an outcome, and addressing the role of the environment [185]. Although conducted in one micro-environment in a school setting, our research represents an important early step in addressing all three of these areas.

Schools have been identified as the optimal venue to deliver health interventions and policies for children generally [42] and should support the inclusion of youth with I/DD. Because the Individuals with Disabilities Education Act (IDEA) protects the rights to education for youth with I/DD in both regular and residential settings, suboptimal inclusion in school-based nutrition interventions and policies could be viewed as unethical [188]. However, the methodological barriers to fulfill public health

responsibilities of surveillance, health promotion, and prevention for youth with I/DD in school settings present daunting challenges.

The failure to capture health information for youth with I/DD is a sizeable concern. Nationally representative data regarding health behaviors and the prevalence of health outcomes are essential to the creation of health policies and the formation of health promotion programs. A number of nationally representative surveys that provide critical data regarding health behaviors are administered in schools. While the assumption is that youth with I/DD are included in these surveys, it is reasonable to believe that they are not. The language, format, and length of typical national health survey questionnaires may render them inaccessible to many youth with I/DD [148]. We are aware of only one pilot study that assessed the feasibility of including youth with I/DD in a large scale school-administered national health survey [148]. In summary, this example highlights some of the real-world challenges to fulfill one public health responsibility and the lack of efforts thus far to overcome them.

The recommendation to adapt existing evidence-based health promotion programs for youth with I/DD rather than to create separate programs is supported by trends in disability prevalence and a number of landmark disability policies that support inclusion. The Olmstead Decision (Olmstead vs. L.C. 1999) provided for people with disabilities to be served in the least restrictive environment possible, and resulted in the movement of adults with I/DD out of restrictive settings (i.e. institutions, nursing homes) to less restrictive settings that provide greater independence and community-based supports. The life course perspective applies broadly to health promotion. Public health and disability researchers should consider the discordance of health policies that exist within the environments that a person with a disability will experience throughout their life-

course to determine interventions that bridge these stages. Lessons learned from the community-engaged adaptation process used here may offer insights for improving the congruence of nutrition policies and programs available to people with disabilities throughout the life course.

Implications Shared by All Specific Aims

Cumulatively, both research endeavors raise important ethical questions about choice and the best way to teach children about dietary choices. In this discussion, it is also useful to acknowledge competing perspectives in child obesity policy regarding the division of responsibility – or the extent to which the target population views obesity as a consequence of an *obesogenic* environment rather than the outcome of a series of individual choices [188]. For typically developing children in the GREEN Project Lunch Box Study, the division of responsibility primarily reflected the tension between parents and schools. The preservation of choice is a relevant ethical consideration for future interventions and policies that aim to improve the diet quality of foods brought from home. The most recent legislation to create standards for competitive foods marks the first time in the history of school food policy when the majority of foods in schools will have to meet nutrition standards. Yet, it is highly debatable whether foods brought from home into the school food environment should be subject to the same standards as competitive foods. If we take away exposure to a range of food offerings in school, we may lose the school environment as a venue to teach about dietary choices. That is, we may lose opportunities for "teachable moments" in school settings and there may be limited alternative settings to teach children about dietary choices.

The division of responsibility is a more complex consideration for youth with I/DD in the COMETS study. As with typically developing children, there was a tension

between the school and parents to take ownership for teaching about dietary choices. However, at the next level, school staff reported struggling with the division of responsibility for providing dietary guidance that existed between groups of school staff and between staff and parents. On one hand, supporting autonomous choices is a tenet of health promotion both universally recognized and widely supported in the disability community [145,189]. On the other hand, the argument that youth with cognitive impairments should be held accountable for the consequences of their dietary choices is tenuous. It is critical to consider how youth with I/DD respond to given sets of food options when making choices and the optimal number of food choices that can be reasonably navigated in a given time period. It is also challenging to include multiple caretakers in conversations about choice, particularly when these individuals may have diverse perspectives and priorities related to health. Additionally, for youth with I/DD, observational and experiential learning (based on social learning theory) may be more effective than theoretical learning [190]. That is, providing meaningful opportunities to practice making choices in real-world contexts may help youth with I/DD generalize health promoting skills to other settings, situations, and environments [191].

Concluding Remarks

In conclusion, dietary intake is an important determinant of obesity and chronic disease throughout the life course. This dissertation contributes to the evidence base that schools are important settings to improve the dietary intake of all children, irrespective of disability status. Children who do not participate in federal meal and afterschool snack programs (i.e. NSLP, SBP, CACFP) on a regular basis may not fully benefit from the federal policies to improve school food environments. Our findings indicate that the majority of lunches and snacks from home do not meet federal nutrition standards and are

in need of improvement. Children from families with lower maternal educational attainment may be at an even greater disadvantage. School wellness policies and associated education efforts should work in partnership with parents to improve foods brought from home to school.

In comparison, few school-based policies or interventions have addressed the needs of youth with I/DD specifically. Despite calls to action, the disability community and public health system has yet to respond to the obesity epidemic among youth with I/DD with a comprehensive plan. Barriers to include youth with I/DD in the national child obesity discussion are sizable. Participatory research methods provide insights for overcoming these challenges, so that effective interventions can be designed and implemented in school settings and beyond. Our findings suggest that youth with I/DD are responsive to environmental enhancements that make the healthier choice the easiest choice. Future research is needed to identify a greater variety of efficacious interventions that can be readily adapted for youth with a range of cognitive, physical, behavioral, sensory, and emotional impairments.

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Appendix A. GREEN Project Lunch Box Study Parent Consent Form

The GREEN Project Lunch Box Study

Your child is invited to join a Tufts University study at _____. The purpose of **The GREEN Project Lunch Box Study** is to evaluate a campaign designed to help children bring healthful foods from home to school.

In order to join, your child must be enrolled in one of the 3rd or 4th grade classrooms participating in The GREEN Project. Your child must usually bring snack and/or lunch from home to school at least 3 times per week.

If your child joins, he or she will be asked to take part in the following activities:

- **Food photos:** Two times during the school year, a researcher will take a digital photo of the food your child brought from home to school. The researcher will also fill out a checklist about the foods. No one but your child will touch his or her food. The photo and checklist will take about 2 minutes.
- **Short surveys:** Two times during the school year, your child will be asked to complete 2 surveys. One survey asks about nutrition and the foods they bring from home to school. It takes about 15 minutes to complete. The other survey asks about the environment. It takes about 5 minutes to complete.

We will use the data from this study to see how different nutrition campaigns affect what foods children bring from home to school. We will use the survey data to see how the campaign affects children's attitudes and beliefs about nutrition and the environment.

Risks and Benefits

The study involves minimal risks. Your child's food photos and surveys will be coded with an ID number. Individual answers will be kept confidential.

Your child may benefit from participating in this study by learning how to choose healthful foods. Your child's participation in the study can also benefit the community by helping researchers find better ways to communicate to families about nutrition. If successful, the campaign can be shared with elementary schools throughout the United States.

Voluntary Participation & Withdrawal

Your child's participation in this study is voluntary. He or she may withdraw at any time or for any reason. Your child may also refuse to answer any questions. Your family will receive the same services from the school whether or not your child is in the study.

Confidentiality

Your child's personal information will be kept confidential and will not be released without your written permission, except as required by law. A code will be used in place of your child's name on all data. Personal information will be stored separately from survey responses and food photos. Your child's name will not be reported in any publication.

Funding

This research is funded by the National Institutes of Health. This study has been reviewed by the Institutional Review Board (IRB) at Tufts University. The IRB makes sure that the rights and welfare of each person is adequately protected and that informed consent is obtained.

Study Contacts

For any questions about this research, please contact Jeanne Goldberg, PhD at (617)636-0895 or jeanne.goldberg@tufts.edu. For questions about your rights as a research subject, call the Tufts University Institutional Review Board at (617) 627-3417.

Statement of Consent

I understand that my child's participation is voluntary and that my child can withdraw from the study at any time without prejudice. Signing this form does not waive any of my or my child's legal rights.

By signing, I acknowledge that I understand the study and my child's role in it. I understand how study data may be used and how my child's privacy will be protected. I have read the explanation of the study and all of my questions have been satisfactorily answered, and I give permission for my child to participate.

☐ Yes, I give my child permission to participate (Please sign below).

_____

Child's full name (printed)

_____ _____

Parent/guardian's full name (printed) **Parent's contact number**

_____ _____

Parent/guardian's signature **Date**

☐ No, I do not give my child _____ permission to participate.

(print child's full name)

PLEASE RETURN THIS FORM TO YOUR CHILD'S CLASSROOM TEACHER.

For office use only

I certify that I have explained fully to the above subject the nature and purpose, procedures, and the possible risks and benefits of this research study.

_____

Signature of researcher or designate

_____

Date

Appendix B. GREEN Project Lunch Box Study Child Assent Form

The GREEN Project Lunch Box Study

We are doing a research study. Research studies are one way to figure out how things work. We want to learn how to help kids your age bring healthy foods to school.

You are being asked to join **The GREEN Project Lunch Box Study** because you are in one of the participating 3rd or 4th grade classrooms at _____. If you join, we will include you in these study activities:

- We will take a picture of the food you bring from home to school. We'll do this once at the beginning, and again at the end of the study.
- We will give you 2 surveys to fill out. There are no right or wrong answers on surveys. One asks what you think about the environment. The other asks about food. You will fill them out once at the beginning, and again at the end of the study.

Sometimes things happen in research studies that may make a kid feel badly. We don't think there is anything that will make you feel bad in this study, but if you do, you are free to tell us and we will listen.

People can have good things happen to them in research studies. If you join this study, you may learn more about foods that are good for you. You will also help us figure out how to help other kids learn the same things.

Your parents have given you permission to join this study. Even if your parents said "yes" you can still say "no" and not join. No one will be angry. Even if you say "yes" first, you may stop later. All you have to do is tell us you want to stop.

Before you say "yes" or "no", we will answer any questions you have. If you say "yes" and join the study, you can still ask questions. Just tell the researcher that you have a question. You or your parent can also contact Jeanne Goldberg, the leader of this study, at (617) 636-0895.

If you have any questions about anything that happens during the study, there is a special office at Tufts University called the Institutional Review Board that will listen to you and answer your questions. Your parents have the phone number for that office and can help you reach them.

Signing your name means that you agree to be in this study.

_____

Child's full name

_____ _____

Child's signature **Date**

For office use only

I certify that I have explained fully to the above subject the nature and purpose, procedures, and the possible risks and benefits of this research study.

_____

Signature of researcher or designate

_____

Date

Appendix C. GREEN Project Lunch Box Study Parent Demographic Form

Please complete this form and return with the signed permission form.

Today's Date: _____/_____/ 20_____ (month/day/year)

Your Relationship to the child participating in the study:

☐ Mother ☐ Female Guardian (grandmother, aunt, or other):_____

☐ Father ☐ Male Guardian (grandfather, uncle, or other):_____

Questions about your child who is participating in the study:

1. What is the child's date of birth? _____/_____/ 20_____ (month/day/year)
2. What is the child's gender? ☐ Male ☐ Female
3. Is the child Hispanic or Latino? ☐ Yes ☐ No
4. Which one or more of the following best describes the child's race? (Check all that apply)

   ☐ White
   ☐ Black/African American
   ☐ Asian
   ☐ Native Hawaiian or Other Pacific Islander
   ☐ American Indian/Alaskan Native
   ☐ Other: _____

Questions about <u>you</u> and <u>your household</u>:

1. What is your age? _____ Years
2. What is your marital status? (Check **one** below)

   ☐ Never married ☐ Married ☐ Separated/Divorced ☐ Widowed
3. Including you, how many total people live in your household? _____ People

   Of these, how many are under the age of 18? _____ Children
4. Are you Hispanic or Latino? ☐ Yes ☐ No
5. Which one or more of the following best describes your race? (Check all that apply)

   ☐ White
   ☐ Black/African American
   ☐ Asian
   ☐ Native Hawaiian or Other Pacific Islander
   ☐ American Indian/Alaskan Native
   ☐ Other: _____

1. What is your current employment status? (Check one below)

   ☐ Full-time employee
   ☐ Part-time employee
   ☐ Temporary or seasonal employee
   ☐ Homemaker/Stay at home parent
   ☐ Student
   ☐ Unemployed

2. What is the last grade or highest level of education completed by the child's **mother**? (Check one below)

   ☐ 8th grade or less
   ☐ Some high school
   ☐ High school graduate or GED
   ☐ Some college or technical school
   ☐ Associates or 2-year degree
   ☐ College graduate or 4-year degree
   ☐ Graduate school
   ☐ Don't know

3. What is the last grade or highest level of education completed by the child's **father**? (Check one below)

   ☐ 8th grade or less
   ☐ Some high school
   ☐ High school graduate or GED
   ☐ Some college or technical school
   ☐ Associates or 2-year degree
   ☐ College graduate or 4-year degree
   ☐ Graduate school
   ☐ Don't know

4. This table shows incomes by year, month, and week. Please mark which row best describes your pre-tax income.

	$ Per Year	**$ Per Month**	**$ Per Week**
☐	5,000 or less	417 or less	97 or less
☐	5,001 to 10,000	418 to 833	98 to 192
☐	10,001 to 30,000	834 to 2,500	193 to 576
☐	30,001 to 50,000	2,5001 to 4,166	577 to 961
☐	50,001 to 70,000	4,167 to 5,833	962 to 1,346
☐	More than 70,000	More than 5,833	More than 1,346

Thank you!

Please return this form with the signed permission form.

Appendix D. GREEN Project Lunch Box Study Food Inventory Checklist

Study ID#: _____ **SNACK ☐** **MEAL ☐**

ADMIN. INITIALS: _____

1. What else do you plan to eat at school today?

☐ NOTHING ☐ SCHOOL LUNCH ☐OTHER:

_____

2. What else do you plan to drink at school today?

☐ NOTHING ☐ MILK ☐WATER ☐OTHER:

_____

Food	Type		
Beverage ☐	☐ Water ☐ Skim milk ☐ Low-fat milk ☐ Whole milk	☐ Flavored milk ☐ 100% fruit juice ☐ Fruit Punch/Drink ☐ Soda	☐ Sports Drink/Vit. Water ☐ Can't Tell ☐ Other:_____
Sandwich ☐	**Filling:** ☐ Meat ☐ Cheese ☐ Meat and Cheese ☐ Peanut Butter	 ☐ Tuna ☐ Egg Salad ☐ Can't Tell ☐ Other:_____	**Bread:** ☐ White ☐ Whole Wheat/Grain ☐ Can't Tell ☐Other:_____
Fruit ☐	Types: ☐ Apple ☐ Banana ☐ Clementine	 ☐ Grapes ☐ Orange	☐ Other:_____
Vegetables ☐	Types:		
Leftovers ☐	☐ Pizza ☐ Pasta	☐ Other:_____	
Snack Foods ☐	☐ Chips:_____ ☐ Crackers ☐ Sandwich crackers ☐ Pretzels	☐ Fruit roll-ups/gummy fruit ☐ Granola bar ☐ String cheese ☐ Nuts/seeds	☐ Lunchables ☐ Can't Tell ☐ Other:_____

Desserts ☐	☐ Cookies ☐ Cake ☐ Muffin	☐ Pudding ☐ Gelatin ☐ Candy:_____	☐ Can't Tell ☐ Other:_____
Misc. Foods ☐	☐ Yogurt ○ *Plain* ○ *Flavored*	☐ Egg ☐ Hummus ☐ Dip/Dressing	☐ Can't Tell ☐ Other:_____

Total Number of Items **Other Notes:**

☐

Appendix E. GREEN Project Lunch Box Study Photo Coding Manual

The photo coding manual is divided into eight sections: beverages, sandwiches, fruit, vegetables, leftovers, snackfoods, desserts, and miscellaneous. The photo coder referred to the coding manual to determine the appropriate food category assignment for each item (e.g. 100% fruit juice versus fruit punch/drink) and which reference photo to use to estimate the portion size. Appendix E features reference photographs of apples from the fruit section of the reference photo manual to illustrate the process the coder used to estimate the portion size. Reference photos were taken of whole fruits and sliced fruits in plastic sandwich bags and a variety of container shapes. Each page shows three sizes: small, medium, and large from angle and aerial views.

Beverages

Food category	Definition	Reference photos can be used for:
100% Fruit juice	Packaging must indicate 100% juice, common brands include: Juicy Juice, Apple & Eve, Tropicana	Use *100% Juice and Fruit Punch/Drink* photos as reference All of the aforementioned items; vegetable juice, cider
100% vegetable juice	Packaging must indicate 100% juice. Common brands include V-8, Mott's EXCLUDES 100% Veggie/fruit juice blends, which should be categorized with 100% fruit juice.	Use *100% juice and fruit punch/drink* photos as reference
Calorie free enhanced water	Includes flavored and unflavored seltzer, flavored unsweetened water, water with electrolytes but no sweetener and no artificial sweetener	Use *water* reference photo

Fruit punch/drink	This category includes juice blends which are not 100% juice, fruit punch, sweetened teas, lemonade, chocolate drinks (Yoohoo, Hersheys) Common brand names: Hi-C, Kool-aid, Minute Maid Lemonade, Sunny Delight, Capri Sun (all varieties unless it says 100% juice)	Use *100% fruit juice and fruit punch/drink* reference photos, EXCEPT for chocolate drinks (Yoohoo, Hersheys). For chocolate drinks use the *milk* reference photos.
Milk ***Flavored*** ***Low fat*** ***Skim*** ***whole***	All skim, low fat, whole, flavored milk	Use *milk* reference photos for all skim, low fat, whole, flavored milk; yogurt smoothies; chocolate drinks (Yoohoo, Hersheys)
Nutrition supplemental beverage	This category covers beverages with enhanced MACRO (carbohydrate, protein, fat) and MICRO nutrient (vitamins and minerals) content. Examples include: Ensure, Boost, Pediasure	Use *milk* reference photos
Reduced calorie artificially sweetened beverage	Includes reduced calorie juices with artificial sweeteners. Beverages with < 25 calories per 8 ounces; if greater, classify as *fruit punch/drink*	Use *100% fruit juice and fruit punch/drink* reference photos
Soda	All regular soda	Use *soda* reference photos for all regular and diet soda
Sports drink/vitamin water	Full calorie sports drinks including Gatorade & Powerade and any vitamin-enhanced sports drinks (like Vitaminwater). Exception is for sports drinks/ beverages that are zero or reduced calorie	Use *sports drink reference photos* for all varieties of sports drinks that are full calorie and reduced calorie. For zero calorie beverages, use the *water* reference photos

	If zero calorie and without artificial sweeteners, code as *calorie free enhanced water* If zero calorie with artificial sweeteners, code as *zero calorie artificially sweetened beverage* If reduced calorie and artificially sweetened (<25 calories per 8 ounces), code *as reduced calorie artificially sweetened beverage*	
Unsweetened tea and coffee	All unsweetened tea and coffee *note, if no details are written on checklist assume teas are sweetened and code under fruit drink/punch	Use fruit drink/punch reference photos for all teas and coffee whether sweetened or unsweetened
Water	All plain commercially bottled water and plain water in reusable containers	Use *water* reference photos for all bottled water, sparkling water, seltzer, calorie free enhanced water, zero calorie artificially sweetened beverages
Yogurt smoothie/drink	All yogurt based smoothie drinks including: Danimals, Dan Active Drinkable Yogurt	Use *milk* reference photos
Zero Calorie Artificially Sweetened Beverage	Diet soda, zero calorie beverages with artificial sweetener	For diet soda, use soda reference photos. For other zero calorie artificially sweetened beverages (such as sports drinks) use water reference photos.

Sandwich Bread

Food category	Definition	Reference photos can be used for:
White ***White with veggie filling***	Includes all breads other than wheat/whole grain (white, cinnamon, raisin); wraps made with white flour (white, spinach, sundried tomato), flatbreads, tortillas, bagels, English muffins, croissants, rolls (onion, potato, etc.)	Reference photos for sandwiches are based on the size of the bread. The same photos are used for sandwiches on white or whole wheat bread
Whole wheat/grain ***Whole wheat/grain with veggie filling***	Includes wheat/whole grain wraps, tortillas, bagels, English muffins, rolls, etc.	Reference photos for sandwiches are based on the size of the bread. The same photos are used for sandwiches on white or whole wheat bread

Sandwich Filling

Food category	Definition	Reference photos can be used for:
Breaded Fish	Check if main protein was breaded fish	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
Cheese	Check if cheese only	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
Chicken salad	Check if main protein is chicken salad	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
Egg salad	Check if egg salad	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
Egg/scrambled egg/breakfast sandwich	Code if main protein is egg and it is not an egg salad sandwich	Reference photos based on bread. Portion size of sandwiches will always be

		coded according to bread rather than filling.
Fat-based spread	Check if spread on sandwich is butter, margarine, cream cheese, etc AND the sandwich has no protein filling	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
Hot dog/brat/sausage	Check this box if student brought hot dogs, brats, or sausage for the sandwich filling	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
Meat	Check if meat only, EXCLUDES hot dogs/brats/sausage	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
Meat and cheese	Check if combination of both (ratio or number of slices does not matter)	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
No filling	Check this box if the student brought bread but it has no filling.	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
Peanut butter	If sandwich is just peanut butter, or alternative nut butter, code as such. EXCLUDES Nutella or any other nut/chocolate spread	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
Peanut butter plus sweet spread	Examples: peanut butter and jelly, peanut butter and fluff, peanut butter and nutella	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
Restaurant/Pre-packaged	Check this box if the student brought a sandwich that is still in the wrapper/packaging from a restaurant (Subway, D'Angelo's, etc).	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
Sweet spread	Check if spread is jelly only, fluff only, nutella only	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread

		rather than filling.
Tuna	Tuna salad sandwich	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.
Veggie	Check this box if the sandwich was composed of 100% vegetables (no other filling).	Reference photos based on bread. Portion size of sandwiches will always be coded according to bread rather than filling.

Fruit

Food Category	Definition	Reference photos can be used for:
Apple	All types of fresh apples	Apples
Applesauce	All types applesauce, whether packaged or homemade, can include blends	Applesauce or other pureed fruit
Other pureed food	All pureed fruit other than applesauce	Pureed fruits other than apple sauce; use apple sauce photos
Banana	Fresh bananas	Banana or plantains Do not include the stem when measuring portion size
Blackberries	All types, fresh or frozen	Use blueberry reference photo
Blueberries	All types, fresh or frozen	Blueberries, raspberries, blackberries
Canned fruit	Canned fruit (in all types of syrup, juice packed, water packed) EXCLUDES applesauce You need not specify the type of fruit cup (mandarin oranges, fruit cocktail, pineapple, etc.)	All canned fruit excluding applesauce
Cantaloupe	Fresh	Cantaloupe, honey-dew, pineapple, watermelon
Cherries	Fresh or frozen, not dried	Use grape reference photos
Clementine	Fresh	Clementines
Dried Fruit	Includes all types of dried fruit (raisins, Craisins, dried apples, dried berries, dried pineapple, prunes, Trader Joe's Fruity Flakes, etc.) Fruit leather and fruit strips that are 100% fruit, with no added sugar	All dried fruit
Fresh mixed fruit	Check for fresh mixed fruit	Fresh mixed fruit
Fruit plus dip	Check if prepackaged fruit plus dip item (apple dippers)	No reference photo for prepackaged items. Refer to

	May also use in cases when fresh fruit is covered with a dip (e.g. chocolate covered strawberries)	manufacturer website or food label If fruit plus dip is home packed, use reference photo for the fruit represented
Grapefruit	Fresh grapefruit	Grapefruit, pumelos
Grapes	Fresh grapes	Grapes, cherries, olives
Honeydew melon	Fresh	Use cantaloupe reference photos
Kiwi	Fresh	Kiwi
Mango	Fresh mango	For sliced mango use cantaloupe reference photo
Nectarine	Fresh nectarine	Nectarine
Olive	Olives, plain or stuffed	Use grape reference photo
Orange	Fresh oranges	Oranges or tangerines
Peach	Fresh	Peach
Pear	Fresh	Pear
Pineapple	Fresh	Use cantaloupe reference photos
Plum	Fresh	Plum
Pomegranate seeds	Pomegranate seeds	Pomegranate seeds
Raspberries	Fresh or frozen	Use blueberry reference photos
Strawberries	Fresh or frozen	Strawberries
Watermelon	Fresh	Use cantaloupe reference photos

Vegetables

Food Category	Definition	Reference photos can be used for:
Artichoke	Artichoke hearts	Use broccoli reference photo
Broccoli	Broccoli	Broccoli, cauliflower
Carrots	Includes whole and baby carrots	Baby carrots and carrot sticks
Cauliflower	Cauliflower	Use broccoli reference photos
Celery	celery	celery
Corn on the cob	Corn on the cob	No reference photo. 1 small - 5 1/2" to 6 1/2" long 1 medium - 6 3/4" to 7 1/2" long 1 large - 7 3/4" to 9" long
Cucumber	Cucumber, excluding pickles which are coded in the miscellaneous category	Cucumber, zucchini, eggplant slices
Eggplant	Eggplant	Use cucumber reference photo
Green beans	Green beans, wax beans, string beans	Use snap pea reference photos
Mixed Veggies	All mixed vegetables	Use broccoli reference photo
Mushrooms	Mushrooms	Use broccoli reference photo
Peas/corn	Peas and corn, EXCLUDES corn on the cob	Use broccoli reference photo
Peppers	Sliced peppers	peppers
Potatoes	Mashed potatoes	Use applesauce reference photo
Salad	Includes all types of lettuce and greens used for salad Note: To account for additional vegetables, salads will be coded according to the following scheme: ➢ Greens ➢ Greens + 1 vegetable ➢ Greens + 2 vegetables ➢ Greens + 3 or more vegetables NOTE: Trace amounts of	All salads

	vegetables included as part of a salad mix (cabbage, carrots) should not be coded as separate vegetables. NOTE: Non-vegetable salad toppings will be coded on the vegetable form, working across the page going from left to right and include: • Cheese, meat, beans, egg, nuts/seeds • Dressing o Check this box if it is already poured on the salad. If the dressing is a separate item in the lunch, include dressing under "Condiment/Accompaniment" category.	
Snap Peas	Snap peas or snow peas	Snap peas or snow peas, green beans, wax beans, string beans
Tomatoes	Small or large cherry tomatoes. For tomato slice on sandwich code separately	Use small or large cherry tomato reference photos
Veggie Plus Dip	Prepackaged veggie plus dip items such as baby carrots and hummus or Ranch dip	Use the cheat sheet or web search to determine oz of package if not visible on package itself.
Zucchini/Summer Squash	Zucchini and summer squash	Use cucumber reference photos

Leftovers

***for all leftovers in opaque thermoses, please use soup thermos reference photos**

Food Category	Definition	Reference photos can be used for:
Leftover Meat	Chopped or ground leftover meat (chicken, beef, turkey, pork) Sliced deli meat that is not associated with a sandwich	Chopped or ground leftover meat, or leftover than is primarily meat-based Sliced deli meat
Other grain dish, no veggie	EXCLUDES pasta and rice. Examples couscous, tabbouleh, quinoa, without veggies mixed in	Use rice photos
Other grain dish, with veggies	Other grain dish with veggies mixed in	Use rice photos
Pizza, no veggie	Thin and thick-sliced pizza, including calzones, without veggie toppings EXCLUDES Lunchable-style pizzas, which are categorized under the "Snack" category	Reference manual includes both thin-slice and thick-slice pizza. Thick-slice pizza photos can be used for calzones
Pizza, with veggies	Pizza, but with vegetable toppings	Reference manual includes both thin-slice and thick-slice pizza. Thick-slice pizza photos can be used for calzones
Pasta, no veggies	Plain pasta and pasta in basic tomato sauce; hot and cold	Pasta and pasta plus
Pasta, with veggies	Pasta with veggies mixed in	Pasta and pasta plus
Pasta Plus, no veggies	Ravioli, tortellini, spaghettio's, chef Boyardee canned spaghetti and meatballs, mac and cheese	Use pasta reference photos
Pasta plus, with veggies	Pasta plus but with added veggies	Use pasta reference photos
Rice, no veggies	Rice based dishes	Rice and other grain dishes
Rice, with veggies	Rice-based dishes (as above) but with vegetables mixed in	Use rice and other grain dishes reference photos
Soup/Stew/Chili, no veggies	Soup/stew/chili without vegetables	Reference photos are in reusable containers and

	Examples include: chicken noodle soup with no visible veggies, meat and noodle dishes with no visible vegetables, chili	thermoses
Soup/Stew/Chili, with veggies	Soups/stew/chili with visible added vegetables	Reference photos are in reusable containers and thermoses
Taco/tortilla/enchilada/burrito	Mexican or Latin American inspired leftover dishes	Use wrap reference photo in sandwiches section
Indian Food		*no reference photo. Discuss with Lindsay or Catherine on case by case basis. May use rice reference photo depending on item.

Snack Foods

Food Category	Definition	Reference photos can be used for:
String Cheese/Snack Cheese	Includes all cheese sticks and "snack cheese" (such as cubes and slices that are not part of a sandwich**)** Babybel cheese Single-serving cheese snacks (Cracker Barrel, Cabot, etc.) Cubed or sliced cheese (excludes sandwich slices)	Reference photos include: Cheese cubes Cheese wedges or rounds Cheese slices/cracker slices String cheese
Chips	Doritos Fritos and other corn chips Potato Tortilla chips Funyuns Plaintain chips Cheetos, cheese-puffs Pita chips Bagel chips Potato stix/shoestring fries Pop chips	Reference photos include: Cheetos – reference for dense cheese puffs (cheese balls, cheese curls) Doritos – reference for Dorito and tortilla style chips Fun-yuns – reference for Fun yuns and pork rinds Potato chip – reference for average potato chip For pop chips – use mini rice cake reference photo
Crackers	Saltines, oyster Cheez-Its Goldfish Triscuits Wheat-thins	Reference photos include: Cheese-its ---reference for small square crackers, including wheat thins Goldfish crackers – reference for puffed crackers Saltines (in sleeve) --- reference for saltines, club, or ritz crackers Triscuits – reference for rye

		crisps or rye vitas
Dry cereal	Dry cereal, excludes granola	All dry cereal, including granola
Dry granola	Granola	Use dry cereal reference photos
Fruit roll ups/gummy fruit	Fruit roll-ups Fruit by the Foot Gummy fruit Fruit snacks EXCLUDES coated, dried fruit (chocolate or yogurt coated)	Fruit roll-ups, gummy fruit, or chewy candy (Swedish fish)
Granola bar	Includes all flavors and types: oat based, fruit and nut, chocolate covered, peanut butter, etc. Cereal bars Fiber bars Luna bars Cliff bars Protein bars Rice Krispies Treats	All items falling under granola bar category
Large rice cakes	All varieties of large rice cakes	Large rice cakes
Lunchables	All varieties of Lunchables and prepackaged lunch boxes (Armour, etc) NOTE: Lunchables with beverage → code drink separately	Default is medium
Mini rice cakes	All varieties of mini rice cakes	Mini rice cakes, Pop chips, soy chips
Nuts/seeds	Excludes trail mix	All varieties of nuts and seeds, EXCLUDES trailmix
Pretzels	Savory pretzels in all forms sticks, twists, nubs; includes flavored honey mustard or BBQ EXCLUDES chocolate and yogurt covered pretzels	May use pretzel reference photos for all pretzels, including those covered and in the dessert section
Puffed snacks	Veggie-style chips, crisps, puffs, or smart puffs, pirate's booty	Reference photo for all veggie-style chips, crisps, puffs, or smart puffs, pirate's booty

Sandwich Crackers	Peanut butter sandwich crackers Cheese sandwich crackers Combination crackers with cheese (ex. Handi-snacks, excluding "dessert" varieties) Combos snacks (including pretzel variety)	Reference photos feature packaged (ritz bitz) and homemade sandwich crackers
Popcorn	EXCLUDES dessert popcorn such as caramel corn, popcorn with chocolate drizzle	May use popcorn reference photo for all popcorn types, including covered and coded in the dessert section
Snack/party mix	Chex-mix, snack mix, includes breakfast varieties, sesame sticks	Snack/party mix
Trail mix	Nut and fruit mixtures	Trailmix

Desserts

Food Category	Definition	Reference photos can be used for:
Cake	Homemade cake Cupcakes Hostess cupcakes Snack cakes (Little Debbie coffee cake, oatmeal crème pies, honey buns, Twinkies, Devil Dogs, Ho-Hos, etc.) Brownies	Reference photos feature: Cupcakes Snack cakes
Chocolate candy	Chocolate candy, candy bars, reeses peanut butter cups	All chocolate candy Multiple pieces of candy will be coded together as a single item (S, M, or L).
Coated dried fruit	Yogurt and chocolate covered fruit such as yogurt covered raisins, dole fruit bites	Coated dried fruit, chocolate covered nuts, dole fruit bites
Coated pretzels	Includes chocolate and yogurt covered pretzels	Use pretzel reference photos from snack foods section
Cookies	Chocolate chip, peanut butter, oatmeal raisin, oreos Animal crackers Graham crackers Keebler elf crackers Pepperidge farm (Milano, shortbread) Teddy grahams Lorna Doones Fig Newtons Goldfish cookies Kellogg's Special K Pastry Crisps Pop Tarts mini crisps	Reference photos include: Animal crackers – reference for animal crackers and mini grahams, vanilla wafers Sandwich cookies – medium round cookies of all varieties (oreas, chocolate chip, peanut butter) Graham crackers – reference for large rectangular graham crackers
Cookies and dip	Prepackaged cookies and dip, such as Handisnacks dessert varieties	Use information from package to determine ounces. If unable to determine from packaging, consult cheat sheet
Doughnut	Doughnut	Doughnut, Danish, pastry,

		munchkins
Gelatin	Includes gelatin with fruit	Jello and pudding
Marshmallows	All types	marshmallows
Muffin	All varieties of muffins, sweet or savory, EXCLUDES cupcakes	Muffins, scones
Non-chocolate candy	Hard candy – mints, butterscotch, lemon drops**,** Skittles**,** Licorice	Non-chocolate candy reference photo features jelly beans
Pastry	Bear claws, other danish	Use doughnut reference photos
Pie	Homemade or packaged pie	Use doughnut reference photos
Pudding	Homemade or packaged, includes mousse varieties	Use jello reference photos
Sweet breads	Sweet breads such as pumpkin, poppy seed, or banana nut bread; cinnamon or raisin Note – these are NOT part of sandwiches	Use sweet bread reference photos
Sweet dessert popcorn	Popcorn covered with chocolate, caramel or other sugary coatings	Use popcorn reference photos from snack foods section
Breakfast pastry	Pop-tarts Toaster strudels	No reference photo 1 pop-tart=small 2 pop-tarts=medium 3 pop-tarts=large

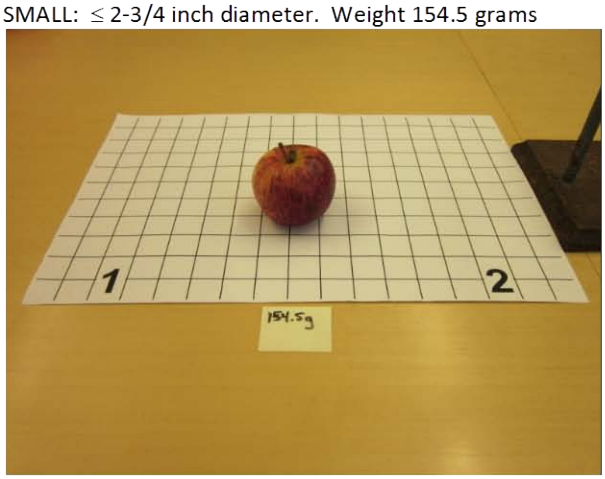
Miscellaneous

Food Category	Definition	Reference photos can be used for:
Cottage cheese	Includes plain and cottage cheese with fruit mixtures	Use yogurt reference photo
Dip/dressing	Includes dressing that is on the side and not already poured on top of the salad This includes oil-based dips and dressing such as Italian dressing	Use hummus reference photo
Egg	Includes hardboiled, scrambled, and other varieties	Egg
Gravy	Gravy when packed separately	Use hummus reference photo
Hummus	Hummus or other bean dip	Hummus, dip/dressing
Ketchup/mustard/relish	Condiments such as ketchup, mustard, relish, mayonnaise when packed separately	Use hummus reference photo
Other savory spread	Sour cream, salsa, cheese spreads	Use salsa reference photo
Peanut/nut butter	Peanut butter or any other nut butter which is not included as part of the sandwich but is included as a side item (peanut butter on celery sticks, peanut butter and fruit slices, peanut butter for dipping, etc.)	Peanut/nut butters, sugar, sweet dip/spreads
Pickle	Pickles, when packed separately	Use cucumber reference photo
Snack meat	Bacon, beef jerky	Use leftover meat reference photo
sugar	Sugar (when brought as an accompaniment)	Use peanut butter reference photo
Sweet dip	Fluff, Nutella, caramel dip (packed individually)	Use peanut butter reference photo
Waffles/pancakes/French	Waffles and pancakes;	No reference photo.

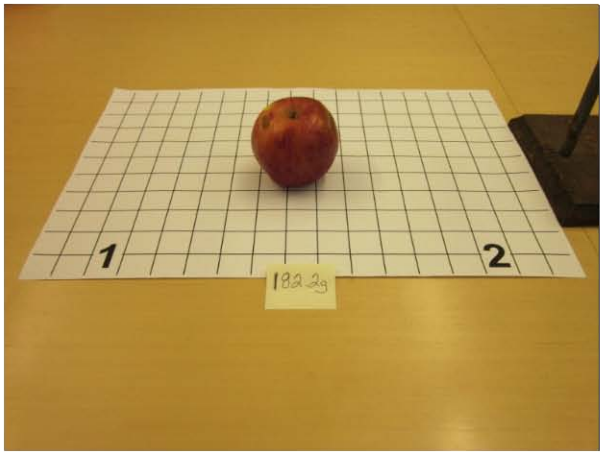
toast	whether homemade or frozen	1 4-6 inch waffle or pancake = small 2 = medium 3 = large
Yogurt	Please indicate plain or flavored Includes Go-gurts and whipped varieties EXCLUDES yogurt smoothie drinks (see beverage = Yogurt smoothie/Drink)	Yogurt
Yogurt with topping	Includes plain or flavored yogurt with toppings, typically pre-packaged Excludes yogurt and granola that are packed in separate containers (i.e. home-packed)	Use yogurt reference photo for total represented by both yogurt and topping

Apple, whole
Reference for: all whole apples

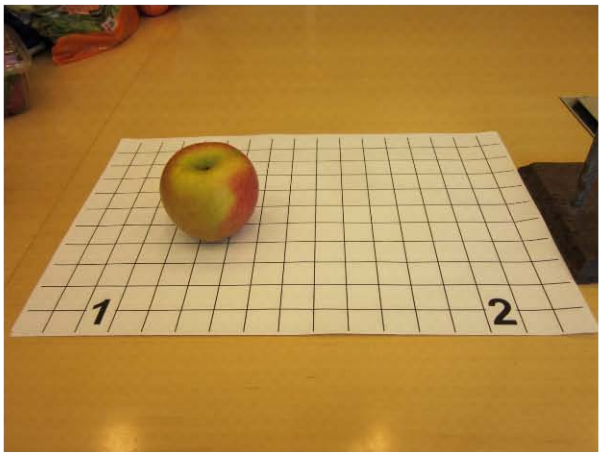
SMALL: ≤ 2-3/4 inch diameter. Weight 154.5 grams

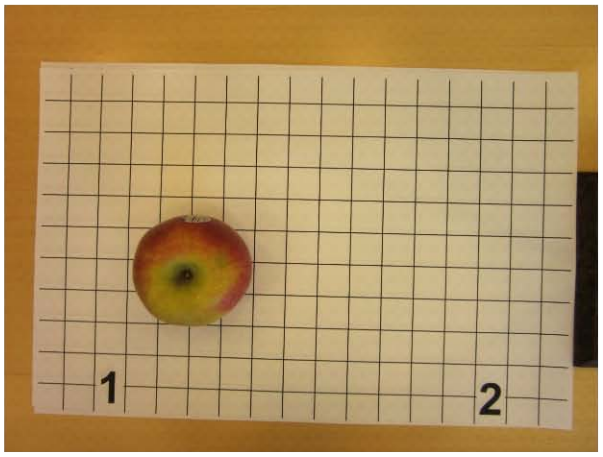


MEDIUM: > 2-3/4 and ≤ 3 inch diameter. Weight 182.2 grams



LARGE: > 3 inch diameter. Pictured: 3-1/4 inch diameter. Weight 224.7 grams

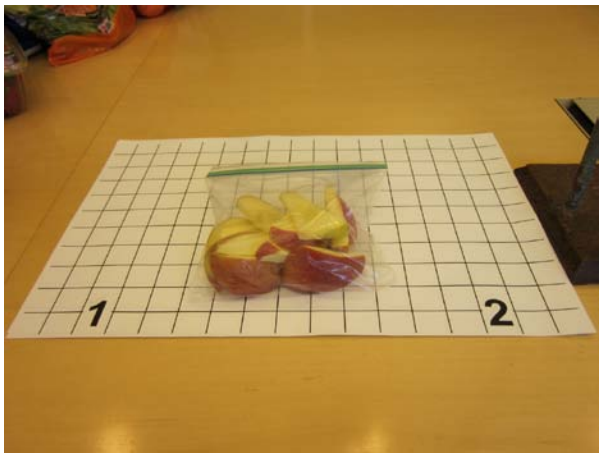




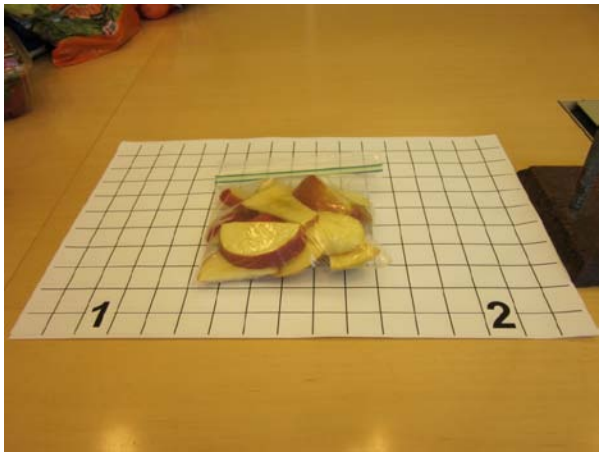
Apple, sliced, in sandwich baggie
Reference for: all sliced apples

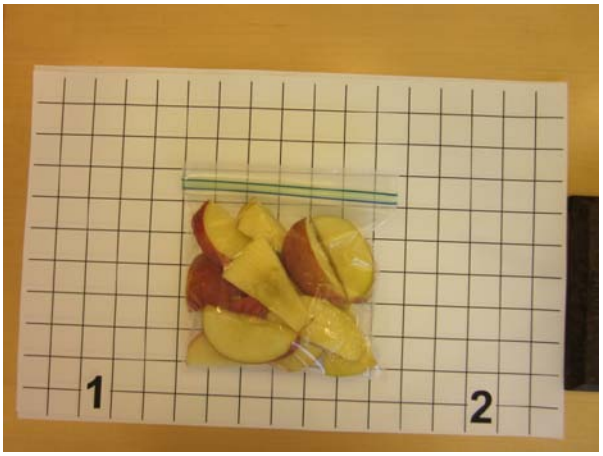
SMALL: ≤ ½ FULL sandwich baggie

MEDIUM: > ½ full and ≤ ¾ FULL SANDWICH BAGGIE



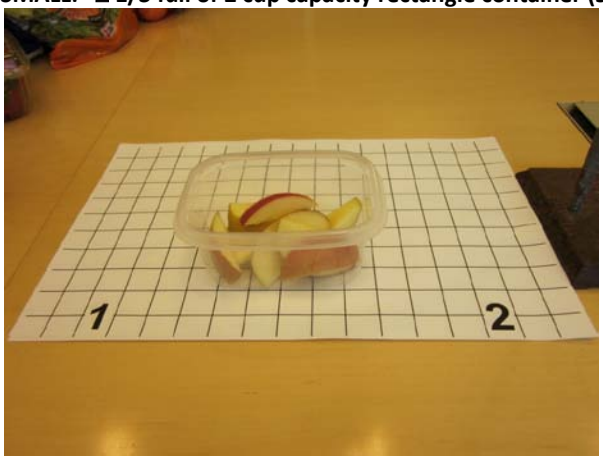
LARGE: > ¾ full sandwich baggie

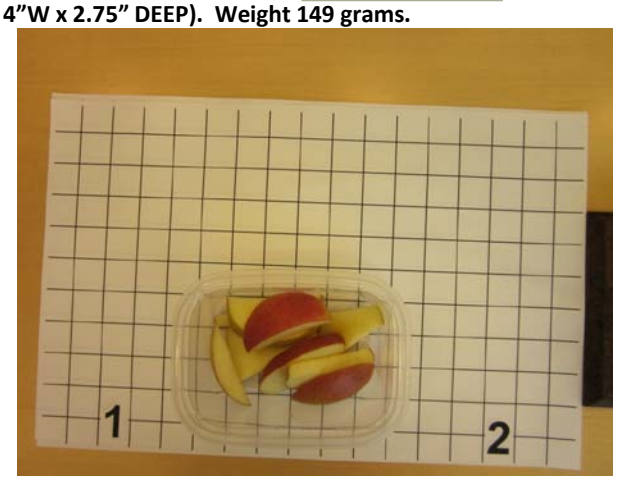




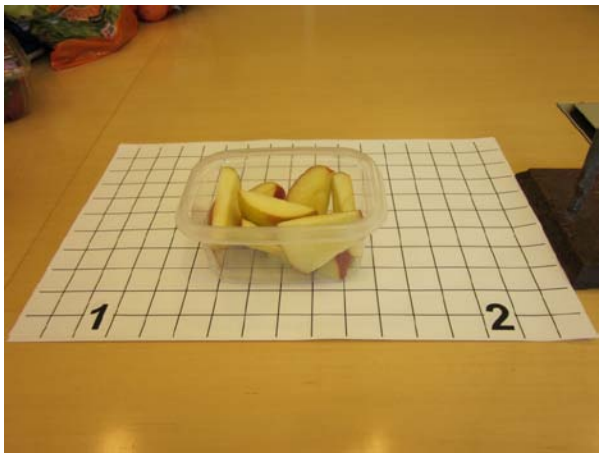
Apple, sliced, container=rectangle
Reference for: all sliced apples

SMALL: ≤ 1/3 full of 2 cup capacity rectangle container (5-1/2" L x 4"W x 2.75" DEEP). Weight 149 grams.

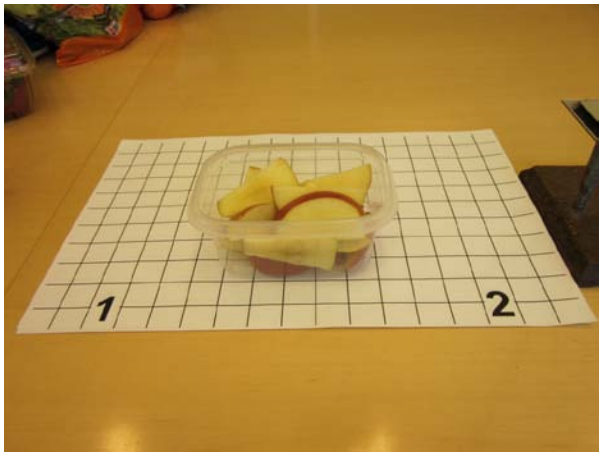


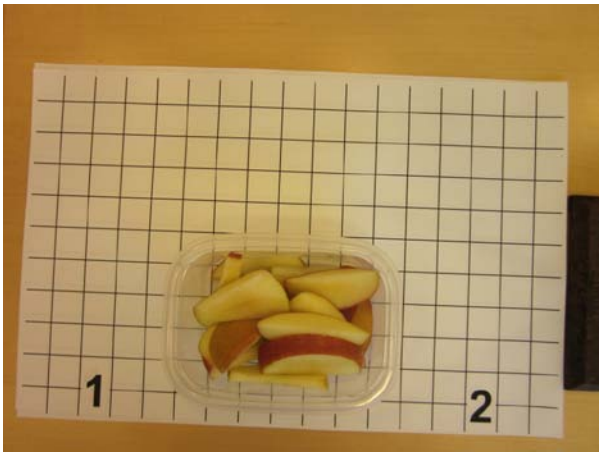


MEDIUM: >1/3 full and ≤2/3 FULL of 2 cup capacity rectangle container (5-1/2" L x 4" W x 2.75" DEEP). Weight 182 grams.



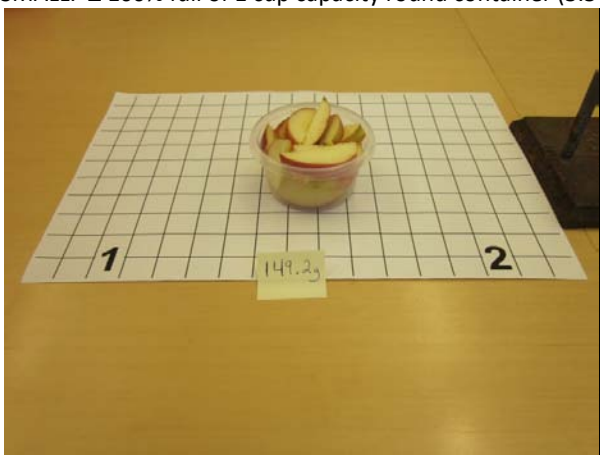
LARGE: >2/3 FULL of 2 cup capacity rectangle container (5-1/2" L x 4" W x 2.75" DEEP). Weight 223 grams

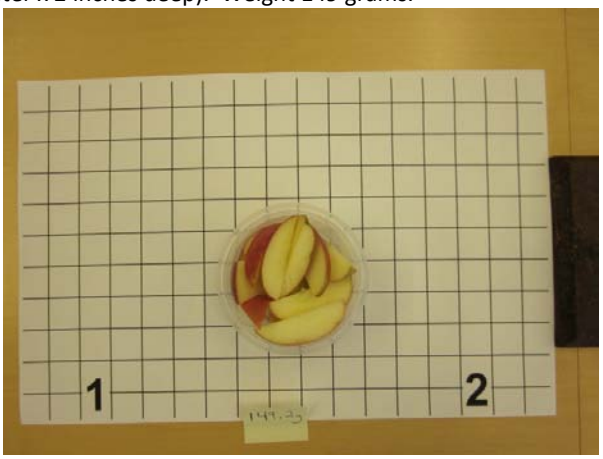




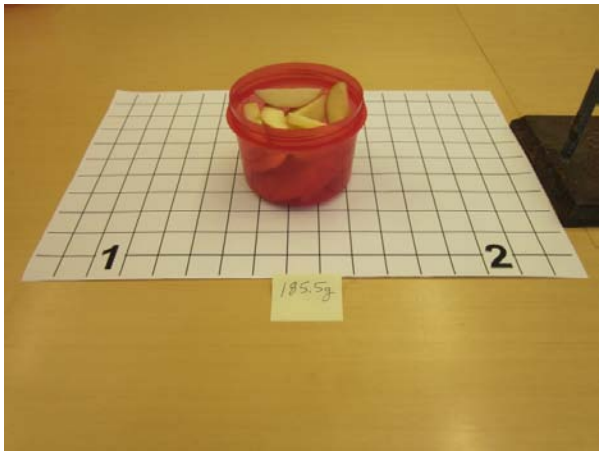
Apple, sliced, container = round
Reference for: all sliced apples

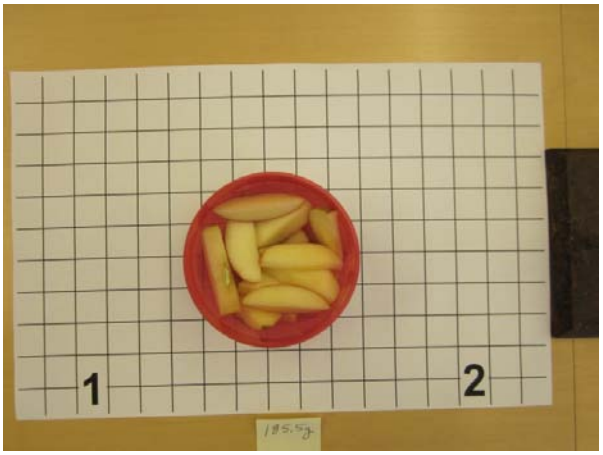
SMALL: ≤ 100% full of 1 cup capacity round container (3.5 inch diameter x 2 inches deep). Weight 149 grams.



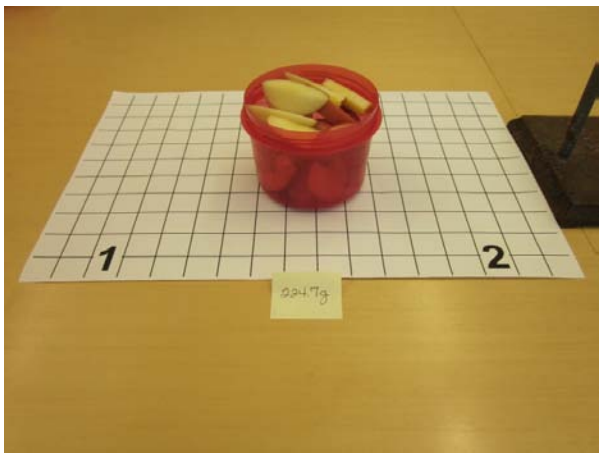


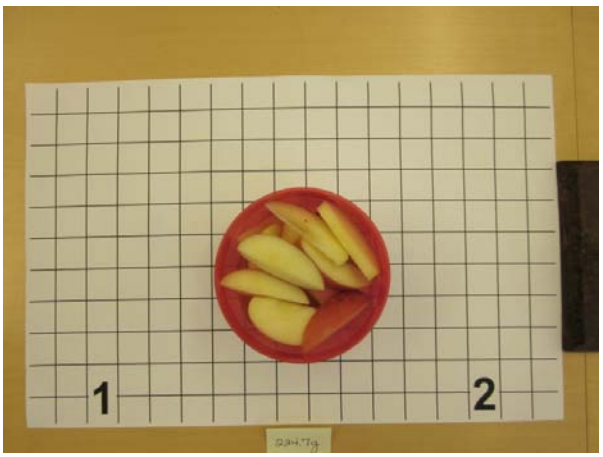
MEDIUM: >100% full of 1 cup capacity and ≤2/3 full of 2 cup capacity (4-1/8" diameter x 3.5" deep). Weight 182 grams.





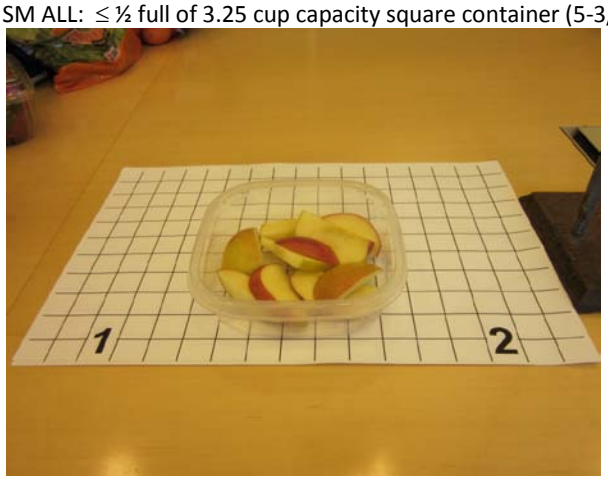
LARGE: > 2/3 full of 2 cup capacity round container (4-1/8" diameter x 3.5"deep). Weight 223 grams.

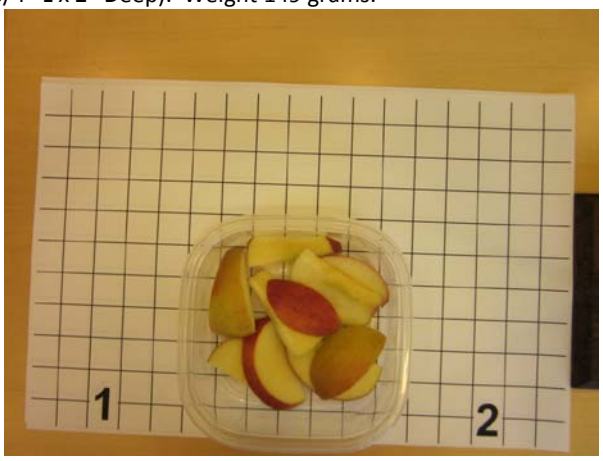




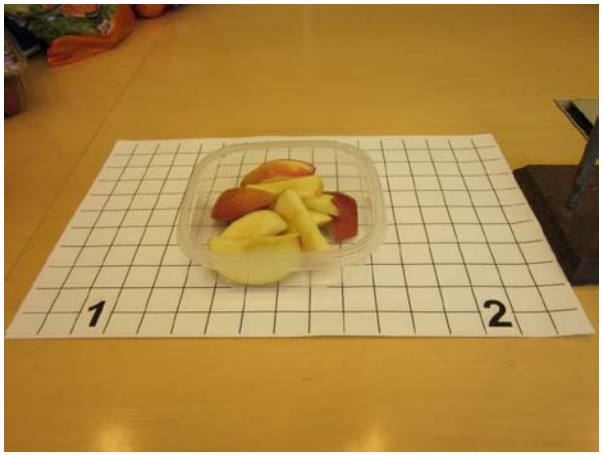
Apple, sliced, container = square
Reference for: all sliced apples

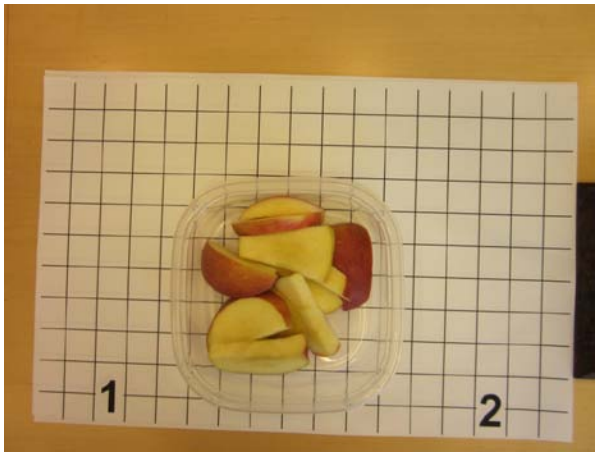
SM ALL: ≤ ½ full of 3.25 cup capacity square container (5-3/4" W x 5-3/4" L x 2" Deep). Weight 149 grams.



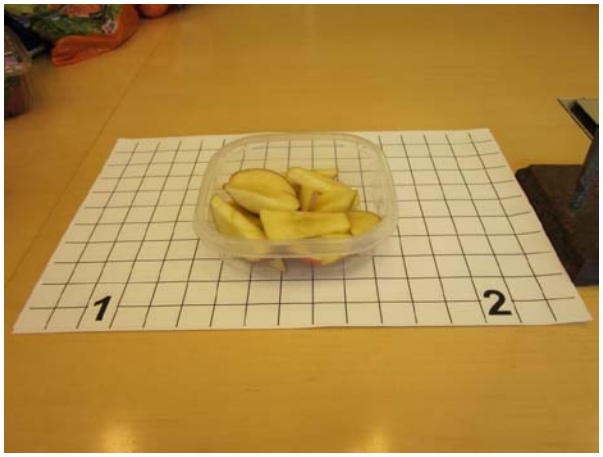


MEDIUM: >½ full and ≤ 2/3 FULL of 3.25 cup capacity (5-3/4" W x 5-3/4" L x 2" Deep). Weight 182 grams.





LARGE: >2/3 FULL of 3.25 cup capacity (5-3/4" W x 5-3/4" L x 2" Deep). Weight 223 grams.



Appendix F: COMETS Key Informant Interview Topic Guide

COMETS
Cushing Opportunities for Meals Eaten Together at School
Food Service Key Informant Interview Topic Guide

Purpose:

To gather information from food service staff about the following key topics:

1) Perception, attitudes, and beliefs about student food choices in the lunch line
2) Their perception of the foods offered in the lunch line and specific feedback on student selection and consumption of fruits, vegetables, and whole grains
3) Share dining hall intervention proposal and gather feedback
    a. Understand concerns for students and concerns for job duties
    b. How changes in the dining hall have been communicated to students in the past
    c. Reaction to Student Lunch Advisory Council and promotional activities

MODERATOR'S GUIDE

Introduction

Good afternoon and welcome. Thanks for taking the time to talk with me about promoting healthy eating habits among students at the Cardinal Cushing School. I'm Kristie Hubbard from Tufts University. Researchers from Tufts have worked with schools and communities on health promotion projects in the past and know that it works best to partner with you from the beginning of planning. Your ideas are important to us. Your responses in this discussion will be used to help design our program.

You were invited to be interviewed because of your role working as food service staff at the Cushing School. We are conducting this interview because we are interested in learning your opinion about the best way to help students make healthier choices by enhancing the food environment at the school. The term "food environment" is used to describe all the physical spaces and situations at the school in which food is present. Some examples of food environments at the school include classrooms, job sites, the dining hall, the residential units, and special events.

First of all, I want to be sure you understand that there are no right or wrong answers to the questions I'll ask. I want to hear your most honest responses, because they will be the most helpful.

I am recording the session because I don't want to miss any of your comments. No names will be included in any of our reports. Instead, I will give you a fake name to use

today so your real name is not recorded in the audio track. Your comments are confidential. You can decline to respond to any question if you do not feel comfortable.

Please let me know if you need to take a break.

The discussion will take about 60 minutes.

The time is now:

We will end at:

KEY TOPIC AREA #1: Perceptions, attitudes, and beliefs about food choices in the lunch line (20 minutes)

1. What, if any, interactions between you and students are rewarding to you in your job?
2. Without naming names, can you tell us about some of the extra steps you might have to take to help students when they go through the serving line? Describe some of the special situations that might arise for particular students.
3. When a child chooses a particular food in the lunch line, what do you think influences their decision?
    a. What are your thoughts about the role you might have on influencing the foods students choose in the lunch line?
    b. What are your thoughts about the role vocational staff & students might have on influencing the foods students choose in the lunch line?
4. Students are learning to make choices in the dining hall. What do you think about the ability of students to make their own food choices which are healthy?
    a. What could food service staff do to encourage students to make their own choices in the lunch line that are healthier?

KEY TOPIC AREA #2: Specific questions about the food offered including fruits, vegetables, and whole grains (20 minutes)

1. What do you think of the overall healthfulness of the food that is offered to students at lunch?
2. What do you think are the most popular items on the lunch menu?
    a. What about these items makes them popular?
3. Tell us about whether you think most students select and eat the fruits that are offered.
    a. What might prevent students from selecting the fruit? Eating it?
    b. What might be done differently to help students choose and eat more fruit?

   c. I am aware that it was a problem when fruit was on the counter because students would touch it and then not take it. Can you think of some ways to work around this problem?
4. Tell us about whether you think most students select and eat the vegetables that are offered.
   a. What might prevent students from selecting vegetables? Eating it?
   b. What might be done differently to help students choose and eat more vegetables?
5. We know that you have worked very hard on offering whole grain foods to students (whole wheat pasta, whole wheat bread, etc). How is that going?
   a. What might prevent students from selecting the whole grains? Eating them?
   b. What might be done differently to help students choose and eat more whole grain foods?

KEY TOPIC AREA #3: Share dining hall intervention proposal and gather ideas & feedback for helping students prepare and respond to change (20 minutes)

MODERATOR: What we plan to do in the program is use subtle techniques to help students make healthier choices when going through the lunch line in the dining hall. There have been many studies that use these techniques (called Smarter Lunchrooms) successfully among typically developing children, but the techniques have not been tested in lunch rooms which serve children with intellectual and developmental disabilities. We want to work with you to determine 3 or 4 changes we can make that will be easy and will not make your job more difficult or require more work on your part. Specific examples of what we might do are: putting the healthiest entrée first in the lunch line, serving sliced or chopped fruit on some days instead of whole fruit, and using verbal prompts in a way that encourages the healthy choice.

1. Please tell us your thoughts about redesigning the dining hall to be *Smarter*.
   a. What might concern you about this?
   b. How might this impact your job?
   c. Describe how students might respond.

2. We would like to redesign the lunchroom in a way that is the least disruptive to students. We know that changes have been made in the past. Can you describe how you communicated with students about the changes or what strategies you might have used to help prepare the students for changes?
   a. Describe any strategies we should avoid.

3. We would also like to form a Student Lunch Advisory Council (SLAC) which would lead student involvement and provide four activities in the dining hall (one each month) in the period of January through April. Tell us your thoughts about having student-led promotions in the dining hall.

a. Talk about any concerns you might have. How might the activities disrupt your work?
b. How do you think students would respond to taste tests and voting activities?

MODERATOR CLOSURE: Is there anything else you would like to share today based on what we have been discussing? Is there something important that I should have asked about? (Sum up what they have said and ask for any corrections or additions to that). Thank you.

Appendix G: COMETS Vocation Staff Focus Group Topic Guide

COMETS
Cushing Opportunities for Meals Eaten Together at School
Vocational Staff Focus Group Topic Guide

Purpose:

To gather information from vocational teachers about the following key topics:

4) Food in the classroom & perception, attitudes, and beliefs about the nutritional health of students and nutrition role modeling
5) Their thoughts on the overall food environment at the school and how it could be improved
    a. Policy options for improving the food environment
    b. Perceptions of students' ability to make food choices which are healthful
6) Food choices in the lunch line and eating with students in the dining hall
7) Share dining hall intervention proposal and gather feedback
    a. Understand concerns for *vocational* students and concerns for *vocational teachers'* job duties
    b. How changes in the dining hall have been communicated to *vocational* students in the past
    c. Reaction to the possibility of changing *vocational student* job responsibilities in the lunch line

MODERATOR'S GUIDE

Introduction

Good morning and welcome. Thanks for taking the time to talk with us about promoting healthy eating habits among students at the Cardinal Cushing School. I'm Kristie Hubbard from Tufts University. Assisting me is Lauren Blumberg. Researchers from Tufts have worked with schools and communities on health promotion projects in the past and know that it works best to partner with you from the beginning of planning. Your thoughts and opinions are important to us. Your responses in this discussion will be used to help design our program.

You were invited to be interviewed because of your role working as teachers in the Vocational Program at the Cushing School. We are conducting this focus group because we are interested in learning your opinion about the best way to help students make healthier choices by enhancing the food environment at the school. The term "food environment" is used to describe all the physical spaces and situations at the school in which food is present. Some examples of food environments at the school include classrooms, job sites, the dining hall, the residential units, and special events.

There are several ground rules for our focus group today. First of all, I want to be sure everyone understands that there are no right or wrong answers to the questions I'll ask. I want to hear your most honest responses, because they will be the most helpful. I also want to hear what everyone thinks. I expect that you may have differing points of view, so please feel free to share yours even if someone else just said something completely different. The point is not to agree, but to get as many ideas out as possible. You might also change your mind based on things others have said. Feel free to say that too. It is very important, however, that you respect what other group members are saying, even if you disagree.

We're recording the session because we don't want to miss any of your comments. We will use fake names today in our discussion in order that your real name is not recorded in the audio track. Your comments are confidential both to us and with each other. No names will be included in any of our reports on this group. Also, please be sure to speak one at time so that we can record what everyone is saying. We're interested in hearing from each of you. If you're talking a lot, I may ask you to give others a chance. If you aren't saying much, I may call on you. We just want to make sure that we hear from all of you.

Feel free to get up and get more refreshments if you like, or go to the bathroom. I only ask that you get up one at a time.

We have name tags to help me remember your names, but they can also help you. If you want to follow up on something someone has said, or if you want to agree, disagree, or give an example, please feel free to do that.

The discussion will take about 90 minutes. We will split up the discussion into two days, each lasting 45 minutes. We will resume on the second day where we end today.

The time is now:

We will end at:

To get started, please tell us your favorite movie as a child. We don't have to go in any particular order (explain popcorn technique). Who would like to start?

KEY TOPIC AREA #1: Perceptions, attitudes, and beliefs about food-related activities on campus, nutritional health of students and food choices (20 minutes)

5. Describe any food-oriented activities that you do with students.
    a. Which activities do students seem to enjoy the most?
6. Talk about the ways, if any, that student health might be addressed in the vocational program.
    a. Nutritional health?

7. What are your thoughts about the nutritional health of your students?
    a. Describe any concerns you may have.
8. What are your thoughts about the food choices that students make on the school campus?
    a. Students are learning to make choices. What could vocational teachers do to encourage students to make their own choices which are healthier?

KEY TOPIC AREA #2: Thoughts on the overall food environment at the school and how it could be improved including policy options (20 minutes)

1. How would you describe the overall food environment at the school?
2. Tell us about the ways the school addresses the nutritional health of students as a part of overall wellness?
    a. Describe what the school does well to address the nutritional health of students.
    b. What ideas do you have that would help the school better address the nutritional health of students?
3. Imagine that the school is going to implement some policy changes that would help the students eat healthier foods, such as limiting desserts at extracurricular events. Talk about the kinds of policies you think might make the most difference.
4. What might get in the way of being able to put these policies into place?

KEY TOPIC AREA #3: Food choices in the lunch line and experience eating with students in the dining hall (25 minutes)

Part A

1. What roles and responsibilities do you have during the lunch period (including getting students to the culinary building, helping them during the meal, recess following the lunch period)?
2. Without naming names, can you tell us about some of the extra steps you might have to take to help students when they go through the serving line? Describe some of the special situations that might arise for particular students.
    a. Describe what you do when a student from your class is on the healthy choice.
3. What do you think of the overall healthfulness of the food that is offered to students at lunch in the dining hall?
4. When a student chooses a particular food in the lunch line, what do you think influences their decision?
    a. What are your thoughts about the role you might have on influencing the foods students choose in the lunch line?

5. Students are learning to make choices. What do you think about the ability of students to make their own food choices in the lunch line which are healthy?

Part B

6. Please tell us about your experience eating with students and monitoring students at the tables when they eat lunch in the dining hall.
    a. How many students are you responsible for?
    b. In what ways, if any, do you help students during this time?
7. Tell us about whether you think most students eat the food that is on their tray.
    a. What foods do you think they throw away the most? The least?
    b. I realize that a common reason why students do not eat certain foods is because they dislike them. But beyond dislikes, what might prevent the students from eating particular foods?
    c. How much do they share food?
8. Describe ways, if any, that you encourage students to eat the food on their tray.
    a. Do you have a key phrase or technique that is successful?
9. How can the teachers help students eat the healthy foods on their tray once they are at the table?
10. Tell us about whether students take food out of the cafeteria to eat later in the day.
    a. How is this handled? Are there policies about taking food out of the cafeteria? If so, are they adhered to?

KEY TOPIC AREA #3: Share dining hall intervention proposal and gather ideas & feedback for helping vocational students prepare and respond to change in their usual job responsibilities (25 minutes)

MODERATOR: What we plan to do in the program is use subtle techniques to help students make healthier choices when going through the lunch line in the dining hall. There have been many studies that use these techniques (called Smarter Lunchrooms) successfully among typically developing children, but the techniques have not been tested in lunch rooms which serve children with intellectual and developmental disabilities. We want to work with you to determine 3 or 4 changes we can make that will be easy and will not make your job more difficult or require more work on your part. Specific examples of what we *might* do are: putting the healthiest entrée first in the lunch line, serving sliced or chopped fruit on some days instead of whole fruit, and using verbal prompts in a way that encourages the healthy choice.

4. Please tell us your thoughts about redesigning the dining hall to be *Smarter*.
    a. What might concern you about this?
    b. How might this impact your job?
    c. How might this change how you train and support the vocational students?
    d. Describe how vocational students might respond if their responsibilities in the dining hall are different.

5. We would like to redesign the lunchroom in a way that is the least disruptive to students. We know that changes have been made in the past. Can you describe how you communicated with students about the changes or what strategies you might have used to help prepare the students for changes?
    a. Describe any strategies we should avoid.

6. We might ask workers on the serving line to use specific prompts, such as asking students going through the line about which vegetable side they would like. Tell us about the ability of the vocational students who work on the line to use verbal prompts.
    a. What are your thoughts about changing non-verbal prompts that vocational students use? (An example is putting fruit in bowls at eye level).
    b. Describe any concerns you may have.

MODERATOR CLOSURE: Is there anything else you would like to share today based on what we have been discussing? Is there something important that I should have asked about? (Sum up what they have said and ask for any corrections or additions to that). Thank you.

Appendix H: COMETS Education Staff Focus Group Topic Guide

COMETS
Cushing Opportunities for Meals Eaten Together at School
Educational Staff Focus Group Topic Guide

Purpose:

To gather information from teachers about the following key topics:

8) Food in the classroom & perception, attitudes, and beliefs about the nutritional health of students and nutrition role modeling
9) Their thoughts on the overall food environment at the school and how it could be improved
    a. Policy options for improving the food environment
    b. Perceptions of students' ability to make food choices which are healthful
10) Food choices in the lunch line and eating with students in the dining hall
11) Share dining hall intervention proposal and gather feedback
    a. Feedback on their ideas for helping students prepare and respond to change
    b. Feedback on strategies to maintain integrity of the research
    c. Feedback on student involvement in the intervention

MODERATOR'S GUIDE

Introduction

Good morning and welcome. Thanks for taking the time to talk with us about promoting healthy eating habits among students at the Cardinal Cushing School. I'm Kristie Hubbard from Tufts University. Assisting me is Lauren Blumberg. Researchers from Tufts have worked with schools and communities on health promotion projects in the past and know that it works best to partner with you from the beginning of planning. Your thoughts and opinions are important to us. Your responses in this discussion will be used to help design our program.

You were invited to be interviewed because of your role working in the educational program at the Cushing School. We are conducting this focus group because we are interested in learning your opinion about the best way to help students make healthier choices by enhancing the food environment at the school. The term "food environment" is used to describe all the physical spaces and situations at the school in which food is present. Some examples of food environments at the school include classrooms, job sites, the dining hall, the residential units, and special events.

There are several ground rules for our focus group today. First of all, I want to be sure everyone understands that there are no right or wrong answers to the questions I'll ask. I want to hear your most honest responses, because they will be the most helpful. I also want to hear what everyone thinks. I expect that you may have differing points of view, so please feel free to share yours even if someone else just said something completely different. The point is not to agree, but to get as many ideas out as possible. You might also change your mind based on things others have said. Feel free to say that too. It is very important, however, that you respect what other group members are saying, even if you disagree.

We're recording the session because we don't want to miss any of your comments. We will use fake names today in our discussion in order that your real name is not recorded in the audio track. Your comments are confidential both to us and with each other. No names will be included in any of our reports on this group. Also, please be sure to speak one at time so that we can record what everyone is saying. We're interested in hearing from each of you. If you're talking a lot, I may ask you to give others a chance. If you aren't saying much, I may call on you. We just want to make sure that we hear from all of you.

Feel free to get up and get more refreshments if you like, or go to the bathroom. I only ask that you get up one at a time.

We have name tags to help me remember your names, but they can also help you. If you want to follow up on something someone has said, or if you want to agree, disagree, or give an example, please feel free to do that.

The discussion will take about 90 minutes. We will split up the discussion into two days, each lasting 45 minutes. We will resume on the second day where we end today.

The time is now:

We will end at:

To get started, please tell us about a food that reminds you of summer. We don't have to go in any particular order (explain popcorn technique). Who would like to start?

KEY TOPIC AREA #1: Food in the classroom & perceptions, attitudes, and beliefs about nutrition role modeling by teachers (20 minutes)

9. Describe any food-oriented activities that you do with students.
    a. Which activities do students seem to enjoy the most?
10. Please describe (if any) school rules or policies that address food in the classroom (type, frequency, quantity).

a. If there are rules, are you able to comply? What makes it challenging to comply? What helps you comply?

11. What are your thoughts about the nutritional health of your students in general?
    a. Describe any concerns you have.
12. What are your thoughts about teachers serving as role models for students in the area of healthy eating?
    b. What about other staff on the campus?
13. What activities do you currently use *in the classroom* to address the health and wellness of students?

KEY TOPIC AREA #2: Teachers' thoughts on the overall food environment at the school and how it could be improved including policy options (20 minutes)

5. How would you describe the overall food environment at the school?
6. Tell us about the ways the school addresses the nutritional health of students as a part of overall wellness?
    a. Describe what the school does well to address the nutritional health of students.
    b. What ideas do you have that would help the school better address the nutritional health of students?
7. Imagine that the school is going to implement some policy changes that would help the students eat healthier foods, such as limiting desserts at extracurricular events. Talk about the kinds of policies you think might make the most difference.
8. What might get in the way of being able to put these policies into place?

KEY TOPIC AREA #3: Food choices in the lunch line and experience eating with students in the dining hall (25 minutes)

Part A

6. What roles and responsibilities do you have during the lunch period (including getting students to the culinary building, helping them during the meal, recess following the lunch period)?
7. Without naming names, can you tell us about some of the extra steps you might have to take to help students when they go through the serving line? Describe some of the special situations that might arise for particular students.
    a. Describe what you do when a child from your class is on the healthy choice.
8. What do you think of the overall healthfulness of the food that is offered to students at lunch in the dining hall?

9. When a child chooses a particular food in the lunch line, what do you think influences their decision?
    a. What are your thoughts about the role you might have on influencing the foods students choose in the lunch line?
10. Students are learning to make choices.
    a. What do you think about the ability of students to make their own food choices in the lunch line which are healthy?
    b. What are your ideas about ways teachers can balance the need for students to make their own decisions with their own desire for the student to eat healthfully?

Part B

11. Please tell us about your experience eating with students and monitoring students at the tables when they eat lunch in the dining hall.
    a. How many students are you responsible for?
    b. In what ways, if any, do you help students during this time?
12. Tell us about whether you think most students eat the food that is on their tray.
    a. What foods do you think they throw away the most? The least?
    b. I realize that a common reason why students do not eat certain foods is because they dislike them. But beyond dislikes, what might prevent the students from eating particular foods?
    c. How much do they share food?
13. Describe ways, if any, that you encourage students to eat the food on their tray.
    a. Do you have a key phrase or technique that is successful?
14. How can the teachers help students eat the healthy foods on their tray once they are at the table?
15. Tell us about whether students take food out of the cafeteria to eat later in the day.
    a. How is this handled? Are there policies about taking food out of the cafeteria? If so, are they adhered to?

KEY TOPIC AREA #4: Share dining hall intervention proposal and gather ideas & feedback for helping students prepare and respond to change (25 minutes)

MODERATOR: What we plan to do in the program is use subtle techniques to help students make healthier choices when going through the lunch line in the dining hall. There have been many studies that use these techniques (called Smarter Lunchrooms) successfully among typically developing children, but the techniques have not been tested in lunch rooms which serve children with intellectual and developmental disabilities. Specific examples of what we might do are: putting the healthiest entrée first in the lunch line, serving sliced or chopped fruit on some days instead of whole fruit, and using verbal prompts in a way that encourages the healthy choice.

7. Please tell us your thoughts about redesigning the lunchroom to be *Smarter*.
    a. What might concern you about this?
    b. Describe how students might respond.
    c. We would like to engage teachers so they are supportive of the intervention and are prepared to help students during the transition period (without being overly influential on student choices). What are your recommendations for achieving this goal?

8. We would like to redesign the lunchroom in a way that is the least disruptive to students. We know that you might currently use strategies in the classroom to help students prepare for transitions. Can you describe strategies that could be used to help prepare students for change?
    a. Describe any strategies we should avoid.

9. We would like students to be involved in the project and need to determine the best strategy for engaging with them.
    a. What do you suggest for communication? Should the information go through teachers? Should we visit individual classrooms? Is there a role for the Student Council?

10. We would also like to form a Student Lunch Advisory Council (SLAC) which would lead student involvement and provide four activities in the dining hall (perhaps one each month) in the period of January through April. Tell us about whether you think students would be interested in joining this group.
    a. How could we make this group fun for students?
    b. Tell us about whether you think students in the SLAC would be willing to conduct taste tests in the cafeteria during the lunch period. Do you think students would participate in a taste test activity including voting?

MODERATOR CLOSURE: Is there anything else you would like to share today based on what we have been discussing? Is there something important that I should have asked about? (Sum up what they have said and ask for any corrections or additions to that). Thank you.

Appendix I: COMETS Parent and Child Participant Recruitment Letter

Dear Parents:

The Cardinal Cushing Centers is pleased to announce its partnership with Tufts University researchers on a special project to take place at the school this year, called *Cushing Opportunities for Meals Eaten Together at School* (COMETS). The goal of the research project is to help students make food choices which are healthier by working with Cardinal Cushing staff to enhance the "food environment" at the school.

As many of you know, unhealthy diets and overweight in our children puts them at a higher risk of being overweight as an adult, and makes them more likely to get diabetes and high blood pressure, as well as depression and fatigue. In the long-run, poor diet can affect their quality of life.

This partnership is a wonderful opportunity for the Cardinal Cushing Centers to show its commitment to the health and wellness of students, families, and staff and to carry forth one of its central missions – *to improve the quality of life for each student*. The research project will help us to meet the long-term goal-- helping students make healthy food choices throughout the entire campus so they develop the skills to keep their healthy habits when they transition into the community.

This winter and spring, the research team will work with food service staff to enhance the dining hall. They will focus on the residential units, classrooms, and extra-curricular events later in the project, the summer and fall of 2012.

We are inviting you to enroll your child in the research that will be conducted in the dining hall this winter and spring. We aim to find out whether the re-design of the dining hall will have a positive impact on the eating habits of students. We will evaluate the changes by taking photos of the foods on students' trays after they have made their choices in the lunch line and what they throw away after they finish eating. The photos of meal trays will be taken for 5 days at the end of January and again at the end of May.

If you decide to that you would like to participate, your child will not need to do anything differently. The only change to their routine will be the taking of the photographs, and they will be prepared for this by their teachers.

The research project is led by an Advisory Board consisting of Cardinal Cushing staff, Tufts University researchers, E.K. Shriver Center researchers, parents, and community members.

We look forward to the opportunity to partner with Tufts University on this important project to improve the health and quality of life of our students at the Cardinal Cushing School. I hope you will consider letting your child participate in the study. Your child will also be asked to agree to participate in their classrooms before the first day of the picture-taking.

The education, training, support, and care your child receives at the Cardinal Cushing School will not change whether or not your child participates in the study.

Answers to frequently-asked-questions are provided in the Information Sheet. If you would like your child to participate, please fill out, sign, and date the Parent Consent Form and return it in the stamped, self-addressed return envelope to the school.

Please contact Aviva Must, PhD (617 636 0446 or aviva.must@tufts.edu) if you have questions or concerns about your child's participation.

With sincere thanks,

_____

Jo Ann Simons
President & CEO

_____

Larry Sauer
Vice President of Operations

_____

Michael Berardo
Director of Clinical Services

_____

Roberta Pulaski
Senior Director of Education

_____

Doug Frazier
Senior Director of Vocational Education

Appendix J: COMETS Information Sheet for Parents and Child Participants

Cardinal Cushing Centers
Tufts University
INFORMATION SHEET FOR PARTICIPANTS
COMETS
Cushing Opportunities for Meals Eaten Together at School
Dining Hall Intervention

WHAT IS THE PROJECT ABOUT?

Your child is being invited to take part in a research study to explore how the Cardinal Cushing School can enhance its "food environment" to help students make healthier food choices. We will redesign the dining hall at the Cardinal Cushing School to see if it has an effect on what students choose and eat at lunch.

Giving permission for your child to take part in this research study is totally your choice. Your child's education and care at the Cardinal Cushing School will not change whether you decide to give permission for your child to participate in the study or not.

This research study has been reviewed and approved by the Institutional Review Board of Tufts University Health Sciences. If you have questions about your rights as a research study subject, you may call the Tufts Medical Center and Tufts University Health Sciences Institutional Review Board (IRB) at (617) 636-7512. The Institutional Review Board is a group of doctors, nurses, and non-medical people who review human research studies for safety and protection of the people who take part in them. Federal law requires the Institutional Review Board to review and approve any research study involving humans. This must be done before the study can begin.

WHAT WILL HAPPEN?

If you agree to have your child participate, photographs will be taken of the foods on your child's tray after he/she has made all selection and when he/she is done eating. Photographs will be taken for 5 consecutive days during a school week in January and again in May. Each lunch tray will be lined with a placemat containing a unique number for your child in order to match their pre and post meal photographs. No other information is being collected about your child. Research staff at Tufts University will examine the food photos to evaluate any changes in what students choose and eat. Once the project has been completed, the food photos will be destroyed.

WHAT ARE THE RISKS?

Your child may feel uncomfortable having a photo taken of the food on his/her tray.

WILL MY CHILD BENEFIT FROM PARTICIPATING?

There is the potential that your child will directly benefit from participating in the study if he/she learns how to make healthier food choices.

DOES MY CHILD HAVE TO PARTICIPATE?

The alternative to participation is not to participate. You should not feel that you have to give permission for your child to participate because other people at the school are participating. The education, training, care, and support of your child will not change at the Cardinal Cushing School whether your child participates or not.

WILL I HAVE TO PAY FOR MY CHILD TO PARTICIPATE?

There are no costs to participate.

WILL I BE PAID FOR MY CHILD'S PARTICIPATION?

You and your child will not be paid to participate in the study.

WILL MY CHILD'S NAME AND FOOD PHOTOS BE KEPT PRIVATE AND CONFIDENTIAL?

Lunch trays will have a paper placemat. The placemat will contain a unique ID number. We are not collecting any personal information about your child. At the end of the project, all of the information will be grouped, so there will be no way to know that anything learned came from your child's food photos. Food photos will not be shared with anyone at the school.

WHAT IF I HAVE QUESTIONS?

If you have questions about this study, you can contact the Principal Investigator, Aviva Must, at 617-636-0446.

Appendix K: COMETS Parent Permission Form

COMETS

Cushing Opportunities for Meals Eaten Together at School

Your child is invited to join a research study at the Cardinal Cushing School being conducted in collaboration with Tufts University. The purpose of the study, called **COMETS**, is to evaluate the redesign of the dining hall to help children choose more healthful foods from the lunch line.

If your child joins, he or she will be asked to take part in the following activity:

- **Food photos:** Two weeks during the school year, a researcher will take a digital photo of the food your child chose in the lunch line and the remaining food on their tray after eating lunch. The researcher will not take photos of your child or touch your child's food. The photo will take less than 2 minutes.

We will use the data from this study to see how the redesign of the dining hall affects what foods children choose in the lunch line and what foods they eat from their tray.

Risks and Benefits

The study involves minimal risks. Your child's food photos will be coded with an ID number.

Your child may benefit from participating in this study by learning how to choose healthful foods.

Your child's participation in the study can also benefit the community by helping researchers find better ways to design lunchrooms so that it is easier for children to choose healthful foods. If successful, the campaign can be shared with other residential schools.

Voluntary Participation & Withdrawal

Your child's participation in this study is voluntary. He or she may withdraw at any time or for any reason. Your family will receive the same services from the school whether or not your child is in the study.

Confidentiality

Your child's personal information will be kept confidential and will not be released without your written permission, except as required by law. A code will be used in place of your child's name on all data. The only personal information collected by researchers

will be the sex and age of participants. Personal information will be stored separately from food photos. Your child's name will not be reported in any publication.

Funding

This research is funded by the Deborah Munroe Noonan Memorial Research Fund. This study has been reviewed by the Institutional Review Board (IRB) at Tufts University. The IRB makes sure that the rights and welfare of each person is adequately protected and that informed consent is obtained.

Study Contacts

For any questions about this research, please contact Aviva Must, PhD at (617) 636-0446 or aviva.must@tufts.edu. For questions about your rights as a research subject, call the Tufts University Institutional Review Board at (617) 627-3417.

Statement of Consent

I understand that my child's participation is voluntary and that my child can withdraw from the study at any time without prejudice. Signing this form does not waive any of my or my child's legal rights.

By signing, I acknowledge that I understand the study and my child's role in it. I understand how study data may be used and how my child's privacy will be protected. I have read the explanation of the study and all of my questions have been satisfactorily answered, and I give permission for my child to participate.

_____

Child's full name (printed)

_____ _____

Parent/guardian's full name (printed) **Parent's contact number**

_____ _____

Parent/guardian's signature **Date**

PLEASE RETURN THIS FORM IN THE STAMPED SELF-ADDRESSED RETURN ENVELOPE TO THE CARDINAL CUSHING SCHOOL

For office use only

I certify that I have explained fully to the above subject the nature and purpose, procedures, and the possible risks and benefits of this research study.

_____ _____

Signature of researcher or designate *Date*

Appendix L: COMETS Child Assent Form

COMETS

Cushing Opportunities for Meals Eaten Together at School

We are doing a research study. Research studies are one way to figure out how things work. We want to learn how to help kids choose healthy foods at school.

You are being asked to join the **COMETS** study because you are a student at the Cardinal Cushing School. If you join, we will include you in one study activity:

- We will take a picture of the food you choose in the lunch line before you eat and after you eat. We'll do this for one week, once at the beginning, and again at the end of the study.

Sometimes things happen in research studies that may make a kid feel badly. We don't think there is anything that will make you feel bad in this study, but if you do, you are free to tell us and we will listen.

People can have good things happen to them in research studies. If you join this study, you may learn more about foods that are good for you. You will also help us figure out how to help other kids learn the same things.

Your parents will also be asked about your joining the study. Even if your parents say "yes" you can still say "no" and not join. No one will be angry. Even if you say "yes" first, you may stop later. All you have to do is tell us you want to stop.

Before you say "yes" or "no", we will answer any questions you have. If you say "yes" and join the study, you can still ask questions. Just tell the researcher that you have a question. You or your parent can also contact Aviva Must, the leader of this study, at (617) 636-0446.

If you have any questions about anything that happens during the study, there is a special office at Tufts University called the Institutional Review Board that will listen to you and answer your questions. Your parents have the phone number for that office and can help you reach them.

Saying "yes" means that you agree to be in this study and that we can take photos of the foods on your tray at lunch.

_____

Child's full name

_____

Date

<u>For office use only</u>

I certify that I have explained fully to the above subject the nature and purpose, procedures, and the possible risks and benefits of this research study.

_____ _____

Signature of researcher or designate *Date*

Appendix M: COMETS Adult Participant Recruitment Letter

Dear Student:

The Cardinal Cushing Centers is pleased to announce its partnership with Tufts University researchers on a special project to take place at the school this year, called *Cushing Opportunities for Meals Eaten Together at School* (COMETS). The goal of the project is to help students make food choices which are healthier by working with Cardinal Cushing staff to enhance the "food environment" at the school.

We are inviting you to enroll in the research that will be done in the dining hall this winter and spring. We aim to find out whether the re-design of the dining hall will change the eating habits of students. We will evaluate the changes by taking photos of the foods on students' trays after they have made their choices in the lunch line and what they throw away after they finish eating. The photos of meal trays will be taken for 5 days at the end of January and again at the end of May.

If you decide that you would like to participate, you will not need to do anything differently. The only change to your routine will be the taking of the photos, and your teacher will help to prepare you for this. I hope you will consider participating in the study.

The education, training, support, and care you receive at the Cardinal Cushing School will not change whether or not you participate in the study.

Answers to frequently-asked-questions are provided in the Information Sheet. If you would like to participate, please fill out, sign, and date the Consent Form and return it in the stamped, self-addressed return envelope to the school.

Please contact Aviva Must, PhD (617 636 0446 or aviva.must@tufts.edu) if you have questions or concerns about participation.

With sincere thanks,

_____
Jo Ann Simons
President & CEO

_____
Larry Sauer
Vice President of Operations

_____
Michael Berardo
Director of Clinical Services

Appendix N: COMETS Adult Participant Information Sheet

Cardinal Cushing Centers

Tufts University
INFORMATION SHEET FOR PARTICIPANTS

COMETS
Cushing Opportunities for Meals Eaten Together at School
Dining Hall Intervention

WHAT IS THE PROJECT ABOUT?

You are being invited to take part in a research study to explore how the Cardinal Cushing School can enhance its "food environment" to help students make healthier food choices. We will redesign the dining hall at the Cardinal Cushing School to see if it has an effect on what students choose and eat at lunch.

Participating in this research study is totally your choice. Your education and care at the Cardinal Cushing School will not change whether you decide to participate in the study or not.

This research study has been reviewed and approved by the Institutional Review Board of Tufts University Health Sciences. If you have questions about your rights as a research study subject, you may call the Tufts Medical Center and Tufts University Health Sciences Institutional Review Board (IRB) at (617) 636-7512. The Institutional Review Board is a group of doctors, nurses, and non-medical people who review human research studies for safety and protection of the people who take part in them. Federal law requires the Institutional Review Board to review and approve any research study involving humans. This must be done before the study can begin.

WHAT WILL HAPPEN?

If you agree to participate, photographs will be taken of the foods on your lunch tray after you have made all selections and when you are done eating. Photographs will be taken for 5 consecutive days during a school week in January and again in May. Each lunch tray will be lined with a placemat containing a unique number in order to match your pre and post meal photographs. No other information is being collected about you. Research staff at Tufts University will examine the food photos to evaluate any changes in what students choose and eat. Once the project has been completed, the food photos will be destroyed.

WHAT ARE THE RISKS?

You may feel uncomfortable having a photo taken of the food on your tray.

WILL I BENEFIT FROM PARTICIPATING?

There is the potential that you will directly benefit from participating in the study if you learn how to make healthier food choices.

DO I HAVE TO PARTICIPATE?

The alternative to participation is not to participate. You should not feel that you have to participate because other people at the school are participating. The education, training, care, and support you receive will not change at the Cardinal Cushing School whether you participate or not.

WILL I HAVE TO PAY TO PARTICIPATE?

There are no costs to participate.

WILL I BE PAID TO PARTICIPATE?

You will not be paid to participate in the study.

WILL MY NAME AND FOOD PHOTOS BE KEPT PRIVATE AND CONFIDENTIAL?

Lunch trays will have a paper placemat. The placemat will contain a unique ID number. We are not collecting any personal information about you. At the end of the project, all of the information will be grouped, so there will be no way to know that anything learned came from your food photos. Food photos will not be shared with anyone at the school.

WHAT IF I HAVE QUESTIONS?

If you have questions about this study, you can contact the Principal Investigator, Aviva Must, at 617-636-0446.

Appendix O. COMETS Adult Consent Form

COMETS

Cushing Opportunities for Meals Eaten Together at School

You are invited to join a research study at the Cardinal Cushing School being conducted in collaboration with Tufts University. The purpose of the study, called **COMETS**, is to evaluate the redesign of the dining hall to help students choose more healthful foods from the lunch line.

If you join, you will be asked to take part in the following activity:

- **Food photos:** Two weeks during the school year, a researcher will take a digital photo of the food you chose in the lunch line and the remaining food on your tray after eating lunch. The researcher will not take photos of you or touch your food. The photo will take less than 2 minutes.

We will use the data from this study to see how the redesign of the dining hall affects what foods students choose in the lunch line and what foods they eat from their tray.

Risks and Benefits

The study involves minimal risks. Your food photos will be coded with an ID number.

You may benefit from participating in this study by learning how to choose healthful foods.

Your participation in the study can also benefit the community by helping researchers find better ways to design lunchrooms so that it is easier for students to choose healthful foods. If successful, the campaign can be shared with other residential schools.

Voluntary Participation & Withdrawal

Your participation in this study is voluntary. You may withdraw at any time or for any reason. You will receive the same services from the school whether or not you participate in the study.

Confidentiality

Your personal information will be kept confidential and will not be released without your written permission, except as required by law. A code will be used in place of your name on all data. The only personal information collected by researchers will be the sex and

age of participants. Personal information will be stored separately from food photos. Your name will not be reported in any publication.

Funding

This research is funded by the Deborah Munroe Noonan Memorial Research Fund. This study has been reviewed by the Institutional Review Board (IRB) at Tufts University. The IRB makes sure that the rights and welfare of each person is adequately protected and that informed consent is obtained.

Study Contacts

For any questions about this research, please contact Aviva Must, PhD at (617)636-0446 or aviva.must@tufts.edu. For questions about your rights as a research subject, call the Tufts University Institutional Review Board at (617) 627-3417.

Statement of Consent

I understand that my participation is voluntary and that I can withdraw from the study at any time without prejudice. Signing this form does not waive any of my legal rights.

By signing, I acknowledge that I understand the study and my role in it. I understand how study data may be used and how my privacy will be protected. I have read the explanation of the study and all of my questions have been satisfactorily answered. My signature indicates that I would like to participate in this study.

_____

Adult Student's full name (printed)

_____

Contact number

_____ _____

Adult student's signature **Date**

Check this box ☐ if you would like the school to inform your parent/guardian that you chose to participate in the study.

PLEASE RETURN THIS FORM IN THE STAMPED SELF-ADDRESSED RETURN ENVELOPE TO THE CARDINAL CUSHING SCHOOL

For office use only

I certify that I have explained fully to the above subject the nature and purpose, procedures, and the possible risks and benefits of this research study.

_____

Signature of researcher or designate

_____

Date

Appendix P: COMETS Sample Recipe for Classroom-Based Taste Testing

Fruit Kabobs with Coconut-Yogurt Dressing

INGREDIENTS:

ASSORTED SLICED FRUIT:

- CUBED PINEAPPLE
- HALVED GRAPES
- SECTIONED ORANGES
- BANANA SLICED
- DRIED APRICOTS
- SEASONAL BERRIES

½ CUP NON-FAT VANILLA YOGURT

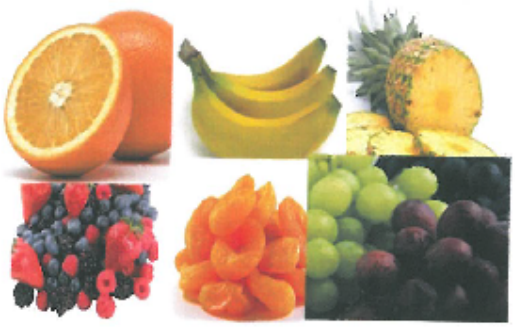
1 TBS. SHREDDED, SWEETENED COCONUT

1 TSP. ORANGE MARMALADE

METHOD:

1. MIX YOGURT, COCONUT, AND MARMALADE TOGETHER AND SET ASIDE IN A SEPARATE BOWL.
2. ASSEMBLE DESIRED FRUIT ONTO WOODEN SKEWERS- BE SURE TO INCLUDE A VARIETY OF FRUITS TO TRY!
3. ENJOY YOUR FRUIT KABOB WITH A DRIZZLE OF YOGURT DRESSING!

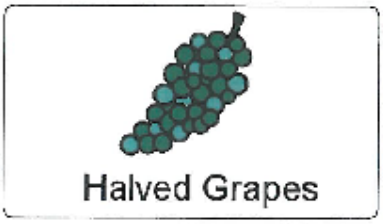
FRUIT SPOTLIGHT

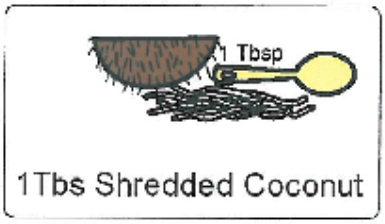


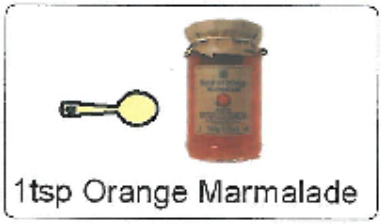
~ORANGES~
~BANANAS~
~PINEAPPLE~
~MIXED BERRIES~
~DRIED APRICOTS~
~GRAPES~

Fruit Kabobs with Coconut - Yogurt Dressing

Ingredients:







Fruit Kabobs with Coconut - Yogurt Dressing

Directions:

1. Mix yogurt, coconut and marmalade together & and set aside. in seperate bowl.

---

2. Assemble desired fruit onto wooden skewers, be sure to try a lot!

---

3. Enjoy your fruit with a drizzle of yogurt dressing!

Fruit Kabobs with Coconut - Yogurt Dressing

Fruit Spotlight!


Cubed Pineapple


Halved Grapes


Sectioned Oranges


Sliced Banana


Dried Apricots


Mixed Berries