PROMOTING HEALTHY WEIGHT IN CHILD CARE: PILOT TESTING, TRAINING METHODOLOGY, AND INSTRUMENT EVALUATION

by
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A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Nutrition in the Schools of Public Health and Medicine.

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ABSTRACT

SARA ELIZABETH BENJAMIN: Promoting Healthy Weight in Child Care: Pilot Testing, Training Methodology, and Instrument Evaluation
(Under the direction of Dianne Ward)

Rates of childhood overweight in the United States continue to rise at a steady and disconcerting pace. Childhood overweight is associated with a variety of adverse health consequences for children and the need to intervene is an important public health goal. Environmental interventions that promote healthy weight in young children may help prevent and mitigate childhood overweight, since eating and physical activity habits are established early in childhood and tend to track into adulthood.

A large percentage of children spend time in child care, and duration of time in care has increased in recent years. Child care facilities may serve as a home-away-from-home setting, where children learn and adopt early nutrition and physical activity behaviors. Thus, child care providers can encourage healthy eating and promote regular physical activity for young children. The child care setting provides a unique opportunity to address healthy weight in children, but intervention efforts that target both nutrition and physical activity environment, policies, and practices are needed to support child level change. However, few preschool interventions have addressed nutrition and physical activity, although interest is growing in this area.

The overarching goal of this dissertation was to promote the health of young children in child care through a nutrition and physical activity environmental intervention. This dissertation consisted of three distinct projects including pilot testing of a recently developed

nutrition and physical activity environmental intervention; comparison of two methods to train community health professionals to deliver the intervention; and assessment of the reliability (test-retest and inter-rater) and validity of the self-assessment instrument which was a key component of the intervention.

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CHAPTER I

INTRODUCTION

I.A. Overview

Rates of childhood overweight in the United States are increasing at an alarming rate, creating a serious public health concern.[1, 2] Childhood overweight is associated with a variety of adverse health consequences for children and the need to intervene is an important public health goal.[3-6] Despite some understanding of contributors to childhood overweight, there is considerable lack of knowledge of successful interventions in young children that address this issue. Early intervention may help mitigate the problem of overweight, since eating and physical activity habits are established early in childhood and tend to track into adulthood.[7]

A large percentage of US children are in some form of child care, and duration of time in care has increased in recent years.[8] The 2001 National Household Education Survey found that 74% of all children ages three to six are in some form of non-parental care and 56% are in center-based child care.[9] Child care facilities may serve as a home-away-from-home setting, where children adopt early nutrition behaviors. These behaviors are often a result of interactions with parents and other caregivers.[10] Young children in particular are more likely to be influenced by adults in an eating environment.[11] Thus, child care centers are in a unique position to encourage and facilitate healthy eating and regular physical activity for young children.

The Nutrition and Physical Activity Self-Assessment for Child Care project (NAP SACC) is an intervention for child care centers aimed at improving nutrition and physical activity policies, practices, and environments through self-assessment and targeted technical assistance. The goals of the NAP SACC program are to improve nutrition and physical activity policies and practices at the child care center, and to enhance the overall center environment. The NAP SACC program is designed to allow child care centers to self-assess their nutrition and physical activity environments, select areas for improvement, and make environmental changes with the help of a local health consultant. NAP SACC is a theory-based program that employs components of Social Cognitive Theory (SCT)[12] against a backdrop of the socio-ecological framework.[13] The inherent relationship between environment and behavior has proven useful in intervention research.

I.B. Specific Aims

This dissertation addressed the following aims and hypotheses:

Aim 1 – To test a pilot nutrition and physical activity intervention in child care centers using a self-assessment instrument and technical assistance from a community health professional.

Aim 2 – To evaluate two training methods (web-based compared to in-person training) in preparing community health professionals to deliver the NAP SACC intervention.

Hypothesis 2 – Web-based and in-person training of child health professionals will yield similar results on knowledge and skill tests as determined by the following:

a) Achievement of a correct score of 75% or greater on the post-training knowledge of childhood overweight, nutrition, and physical activity and skill test.

b) No significant differences in test results will be observed between web-based and in-person trained community health professionals.

Aim 3 – To test validity (criterion) and reliability (test-retest and inter-rater) of the Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) self-assessment instrument.

Hypothesis 3A – The NAP SACC self-assessment instrument will prove to be a valid measure of the child care center environment as assessed by the following standards:

a) No question will have a correlation of less than 0.20 when compared to a researcher-administered gold standard evaluation of the child care center environment (criterion validity).

Hypothesis 3B – The NAP SACC self-assessment instrument will prove to be a reliable measure of the child care center environment as assessed by the following standards:

a) No question will have a kappa coefficient of less than 0.20 when compared to repeat measures of the same instrument completed by the child care center director at two points in time no more than two weeks apart (test-retest reliability).
b) No question will have a kappa coefficient of less than 0.20 when compared to repeat measures of the same instrument completed at the same time by the child care center director and a second key staff person at the center (inter-rater reliability).

CHAPTER II

LITERATURE REVIEW

II.A. Prevalence of Childhood Overweight

Statistics on the increasing prevalence of childhood overweight describe a problem of pandemic proportions. [1, 2, 14] Data from the 2004 North Carolina Nutrition and Physical Activity Surveillance System [15] show 14.9% of children ages 2-4, 23.8% of children ages 5-11, and 27.2% of children ages 12-18 as overweight, with a body mass index (BMI) at or above the 95th percentile on the CDC BMI growth charts.[16] The percent of overweight preschoolers is nearly three times the expected prevalence and represents a 36% increase in overweight preschool age children in North Carolina since 1995. [16] These trends, which affect all ages and both genders, exemplify the need for interventions that stem or mitigate rates of childhood overweight.

II.B. Health Consequences of Childhood Overweight

Childhood overweight has emerged as a leading public health problem in the United States and is associated with significant adverse health consequences. Several studies have shown that sedentary activities and poor diet are strong contributors to diseases such as coronary heart disease, cancer, cardiovascular failure, diabetes, and osteoporosis.[17] Health consequences of childhood overweight can include Type II diabetes mellitus,[4, 6] hypertension and hyperlipidemia,[4, 5, 18] early maturation, orthopedic problems, sleep apnea,[19] and

psychosocial stress.[3] Moreover, overweight in adolescence tends to track into adulthood, causing overweight children to become overweight or obese adults. [7]

II.C. Opportunities to Address Childhood Overweight

Although childhood overweight may have genetic components, environmental influences can help modify the expression of a genetic predisposition and are thought to be more significant contributors to the recent increase in childhood overweight.[20] A complex array of environmental, attitudinal, and behavioral factors contribute to child overweight and these factors occur across multiple domains (i.e., individual, family, school, community). Birch and colleagues state that dietary and activity risk factors are influenced by parental (e.g., parent's nutritional knowledge), school (e.g., structured periods for activity) and community (e.g., accessibility of recreational facilities) environmental factors.[21]

The goal of healthy weight efforts is to encourage energy balance, whereby the number of calories the child ingests does not exceed the child's energy needs.[22] Specifically, individual behaviors can be targeted, which encourage consumption of nutrient dense foods, increased activity, and decreased sedentary activity.[23] There appears to be widespread consensus regarding the need to decrease TV viewing, increase physical activity, and decrease consumption of sugar sweetened beverages.[24-26] A number of researchers have examined these behaviors in young children.

II.C.1. Physical Activity and Inactivity

Dennison and colleagues found that children with a television in the bedroom were more likely to be overweight, and that the number of hours spent watching television was associated with risk of being overweight for young preschool-aged children.[27] Additionally,

Lumeng and colleagues found that exposure of two or more hours of television daily was positively associated with an increased risk of overweight at ages 36 and 54 months.[28] Trost et al examined physical activity levels of overweight and non-overweight children 3-5 years of age. He found that overweight boys were less active at preschool than boy who were not overweight, but the researchers found no significant differences in girls.[29] A South Carolina study of preschool age children found that girls were more likely to participate in sedentary activities than boys in open settings.[30] A study of urban African-American preschoolers found that income and status are variables directly linked to sedentary activity and poor nutrition in young children.[31]

Additionally, Burdette and Whitaker found that although age was an important factor in physical activity levels, play, which can involve any type of physical movement, is on the decline among children of all ages and may contribute to increases in sedentary activity and obesity.[32] Finn et al found that sex, history of preterm birth, and paternal BMI all influenced physical activity level of children 3-5 years attending child care.[33] Reilly et al found surprisingly low levels of physical activity in children 3-5 years.[34] These studies highlight the need to promote physical activity for preschool-aged children by identifying opportunities to increase active time and decrease inactivity in child care settings.

II.C.2. Dietary Intake

In addition to activity level, diet composition and quality plays a role in the development of childhood overweight. Researchers have examined dietary trends that parallel the increase in childhood overweight in an attempt to identify dietary factors related to overweight. Sturm reported that the intake of high sodium snacks (chips, crackers, popcorn, and pretzels)

has roughly tripled from the mid 1970s to the mid 1990s for both boys and girls six to eleven years old.[8] Other studies corroborate this increase in salty snacks over a similar time period.[35] This study also reports an increase in soft drink consumption between 70 and 83% from 1977 to 1996 for children 2-18 years.[35] In a more recent report, Nielsen and Popkin report that sweetened beverage consumption has increased in children 2-18 from 1977 to 2001; soft drink consumption increased from 3.0% to 6.9% of daily energy intake, while fruit juice consumption increased from 1.8% to 3.4% of daily energy intake.[36] High-fructose corn syrup has been identified by researchers as a potential contributor to the childhood overweight epidemic; the increase in consumption shows a pattern consistent with the rise in overweight and obesity.[37] Ludwig et al found that servings of sugar-sweetened beverages consumed was correlated with body mass index (BMI) after adjusting for anthropometic, demographic, dietary and lifestyle variables.[38] A recent paper by O'Connor and colleagues examined overall beverage intakes of a sample of US preschoolers and found that increased beverage consumption was related to increased caloric intake, but not associated with BMI.[39] While some researchers believe that many of these behaviors may be related to overweight, the exact causes are still unknown.

Many health professionals, however, believe that prevention efforts must target these individual diet and exercise behaviors at multiple levels of a child's ecological context to potentiate the maintenance of newly acquired habits.[26] Interventions that target children in child care may be an effective tool to help mitigate the problem since many children spend a great deal of time in this "home away from home" setting.

II.D. Addressing Childhood Overweight in Child Care Settings

Child care has recently been cited as an important area for promoting healthy weight in young children.[40] To date, only a small number of prevention interventions focusing on childhood overweight have specifically targeted children under the age of six,[41-43] even though preschool age children are more likely than school age children to alter lifestyle behaviors.[44] Furthermore, limited prevention research has been conducted in child care centers where many preschool children consume a significant portion of their daily calories.[45] Although physical activity at the child care center is less regulated than diet, it is affected by a center's policies and practices. Recent work by Pate and colleagues found that physical activity behaviors of young children varied based on the center attended.[30] These authors recruited 281 3-5 yr old children from nine child care centers to wear an activity monitor for an average of 6.6 days. In a recent publication, the American Heart Association suggests that multi-component preschool programs can be effective in promoting healthy behaviors and reducing heart disease risk.[46]

Healthy Start, a demonstration and education program designed to decrease cardiovascular risk, was conducted in nine Head Start Centers in New York State.[47, 48] The project included nutrition education as well as a food service intervention. After one year, the researchers found a significant decrease in saturated fat intake and a decrease in saturated fat content of menu items over two years of the intervention. Physical activity, however, was not addressed. Another preschool intervention focused on decreasing television viewing.[41] As part of a larger health promotion curriculum, program staff provided seven educational sessions that focused on reduced TV viewing and suggestions for alternative activities. TV/video viewing decreased significantly in the intervention group. These results are

promising, but information on efforts to change diet and physical activity behavior was not provided.

Hip Hop to Health, Jr. is a project that took place in 12 Chicago Head Start Centers from 1999-2002. The study evaluated an overweight prevention intervention in African American and Latino(a) preschool children.[49, 50] Researchers found that children that participated in the14 week weight control intervention had a lower increase in mean BMI at one year post-intervention follow-up than children that received the general health intervention.[50]

In June, 2005, the American Dietetic Association published a position statement on nutrition standards for child care. This article highlighted four main areas that describe quality nutrition practices in child care including *meal plans*, *food preparation and food service*, *physical and emotional environment*, and *nutrition consultation and training*.[51] These recommendations provide guidance for child care interventions that aim to address childhood overweight through diet and physical activity.

II.E. An Environmental Intervention to Address Childhood Overweight

In 2000, the North Carolina Healthy Weight Initiative was created through an obesity prevention grant to address childhood overweight by the Centers for Disease Control and Prevention. The Healthy Weight Initiative had three major components: 1) Planning for comprehensive nutrition and physical activity programs to prevent overweight and related chronic diseases in children and youth, 2) Implementation of a multi-level pilot intervention that targets preschool children and their families, and 3) Enhancement of a statewide nutrition and physical activity surveillance system.

Born out of the Healthy Weight initiative, the Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) program aims to improve nutrition and physical activity environmental policies and practices through self-assessment and targeted technical assistance in child care settings.

II.F. Using Self-Assessment to Intervene

The self-assessment approach has been used in a variety of research and practice settings.[52, 53] The School Health Index,[14] developed by the Centers for Disease Control and Prevention, is perhaps the most widely available self-assessment instrument in the United States and has been used by a number of researchers.[54-57] The School Health Index Self-Assessment and Planning Guide was created with assistance from school administrators and staff, health experts, and parents. The purpose of the instrument was to help schools examine their current policies and practices and develop an action plan to address areas of need.

Other environmental assessment instruments have taken a different approach. The University of North Carolina at Chapel Hill Frank Porter Graham Child Development Center created the Early Childhood Environmental Rating System (ECERS)[58] and Infant/Toddler Environmental Rating System (ITERS)[59] to assess the health environments of child care centers. These instruments have been incorporated into the North Carolina licensing system for child care centers and are administered by an outside evaluator (not a self-assessment). The ECERS and ITERS instruments, as well as the School Health Index were used as models for the NAP SACC self-assessment instrument.

In a recent publication, Pearlman and colleagues used the School Health Index as an intervention outcome for their study, although it has not been proven a valid or reliable measure. Self-assessment instruments that are used either as intervention tools, or as

outcome measures require the instrument to be of reasonable quality. Quality should be measured by assessing the reliability and validity of the instrument to determine its stability and accuracy.

II.G. A Train-the-Trainer Model for an Environmental Intervention

II.G.1. In-Person Training

The *train-the-trainer* model has been used in a number of previous studies.[60-62] Participants typically attend an in-person training or workshop and receive supplemental materials for post-training reference. The benefits cited for in-person training include direct interaction with other human beings, the ability to read body language and communicate non-verbally, the opportunities to ask questions and clarify information, and the synergistic effects of group discussion.[63] Herse and Lee report a high degree of student preference for in-person lectures (in a group optometry students in Australia).[64] They also suggest, however, that most people teach as they have been taught; perceived learning preferences and teaching modalities may shift as alternative training methods evolve.

II.G.2. Web-Based Training

An examination of the literature concerning the educational effectiveness of computer-based instruction identifies numerous benefits in using computers and the World Wide Web as a mechanism for intervention training and delivery. As computer and online access improves, the ability to receive training and educational material in a host of locations is now possible. Many organizations are looking to web-based training to lower costs and decrease

participant burden. Demonstrated effectiveness of web-based training compared to in-person training is often not considered.

A handful of research studies have examined web-based learning in a diversity of health fields including injury prevention, asthma education, medical student training, depression, nursing and nutrition education.[63-75] While the degree of efficacy varies among studies, web-based learning is typically associated with some degree of positive outcomes and seen as a pedagogical tool with promising potential. Web-training offers individuals the freedom to interface with lessons at their chosen pace. This ability to self-pace allows participants to access information at their convenience without requiring travel and provides a centralized resource to be consulted as needed. As a tool for professional development, on-line training has shown some efficacy at strengthening the knowledge and skills of public health workers, but few studies have used randomized, controlled trials to examine this effect.

An article reviewing health-related web-based learning literature, published in 2002 examined results from 35 evaluative studies and 41 descriptive studies.[76] Evaluative studies were those that used a control group or pre-test/post-test design, and compared media. Descriptive studies may have included an evaluation plan, but data were not reported in the article, or used learner attitudes and satisfaction or usability as the main outcome. Twenty studies assessed gains in knowledge through web-based learning and each employed a slightly different method of outcome assessment. Eighteen of the studies used a multiple choice questionnaire to compute change scores, one study used a multiple choice questionnaire plus an interview, and one used a case analysis.[76] Three studies compared web-based training to a more traditional training method with the same content and found little to no difference in knowledge among the two groups.[77-79] More recent studies,

however, have reported conflicting results in knowledge changes with web-based training. Maiburg et al reported a significant difference in post-test score nutrition knowledge in the web-based training of general practitioner trainees compared to a more traditional training method.[65] Solomon et al, 2004, however, reported no differences in digital lecture formats from traditional live lecture formats for medical students.[80]

Researchers have also found web-based education to be valuable as an adjunct component to traditional modes of teaching by reinforcing material from the classroom. Krishna et al found that supplementing an asthma education program with an interactive web tool enhanced the awareness of participants and resulted in fewer asthma symptoms in child subjects.[81] In addition to web-based learning studies, more and more interventions are including on-line components to their projects or are evaluating interventions conducted entirely on-line. To date, several web-based interventions have been employed in studies addressing weight loss, nutrition education, and smoking cessation.[82-84] Oenema found that a computer-tailored intervention was more successful at motivating intervention participants with the intention to make dietary change after receiving tailored dietary feedback compared to participants who received only general nutrition information.[83] In an Internet delivered weight loss program, Tate et al supplemented weight loss behavior therapy with weekly email lessons, online diaries, therapist feedback via email, and an online bulletin board.[84] This group showed a higher average weight loss at the end of the intervention compared with the group only receiving online weight loss resources. Overall, web-based training has demonstrated potential as an effective modality for delivery of training. In some cases, web-training may be more effective than traditional training methods.

II.H. Significance of this research project

A dramatic increase in the number of overweight children in the United States has gained the attention of researchers, health professionals and policy makers alike. Intervention efforts that focus on preventing childhood overweight have shown some success in school-age populations, but few studies have examined the effects of interventions that take place in child care centers. Some studies have demonstrated that altering the physical environment in schools and work sites can result in changes in health related behavior.[85] This project proposes a systematic comparison of web-based and in-person training of Child Care Health Consultants in intervention delivery and outcome as well as reliability and validity testing of the NAP SACC self-assessment instrument.

CHAPTER III

THEORETICAL FRAMEWORK

III.A. Nutrition and Physical Activity Intervention in Child Care Settings

Influencing nutrition and physical activity behaviors of children necessitates an intervention approach that considers individual behaviors as well as the environments in which behaviors take place. For example, physical activity is heavily affected by the social environment, where children can learn behaviors through observing the model of the teacher. Similarly, dietary choices are influenced by the physical environment through food provision and availability. This inherent relationship between environments and behaviors related to nutrition and physical activity, coupled with strong support from intervention research, demonstrate the utility of using Social Cognitive Theory[12] as a theoretical basis for a nutrition and physical activity environmental intervention. The Nutrition and Physical Activity Self-Assessment for Child Care program is a theory-based intervention that employs components of Social Cognitive Theory against a backdrop of the socio-ecological framework.[13]

The inherent relationship between environment and behavior has proven useful in intervention research. Social Cognitive Theory identifies several crucial factors that influence behavior change including expectancies, observational learning, self-efficacy, behavioral capability, environment, situation, reinforcement, and reciprocal determinism.[12]

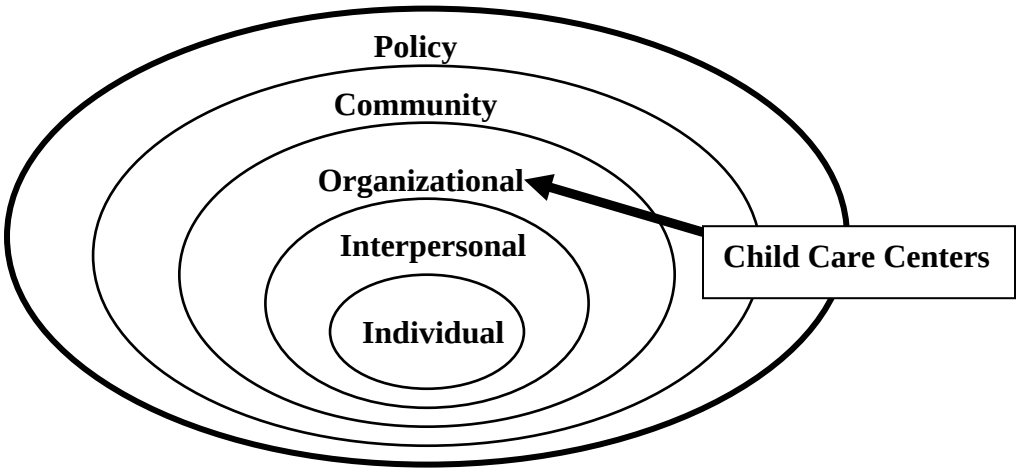
The NAP SACC intervention, delivered by local health professionals (NAP SACC Consultants) is designed to reflect key constructs of Social Cognitive Thoery.

Table 1 Key Constructs of Social Cognitive Theory: NAP SACC Intervention

Key Construct	NAP SACC Intervention Characteristic
Expectancies The value an individual places on the expected outcomes resulting from the behavior	Children involved in the NAP SACC program learn to value good nutrition and physical activity habits through various reinforcements from center staff.
Observational Learning Learning the behavior and its outcomes by watching others	Teachers model healthy nutrition and physical activity behaviors for children at meal times and during indoor and outdoor active play.
Self-efficacy Having confidence in performing the behavior and overcoming barriers	NAP SACC uses workshops and assistance from the NAP SACC Consultant to increase director and teacher confidence in overcoming barriers to improving center nutrition and physical activity environments.
Behavioral Capability Possessing the skills and knowledge necessary to perform the behavior	The NAP SACC workshops help to increase the skills and knowledge that center directors and staff need to improve center nutrition and physical activity environments.
Environment External factors, both physical and social, that could potentially impact behavior	NAP SACC is an environment-centered program that encourages increased availability of play equipment and recreational space to promote physical activity and healthy food to promote good nutrition.
Situation An individual's perception of the environment	NAP SACC helps to change how staff perceive the center environment (e.g., for active play by demonstrating how children can be active, even when the weather is not suitable for outdoor activity).
Reinforcement Responses to an individual's behavior that increases the likelihood that the individual will repeat the behavior	NAP SACC center staff are encouraged to give positive feedback (e.g., to children when children try new or less favorite foods).
Reciprocal Determinism The interplay between person, behavior and the environment	Behavioral changes in NAP SACC staff and children help to create a healthier center environment, while changing al changes in the environment help to shape healthy behaviors.

In addition to social cognitive theory, the NAP SACC program was informed by the socio-ecological framework. Social Cognitive Theory and the socio-ecological framework work together to describe the relationship between an individual and the environment. The socio-ecological framework highlights multiple levels of influence on health behaviors, including the intrapersonal, interpersonal, organizational, community, and policy levels. This research includes work within multiple levels of the framework including interpersonal (child-staff interactions), organizational (child care center environment and practices), and policy (state and child care center nutrition and physical activity policies). The NAP SACC self-assessment instrument targets the organizational level of the socio-ecological framework (Figure 1), and provides child care center staff the opportunity to assess how their own environments, including policies, influence the behaviors and health of the children in care.

Figure 1 Socio-Ecological Framework



III.B. Training of Community Health Professionals to Deliver an Overweight Prevention Intervention

Diffusion of Innovations (DI) is the process by which a new idea, practice or object is communicated through a variety of channels, including both formal and informal, for the purpose of adoption by new users.[12] The speed and extent to which an innovation can be disseminated depends on a number of factors including relative advantage, compatibility, trialability, observability, social relations, reversibility, communicability, time required, risk and uncertainty level, commitment required, modifiability, concordance with organizational mission, and complexity.[12] As indicated in Table 2, the overall NAP SACC project is designed to enhance diffusion by addressing many of these factors. Diffusion of Innovation can be applied to both training methods (web-based and in-person) and is a helpful tool when assessing their effectiveness.

Table 2 Key Determinants of Diffusion's Speed and Extent: NAP SACC Intervention

Key Determinant	NAP SACC Intervention Characteristic
Relative Advantage Innovation is better than what it will replace	The NAP SACC project is designed to replace any existing nutrition and physical activity environmental intervention (currently none available).
Compatibility Innovation should be appropriate for the abilities and settings of the new users	The NAP SACC project was designed to be delivered by a CCHC. The skills and experiences of NC CCHC were carefully considered when the project was developed. CCHC served on the advisory group that helped guide the development and implementation of the intervention.
Complexity Innovation should be as easy to use as possible	In order to deliver the NAP SACC intervention, CHP must undergo training. This training should be as straightforward and user-friendly as possible. Two distinct training methods will be evaluated in this dissertation for their clarity and ease of use.

Trialability Innovation can be subjected to trial	The NAP SACC intervention is currently being subjected to a large scale evaluation. In addition, the self-assessment instruments as well as two training methods to deliver the intervention will be assessed for this dissertation.
Observability Results should be observable and easily measurable	The large scale NAP SACC intervention will be tested using a researcher administered one-day environmental and policy assessment system (EPAO). The validity and reliability of the NAP SACC self-assessment instrument will be evaluated using the EPAO and repeat administration to center staff. The overall evaluation of the NAP SACC Consultant trainings includes a knowledge and skill assessment completed pre and post training.
Impact on Social Relations Innovation should not disrupt the user's social environment	The overall NAP SACC intervention is designed to fit within CHP duties and responsibilities and not disrupt their professional work. Since the web training can be conducted at the convenience of the CHP, it is less likely to disrupt the CHP social environment (less so that traveling to an in-person training). However, the in-person trainings will be held in two different geographic locations to decrease travel burden on CHP from outlying counties.
Reversibility Innovation should be easily discontinued	If the NAP SACC project is not proven effective, it can be revised or discontinued as appropriate.
Communicability Innovation should be understood clearly and easily	The overall NAP SACC project and companion materials were designed to be user-friendly and easily navigable. The trainings were designed to be engaging and easy to follow.
Time Required Innovation should be able to be adopted with minimal investment of time	In the pilot, CHP were ready to implement NAP SACC after 4 hours of in-person training. The web-based training will not include travel time to the in-person training site and will take approximately 2-3 hours to complete. Once trained, pilot project NAP SACC Consultants reported that the project takes approximately 5 hours a month to implement the project in one child care center. In addition, they reported that this time was not excessive.

Risk and Uncertainty Level Innovation should be able to be adopted with minimal risk and uncertainty	In order to deliver the NAP SACC project, CHP must undergo training. In this dissertation project, CHP received either in-person or web-based training. Although there has been some resistance to web-based training replacing in-person training, CHP have been exposed to state level CHP training materials on-line which should minimize uncertainty levels associated with web-based learning. CHP have expressed some hesitation in the confidence level (ability to deliver a nutrition and physical activity intervention), but both trainings were designed to build self-efficacy.
Commitment Required Innovation can be used effectively with modest commitment	Overall the NAP SACC project can be implemented with a minimal amount of time and effort. CHP from the pilot intervention report a time commitment of approximately 5 hours per month per center. Once training is complete, CHP are free to use the NAP SACC project at their convenience with other centers in their counties.
Modifiability Innovation can be updated and modified over time	The NAP SACC project can be easily and readily modified if needed at the end of the intervention.
Concordance with Organizational Mission Innovation fits with goals/objectives of organization	CHP are committed to improving the health of the children in child care. Implementing the NAP SACC project that promotes nutrition and physical activity for preschoolers is of great interest to CHP and is considered part of their job responsibilities.

At the organizational level (e.g. a workplace, school or child care setting), use of the innovation often requires the introduction of new programs or services, changes in policies or regulations, or changes in the roles and functions of particular personnel. NAP SACC introduces change in the method of training Community Health Professionals (CHP) to deliver the intervention as NAP SACC Consultants. Web-training may provide a more economical, convenient way to train CHP to implement the NAP SACC intervention

compared to the traditional in-person training method. Aim 2 of this proposal evaluates the effectiveness of both trainings.

CHAPTER IV

An intervention to promote healthy weight in child care: Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC)[1]

Aim 1 – To test a pilot nutrition and physical activity intervention in child care centers using a self-assessment instrument and technical assistance from a community health professional.

IV.A. Abstract

Objective: To determine the feasibility, acceptability, and reported impact of a nutrition and physical activity environmental intervention in child care.

Design: Self-assessment instrument completed pre-and post-intervention by randomly assigned intervention and comparison child care centers.

Setting: Child care centers in 8 counties across North Carolina.

Participants: A convenience sample of 19 child care centers (15 intervention and 4 comparison centers).

Intervention: Intervention centers completed the self-assessment instrument at baseline and then selected 3 environmental improvements to make over the 6-mo. intervention period with assistance from a trained NAP SACC Consultant.

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[1] Benjamin S, Ammerman A, Sommers J, Dodds J, Neelon B, and Ward D. Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC): Results from a Pilot Intervention. Journal of Nutrition Education and Behavior.(in press)

Main Outcome Measure: Changes in pre-post-intervention self-assessment of the nutrition and physical activity child care environment with additional process measures to evaluate project implementation, feasibility and acceptability.

Analysis: Comparison of pre- and post-test scores for the intervention group using a Wilcoxon signed-rank test and descriptions of environmental changes.

Results: Intervention centers rated themselves higher at follow-up than at baseline, and relative to comparison centers, reported a variety of environmental nutrition and physical activity improvements confirmed by research staff.

Conclusions and Implications: The NAP SACC pilot intervention shows promise as an approach to promote healthy weight environments in preschool settings. Additional evaluation of the project is needed using a greater number of centers and a more objective outcome measure.

IV.B. Introduction

The prevalence of overweight among young children has risen at a steady and disconcerting pace, creating a serious public health concern.[2, 86] Data from the 2003-2004 NHANES reported 26.2% of 2-5 year olds were considered at overweight or at risk for overweight.[1] Even in childhood, overweight is associated with a myriad of deleterious health consequences that can include Type II diabetes mellitus [4, 6], hypertension and hyperlipidemia [4, 5], early maturation, orthopedic problems, sleep apnea [19], and psychosocial stress.[3] Overweight in youth tends to track into adulthood, causing overweight children to become overweight or obese adults.[7] It is evident that overweight is a problem among preschool age children and intervention efforts are needed to mitigate this trend.

The association between nutrition, physical activity, and healthy weight among young children is well documented, although exact causes of childhood overweight are not known. Low levels of physical activity have been observed in children 3-5 years, and sedentary activity (measured by TV time) and having a TV in the bedroom have been associated with risk of overweight. [27, 29] Consumption of sugar sweetened beverages and high fructose corn syrup [35, 36] may be contributors to the childhood overweight epidemic as the increase in consumption shows a pattern consistent with the rise in overweight and obesity.[37, 38, 87] In addition, maternal employment may increase the probability of a child being overweight.[88]

A greater proportion of children are now spending time in child care and duration of time in care has increased as well. [8] Environmental influences are thought to be contributors to the recent increase in childhood overweight [20] and only a handful of studies have examined this issue at child care. Healthy Start, a program designed to decrease cardiovascular risk in Head Start children produced a significant decrease in the saturated fat content of menu items as well as a decreased intake of saturated fat.[43, 47] Another preschool intervention, focused on decreasing television viewing, found that educational sessions significantly reduced TV/video viewing in the intervention group. [41] Hip Hop to Health, Jr. evaluated an overweight prevention program in African American and Latino(a) children in Chicago Head Start centers [49] and found that 1 year post-intervention, participants in the14-wk weight control intervention had a lower increase in mean Body Mass Index (BMI) than children who received the general health intervention. [50] This intervention, however, focused on delivery of a curriculum and was not an environmental intervention.

While these studies provide guidance for future interventions, they also highlight the need to examine environmental influences on child weight. Child care has recently been cited as

an important site for promoting healthy weight in children. The American Heart Association suggests that multi-component preschool programs can be effective in promoting healthy behaviors and reducing heart disease risk. [46] In addition, the American Dietetic Association's recent position statement on nutrition standards for child care highlights four main areas of quality nutrition practices in child care including meal plans, food preparation and food service, physical and emotional environment, and nutrition consultation and training. [89] Child care centers are in a unique position to support and facilitate healthy eating and regular physical activity for young children and, as such, provide an opportunity for intervention.

In this paper we present initial findings from a promising intervention, Nutrition and Physical Activity Self Assessment for Child Care (NAP SACC). The NAP SACC pilot study was designed to test the feasibility, acceptability and self-reported environmental change of an intervention to improve the nutrition and physical activity environments in child care settings.

IV.C. Methods

The NAP SACC Program

The goals of the NAP SACC program were to improve nutrition and physical activity policies and practices at the child care center, and to enhance the overall center environment. The NAP SACC program was designed to allow child care centers to self-assess their nutrition and physical activity environments, select areas for improvement, and make environmental changes with the help of a local health consultant.

NAP SACC is a theory-based program that employs components of Social Cognitive Theory (SCT) [12] against a backdrop of the socio-ecological framework. [13] The inherent

relationship between environment and behavior has proven useful in intervention research. SCT identifies several factors that influence behavior change including expectancies, observational learning, self-efficacy, behavioral capability, reinforcement, and reciprocal determinism, which were all principles used to guide the NAP SACC intervention. The NAP SACC program focused on 15 key nutrition and physical activity areas on the self-assessment instrument and corresponding technical assistance materials. These areas were chosen and all materials developed based on current scientific literature as well as national recommendations and standards. Development, rationale, and funding of the NAP SACC intervention and self-assessment instrument is described elsewhere (A.S. Ammerman, unpublished data, 2002). Key NAP SACC nutrition areas of focus included: Fruits and Vegetables; Fried Foods and High Fat Meats; Beverages; Menus and Variety; Meals and Snacks; Foods Outside of Regular Meals and Snacks; Supporting Healthy Eating; Nutrition Education for Children, Parents and Staff; and Nutrition Policy. Key NAP SACC physical activity areas of focus included: Active Play and Inactive Time; TV Use and TV Viewing; Play Environment; Supporting Physical Activity; Physical Activity Education for Children, Parents, and Staff; and Physical Activity Policy.

Participant Recruitment

NAP SACC Consultant Recruitment. The pilot intervention was built on an existing infrastructure of trained Child Care Health Consultants (CCHC), local health professionals employed by county level agencies (typically Registered Nurses) that exist in many states across the country. Although other health professionals could deliver the intervention, CCHC were used as NAP SACC Consultants for this pilot intervention. The pilot intervention was

implemented in a convenience sample of 6 intervention and 2 comparison North Carolina counties matched on urban/rural status that were randomly allocated into either the intervention or comparison group. The counties chosen were the eight counties that had a previously established relationship with the NC Department of Health and Human Services from a former project. The CCHC from these counties (n=10) all agreed to participate in the project. These CCHC attended a one day training on nutrition, physical activity and overweight in young children to help prepare them to deliver the intervention as NAP SACC Consultants. They were also given a NAP SACC Tool Kit at the intervention training, which included the self-assessment instrument, a resource notebook with information on each of the fifteen nutrition and physical activity areas on the self-assessment instrument, a packet of handouts for center staff, three workshops to be delivered to child care providers on CD with handouts, and a brochure for parents and caregivers.

Center Recruitment. NC's child care regulatory agency, the Division of Child Development, provided a list of eligible child care centers for each intervention and comparison county. Two centers were selected per county with the exception of one large county that was given permission to have five centers participate. Inclusion criteria for the pilot intervention included size of the child care center (between 20-150 children); participation in the Child and Adult Care Food Program (CACFP); and a rating of three, four or five stars on the North Carolina 1-5 Star Rating System for quality child care (http://ncchildcare.dhhs.state.nc.us/general/home.asp). Centers were excluded from participation if they had an open case of child abuse or neglect, provided services to a special population of children only, were a Head Start center, or were classified as a family child

care home. Although Head Start centers and family child care homes are appropriate sites for the NAP SACC intervention, for the purposes of this pilot intervention, we wanted a more homogenous sample of child care centers.

Letters of invitation for participation in the intervention were mailed to all eligible child care centers in the intervention and comparison counties. Thirty intervention (43% acceptance rate) and five comparison centers (50% acceptance rate) volunteered to participate. Centers were enrolled on a first-come basis, but enrollment was limited to 2 centers per county due to time constraints identified by the NAP SACC Consultants (excluding the previously noted exception). Both intervention and control centers received the self-assessment instrument in the mail and returned it, completed, to study coordinators within 2 weeks. The comparison centers did not receive any training or technical assistance from a NAP SACC Consultant but completed only the pre- and post-self-assessment instrument.

All procedures were approved by the University of North Carolina--Chapel Hill Biomedical Institutional Review Board, and all participants gave informed consent to participate in the study.

Implementation Activities

Self-Assessment. The self-assessment instrument included 29 nutrition and 15 physical activity questions that had either a demonstrated or perceived relationship to childhood overweight. Each question had three response categories, assigned 1, 2, or 3 points (1=minimum standard, 2=good, 3=best practice) (Table 3). The range of total score for the instrument was 44 to 132 points, with a nutrition score range of 29 to 87 points and a

physical activity score range of 15 to 45 points. Child care center directors, with assistance from key center staff, completed the self-assessment instrument to identify current center nutrition and physical activity policies and practices. Self-assessment instruments were scored by research staff, and an overall score, a nutrition score, and a physical activity score was assigned to each center at baseline and again at follow-up. These scores were not shared with centers but rather used for program evaluation purposes.

Development of the Action Plan. The NAP SACC Consultant worked with the centers to develop an action plan to improve at least three areas from the self-assessment instrument. Child care center directors were asked to select their priority areas for improvement in order to facilitate the most fitting and lasting environmental changes at the center, therefore, areas selected were not necessarily those that received the lowest score on the self-assessment instrument. Center directors were free to choose any area for improvement that they felt willing and able to address.

Delivery of the Workshops and Provision of Technical Assistance. The trained NAP SACC Consultant delivered three 30 minute workshops to center directors and interested providers in the child care centers on: Childhood Overweight, Healthy Eating, and Physical Activity. Center staff that attended these workshops received continuing education credits from the NC licensing agency for child care. On-going technical assistance (visits and calls) was provided by the NAP SACC Consultant to the center directors to support center policy and practice changes. At the end of the six-month intervention, center directors once again

completed the self-assessment instrument to identify current center nutrition and physical activity policies and practices.

Table 3 NAP SACC Self-Assessment Instrument Sample Questions

Question	1 point response	2 point response	3 point response*
Milk served to children ages 2 and older is usually:	Whole	2% reduced fat	1% low-fat or skim
Active play time is provided to all children:	30 minutes or less each day	31-60 minutes each day	More than 60 minutes each day

*A 4 point response category was later added based on feedback from expert reviewers

Evaluation

To assess the effectiveness of the pilot intervention at improving child care center nutrition and physical activity environments, the NAP SACC team developed an evaluation plan that included outcome and process (quantitative and qualitative) measures (Table 4). For this pilot, results from the self-assessment instrument were used as the main intervention outcome measure.

By the end of the pilot, 2 intervention centers had withdrawn because their directors had left their position with the center, while a third center chose to complete all aspects of the intervention except for the workshops. A total of 16 of the original 19 centers completed all aspects the project (16% attrition rate). However, self-assessment and other data are available for 17 centers, including the center that did not complete the workshops. At the end of the intervention, center directors from intervention and comparison centers completed telephone interviews. Four months post intervention, 6 intervention centers were randomly selected for site visits by research assistants to provide further documentation of center enhancements. Research assistants collected copies of menus, policies, and lesson plans, took photographs, and interviewed 3 staff members at each child care center in order to document center

environmental improvements. In addition, one month post-intervention, a focus group with NAP SACC Consultants was conducted to provide feedback to the research team on the overall project.

Although this pilot study had a small sample size, results of the self-assessment instrument completed pre- and post-intervention were examined as indicative of program impact. Differences in pre- and post-test scores for the intervention group were compared using a signed-rank test. Given the small sample size (n=4) in the comparison group, no formal statistical analysis was performed for this group or between groups; however, results from the comparison centers are presented for exploratory purposes.

Table 4 NAP SACC Intervention Evaluation Overview

Instrument	**Purpose of Measure**	**Point in Project**	**Method**	*Completed By*
NAP SACC Self-Assessment I	Measure of nutrition and physical activity policies and practices	Prior to onset of intervention	Mailed to centers	Center director (13 intervention and 4 control centers)
Workshop Evaluation	Evaluation of the workshops delivered by the CCHC	Post workshop (usually month 3 of intervention)	Mailed to centers	Center director (12 intervention centers)
NAP SACC Self-Assessment II	Measure of nutrition and physical activity policies and practices	Immediately following intervention	Mailed to centers	Center director (13 intervention and 4 control centers)
Intervention Evaluation-Centers	Evaluation of the overall NAP SACC program	1 Month post-intervention	Telephone interview	Center directors (13 intervention and 4 control centers)
Intervention Evaluation-CCHC	Evaluation of the overall NAP SACC program	1 Month post-intervention	Focus group	CCHC (all 10)
Site Visit	Documentation of improvements	4 Month post-intervention	In-person visit	Sample of 6 intervention centers

IV.D. Results

Self-Assessment Results

Overall, the intervention group (n=13) increased an average of 12.84 points while the comparison group (n=4) increased an average of 7.75 points on the pre- to post-self-assessment instrument (Table 5). The intervention group median for total self-assessment score was 106, which improved to 118 after the intervention period (p=.0005). The intervention group median baseline nutrition score was 68, which improved to 78 after the intervention period (p=.0017). The intervention group mean baseline physical activity score was 33, which improved to 40 after the intervention period (p=.0002).

Table 5 Child Care Center Scores on the NAP SACC Self-Assessment Instrument

Intervention Centers	**Baseline Nutrition Score**	**Baseline Physical Activity Score**	**Baseline Total Score**	**Follow-up Nutrition Score**	**Follow-up Physical Activity Score**	**Follow-up Total Score**	*Difference Total Score*
Center 1	68	38	106	76	40	116	10
Center 2	68	33	101	78	40	118	17
Center 3	70	33	103	79	43	122	19
Center 4	70	35	105	78	40	118	13
Center 5	70	38	109	82	45	127	18
Center 6	78	34	112	77	45	122	10
Center 7	68	32	100	76	35	111	11
Center 8	62	30	93	73	44	117	24
Center 9	68	38	106	77	40	117	11
Center 10	74	33	107	79	36	115	8
Center 11	80	33	113	82	39	121	8
Center 12*	68	39	107	64	41	105	-2
Center 13	67	29	107	82	45	127	20
Mean (SD)	**70.08 (4.77)**	**34.23 (3.19)**	**105.31 (5.25)**	**77.15 (4.76)**	**41.00 (3.29)**	**118.15 (6.03)**	**12.85**
Median	**68**	**33**	**106**	**78**	**40**	**118**	**11**
Comparison Centers	**Baseline Nutrition Score**	**Baseline Physical Activity Score**	**Baseline Total Score**	**Follow-up Nutrition Score**	**Follow-up Physical Activity Score**	**Follow-up Total Score**	**Difference Total Score**
Center 1	67	31	103	76	43	119	16
Center 2	75	36	111	77	40	117	6

Center 3	71	40	111	71	39	110	-1
Center 4	68	40	109	77	42	119	10
Mean (SD)	**70.25 (3.59)**	**36.75 (4.27)**	**108.50 (3.79)**	**75.25 (2.87)**	**41.00 (1.83)**	**116.25 (4.27)**	**7.75**
Median	**69.5**	**38**	**110**	**76.5**	**41**	**118**	**8**

*****Completed all aspects of the intervention except the workshops
SD=standard deviation

Feasibility and Acceptability

Feedback from the NAP SACC Consultants. Data from the questionnaires and focus group indicated that the NAP SACC Consultants (n=10) felt the self-assessment tool was comprehensive (80% agree; 10% somewhat agree; 10% somewhat disagree) and somewhat easy to understand (40% agree; 50% somewhat agree; 10% somewhat disagree), meetings with center directors were productive (70% agree; 20% somewhat agree; 10% neutral), and they felt confident in their ability to deliver the NAP SACC program (60% agree; 40% somewhat agree).

Feedback from the Child Care Centers. Directors reported that the self-assessment instrument was either fairly easy to use (36%) or very easy to use (64%) and took an average of 26 minutes to complete (range 12-180 minutes; SD=10.34), which they all felt was an appropriate amount of time. One center was not able to report the number of minutes but estimated that it took her approximately 3 hours to complete the instrument due to frequent interruptions. In addition, directors stated that the instrument was either a very helpful (83%) or somewhat helpful (17%) measure of their nutrition environments and either a very helpful (50%) or somewhat helpful (50%) measure of their physical activity environments. Directors also reported that the workshops delivered by the NAP SACC Consultants were clear and relevant (92% agree), and that the workshops provided useful information on childhood

overweight, nutrition and physical activity (88% agree). Additionally, 12 directors reported that they would recommend the NAP SACC program to other centers, while one center believed it would depend on the characteristics of the center. Four months post intervention, 6 intervention centers were randomly selected for site visits by the research team to provide further documentation of center-level environmental change. Digital cameras were used to photograph environmental improvements and copies of menus, policies, and lesson plans were collected to document policy changes. All 6 centers visited provided visual documentation of their reported nutrition and physical activity improvements (Table 6). One center was not able to provide documentation for one of their four changes, although the director stated that improvements in this area had been made (Table 4).

Table 6 NAP SACC Intervention and Comparison Center Reported Improvements

Intervention	Reported Improvements
Center 1*	1. Changed to 1% milk for children over 2‡ 2. Decreased fried foods on menu‡
Center 2	1. Switched to 2% milk for children over 2 2. Reduced sugary and salty snacks 3. Began serving more fresh vegetables and fruits 4. Reduced amount of pre-fried meats served to once a week 5. Planned a physical activity training session for staff
Center 3	1. Added more fruits and vegetables to menu 2. Switched to 2% milk for children over 2 3. Added more nutrition information to parent newsletter 4. Added a hop-a-thon and a truck-a-thon
Center 4	1. Enforced policy-parents bring in healthy treats for celebrations 2. Served more fruit and less juice 3. Wrote center nutrition policy 4. Increased physical activity time
Center 5	1. Reduced amount of french fries and mashed potatoes served 2. Added more fruits and vegetables to menu 3. Increased amount of daily physical activity in lesson plans 4. Increased time spent outside
Center 6	1. Switched to 1% milk for children over 2 2. Staff learned indoor activities to keep children active
Center 7*	1. Switched to 2% milk for children over 2‡ 2. Decreased fried foods on menu‡
Center 8*	1. Switched to skim milk for children over 2‡

	2. Converted an empty classroom to a physical activity room‡ 3. Bought bikes, trikes, tumbling mats, and small indoor slides‡
Center 9	1. Switched to skim milk for children over 2 2. Reduced amount of fat and sugar served 3. Brought in teacher to demonstrate exercises to children and staff
Center 10*	1. Switched to 1% milk for children over 2‡ 2. Moved vending machine from lobby to back teacher break room‡
Center 11*	1. Switched to 1% milk for children over 2‡
Center 12†	None
Center 13*	1. Switched to family style service of meals‡ 2. Reduced amount of sugar and sweet products served 3. Served more 1% milk to children over 2‡ 4. Added more planned group activity to lesson plans‡
Comparison	**Reported Improvements**
Center 1	1. Improved variety of healthy foods on menu 2. Increased outdoor time for children 3. Added more structured group activities outside
Center 2	1. Decreased fried foods on menu 2. Increased educational opportunities for staff 3. Planned educational opportunity for parents
Center 3	None
Center 4	1. Decreased fried foods on menu 2. Wrote center physical activity policy

* Received center site visit post-intervention
†Completed all aspects of the intervention except the workshops
‡Improvement documented during center site visit

Changes in Policy and Practice

Centers made a number of improvements to their nutrition and physical activity environments as reported by center directors during post-intervention telephone interviews (Table 6). The most common environmental change was switching from whole to reduced-fat milk for children over two.

IV.E. Discussion

Although the prevalence of overweight is rising in preschool age children, few interventions exist that currently address this important issue. The NAP SACC intervention

was designed to improve the nutrition and physical activity environment through enhanced policies and practices at the child care center. Results of this pilot study suggest that the intervention centers improved their score on the self-assessment instrument, and made tangible nutrition and physical activity environmental improvements, while comparison centers demonstrated minimal change. The one intervention center that had a decrease in pre- to post-score on the self-assessment instrument (-2 points) was not able to complete the workshops, which may have impacted their overall commitment and performance in the NAP SACC program. Given the small sample size for the comparison group, we could not conclude that their increase in total score on the self-assessment instrument was or was not statistically significant. One comparison center was extremely motivated at the onset of the intervention and reported a number of nutrition and physical activity improvements to their center during a follow-up telephone interview. Their 16-point baseline to follow-up increase on the self-assessment score appeared to be a result of these improvements. Additionally, the majority of Child Care Health Consultants reported that the self-assessment instrument was only somewhat easy to understand. Thus, revisions to this instrument are warranted. The ability of the self-assessment instrument to act as a "minimal intervention" is being examined in the current NAP SACC evaluation project. These results suggest that the NAP SACC program has potential as a unique and feasible approach to address environmental factors that could influence child weight.

Few preschool interventions have addressed nutrition and physical activity, and of those that have the interventions were implemented by the research staff and not by existing and relevant community professionals. [41, 50] NAP SACC represents a novel approach to

overweight intervention; such an approach has excellent potential for creating supportive environments for developing child healthy weight behaviors.

Although the pilot project was well received by both the child care centers and the NAP SACC Consultants, the primary outcomes of the pilot were based heavily on self-report and results should be interpreted with caution. In addition, the small sample size of intervention and especially comparison centers limits our ability to draw major conclusions from the study. Moreover, for this pilot project, the child care center was the unit of analysis, and outcome measures were not assessed at the child level. Future studies may include child level outcome data such as dietary intake and physical activity level and duration. Despite these limitations, this pilot project demonstrates the need for additional research in this area and helps to establish child care centers as an appropriate setting for healthy weight interventions for children.

Implications for Research and Practice

Child care centers provide a unique opportunity for interventions to address and promote healthy weight in children, but environmental intervention efforts that target both nutrition and physical activity policies and practices are needed to support individual level change. The NAP SACC program shows promise as a unique approach to address this issue and makes a valuable contribution to the growing body of literature on child healthy weight environments.

Ongoing NAP SACC research efforts include a more comprehensive and objective evaluation of the intervention using a researcher-administered environmental assessment system, as well as a measure of child behaviors through direct observation of child dietary

intake and physical activity. Additional work will test the reliability and validity of the NAP SACC self-assessment instrument in a sample of child care centers. Future research for NAP SACC includes a more intensive delivery of the intervention with an assessment of children's body mass index (BMI) as the main outcome of the study and a focus on parents and the home environment. In addition, nine additional states are currently using the NAP SACC program to help address childhood overweight, which demonstrates a need for environmental interventions of this nature. These studies and ongoing initiatives will help determine the extent to which NAP SACC can be recommended for widespread use.

CHAPTER V

Training community health professionals to address childhood overweight[2]

Aim 2 – To evaluate two training methods (web-based compared to in-person training) in preparing community health professionals to deliver the NAP SACC intervention.

Hypothesis 2A – Web-based and in-person training of child health professionals will yield similar results on knowledge and skill tests as determined by the following:

a) Achievement of a correct score of 75% or greater on the post-training knowledge of childhood overweight, nutrition, and physical activity and skill test.
b) No significant differences in test results will be observed between web-based and in-person trained community health professionals.

V.A. Abstract

Background: Child care centers are appropriate targets for overweight prevention efforts directed at young children. Community health professionals who provide consultation to these centers, however, receive little training on the basic nutrition and physical activity principles important for the development of healthful lifestyles. In-person approaches are

[2] Benjamin S, Tate D, Bangdiwala S, Neelon B, Ammerman A, Dodds J, and Ward D. Web training of health professionals: A randomized controlled trial to address childhood overweight. (submitted manuscript)

commonly used for training but are limited in their ability to disseminate health information to a geographically diverse population of health professionals. Web-based training may offer a more efficient alternative to in-person training.

Design: Randomized controlled trial conducted between August 2005 and June 2006.

Participants: 50 community health professionals who provide consultation to child care centers.

Intervention: Web-based and in-person training on nutrition and physical activity to address childhood overweight in child care settings.

Main Outcome Measure: Knowledge of nutrition information related to childhood overweight measured by a 28-item multiple choice test administered pre- and post-training.

Results: Results from the ANCOVA model suggest that web trained participants performed similarly to participants from the in-person trained group on the knowledge test ($p<.0001$). Additionally, both training groups improved significantly compared to controls ($p<.0001$ for each group).

Conclusions: This study found no significant differences in post-training knowledge between in-person and web trained community health professionals. Scores on the post-training knowledge test were within 0.5 points for the in-person and web trained groups. These results demonstrate that web-based instruction is as effective as in-person training on improving basic nutrition and physical activity knowledge for promoting healthy weight in preschool children.

V.B. Introduction

A variety of health professionals are being asked to take a more active role in the prevention of childhood overweight. This task requires basic training in nutrition and physical activity to fully understand the etiology of the condition, and the behaviors that influence child weight status. Until recently, in-person training has typically been used to communicate health information to trainees. The benefits of in-person training include the ability to read body language, the opportunity to ask questions and clarify information, and the synergistic effect of group discussion.[1] Though often preferred[2] and generally effective,[3-5] in-person training can be expensive and inefficient. Many state and local health organizations are therefore looking to web-based training to lower costs and decrease trainee burden.

Prevalence and widespread use of the internet have changed the way we communicate health information,[6, 7] and health professionals report high rates of internet use.[8-10] The usefulness of web-based instruction has been reasonably established in a diverse array of health fields, including injury prevention, depression, nursing, and nutrition education.[1, 2, 11-26] However, few studies have compared web to in-person training using randomized, controlled trials.

This paper reports results from a study that compared nutrition and physical activity knowledge and consultation skill among web and in-person trained community health professionals (CHP). Training in nutrition and physical activity was designed to prepare CHP to deliver a child care-based intervention to promote healthy weight in children.

V.C. Methods

Nutrition and Physical Activity Training

The training was originally developed for the Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) pilot intervention.[27] NAP SACC is an environmental intervention designed to improve policies and practices in child care that promote healthy weight in children. Trained Child Care Health Consultants (CCHC) provided technical assistance and support for environmental improvements at the child care centers. Employed in a number of states, CCHC are typically Registered Nurses who provide health consultation to child care facilities.[28-31] The training provided information on nutrition and physical activity factors that had a demonstrated relationship to childhood overweight. The 6-month NAP SACC intervention was pilot tested in 2002 using a sample of 10 CHP from across North Carolina. At the end of the pilot study, CHP reported that the initial 5 hour in-person training was the most burdensome aspect of the project; web training was proposed to address this barrier.

Development of Trainings

Development of the In-Person Training

The CHP training from the NAP SACC intervention was modified in a number of ways for use in this project. Nutrition and physical activity recommendations for children were updated, a nutrition and physical activity for adults section was added, and a number of the small group activities were removed. The overall training was decreased from 5 to 3 hours in length.

The in-person and web-based trainings were designed to be similar in both content and structure in order to test differences in training modality, while holding other factors constant. Each training included the following four modules: 1. Intervention Overview; 2. Introduction to Childhood Overweight; 3. Nutrition and Physical Activity for Children and Adults; and 4. Providing Consultation to Child Care Centers (Table 7). The fourth module, Providing Consultation to Child Care Centers, presented CHP with challenging scenarios they might encounter at a child care center followed by a series of behavior-related questions. These scenarios attempted to model the skill of providing consultation.

Table 7 Content of the Web and In-Person Trainings

Module 1: Intervention overview

Why we are concerned about childhood overweight

Why intervention is needed

Key nutrition and physical activity areas for intervention

Module 2: Introduction to childhood overweight

National and state childhood overweight trends and statistics

Gender, race and ethnicity differences in childhood overweight

Health risks associated with childhood overweight

Calories consumed vs. calories expended (energy balance)

Factors associated with overweight that are modifiable

What health professionals can do to address childhood overweight

Module 3: Nutrition and physical activity for children and adults

Health benefits of fruits and vegetables

Limiting intake of fruit juice

Limiting sugar sweetened beverages

Promoting low-fat milk for children over 2 years

Limiting fried foods and high fat meats

Healthy meals and snacks

Developing and enhancing a cycle menu

Serving a variety of foods to preschoolers

Supporting healthy eating through adult role modeling

Adult dietary recommendations

Limiting television, video game play, and computer use (sedentary time)

Promoting active play inside and outside

Offering a variety of fixed and portable play equipment to facilitate active play

Promoting physical activity for children with special needs

Supporting physical activity through adult role modeling

Adult physical activity recommendations

Defining "moderate" physical activity

Reducing barriers to being physically active

Module 4: Providing consultation to child care centers

4 consultation scenarios were presented followed by a series of 1-4 related questions

Development of the Web Training

The web training included interactive features that would mimic components of the in-person training. Photographs of adults and children in child care settings were added throughout the training and interactive quizzes followed the first 3 modules. The fourth

module consisted entirely of interactive multiple choice questions where participants were asked to respond to scenarios they might encounter while providing consultation to child care centers. If participants selected the "best" response, they were praised and the skill was reinforced. If participants selected the less ideal response, the rationale for the best response and a model script were provided.

Outcome Measures

Development of the Knowledge and Skill Tests

The knowledge test was designed to test mastery of a select number of key issues from the training material. It was comprised of 28 multiple choice questions (childhood overweight=4; nutrition for children=10; physical activity for children=8; and nutrition and physical activity for adults=6) with 2 to 5 possible response options. The skill test consisted of 13 multiple choice questions, each with 4 possible response options. The skill test was designed to assess the abilities of the CHP to respond to challenging scenarios they might encounter at a child care center. The knowledge and skill tests were pilot tested with a group of 5 health professionals. Four knowledge and 2 skill test questions were revised based on their feedback. Sample questions from both tests can be found in Table 8.

Table 8 Knowledge and Skill Tests Sample Questions

Test	Question	Response Options
Knowledge	What is the best definition for the term "nutrient dense"?	A. Foods that contain at least 15% of the RDA for a vitamin or mineral. B. Foods that contain a high ratio of calories to nutrients. C. Foods that contain less than 30% of calories from fat. D. Foods that contain a high ratio of nutrients to calories.

Knowledge	What is the recommended amount of daily unstructured physical activity for toddlers?	A. 30 minutes B. 45 minutes C. 60 minutes D. 90 minutes E. 120 minutes
Skill	A child care provider is having trouble adding new foods to her menus. She says she adds several new foods in one meal to offer variety, but the children won't touch the different foods. What do you suggest?	A. Brainstorm with the center director on ways to make new foods fun and tell her she might want to offer one new food at a time instead of several at once (and it still may take up to ten times before they will try it). B. Tell her that she should continue what she is doing, especially since children may need to see a food ten times before they will try it. C. Explain that it is better for her to offer the children their favorites so they will eat enough calories, and suggest they choose other areas for improvement. D. Suggest that she punish the children for not trying the new foods by withholding outside playtime.
Skill	You get a lot of questions about very low carbohydrate diets from child care center staff members. Several of the teachers have lost weight on the diet and act offended when you say fad diets are not healthy. How do you respond?	A. Congratulate the staff members on losing weight and tell them to keep it up. B. Explain why very low carbohydrate diets are harmful and recommend that they switch to a healthier diet. C. Ask the staff if they see any problems with the diet and discuss the pros and cons of a more moderate diet and quality of carbohydrates. D. Tell the staff that they will regain the weight as soon as they go off the diet because weight loss due to carbohydrates is often only water weight.

Pre-Testing of Trainings and Outcome Measures

Both trainings were pilot tested in two distinct groups to assess impact on knowledge and skill scores. The in-person training was tested in a group of 10 health professionals, with pre- and post-training knowledge and skill tests administered. The group mean for pre-test knowledge score (SD) was 76% (11.26) correct, which improved to 90% (7.69) correct after

training (p=.0009). The group mean for pre-test skill score (SD) was 90% (6.07) correct, which remained at 90% (3.52) correct after the training.

The web training was pilot tested in a group of 10 senior nursing students from a local university. Participants completed electronic knowledge and skill tests prior to and immediately following the web training. Access to the web training was disabled and participants were asked to refrain from consulting other sources while completing the tests. The group mean for pre-test knowledge score (SD) was 73% (6.74) correct, which improved to 88% (5.36) correct after the training (p=.0004). The group mean for pre-test skill score (SD) was 89% (8.70) correct, which improved to 90% (6.67) correct after the training.

In order to improve implementation and acceptability of both trainings, a number of modifications were made at the end of the pilot testing period. Two group activities were eliminated from the in-person training to keep the training to 3 hours duration. The web training was modified to allow for greater flexibility in movement between modules and a log out feature was added. Some nutrition and physical activity information that was not presented clearly was modified for both final trainings. Additionally, given that both groups performed well on the pilot skill tests, 7 of the 13 questions were revised to increase discriminative power.

Randomized Trial

Study Design

This three-group randomized controlled trial used a pre-test/post-test design to train CHP on basic nutrition and physical activity principles to address childhood overweight. CHP were randomly assigned to either the in-person training (n=16), web training (n=17), or

control (n=17) group. Nutrition and physical activity knowledge and skill were assessed before and after the training using the 28-item knowledge and 13-item skill tests.

The null hypothesis for this study was that in-person trained CHP would perform more than 5 points better than web trained CHP on the knowledge test, and that both groups would perform significantly better than controls. A 5 point between group difference estimate was used because it was assumed that traditional in-person training would be the superior method, but that web training would not yield drastically lower results. The alternative hypothesis was that the in-person trained CHP and the web trained CHP would perform similarly, showing no significant differences in knowledge test outcomes between the two groups. Sample sizes for each group were calculated to have over 90% power to reject this hypothesis, using the expected change and standard deviation found in the pre-testing samples.

Subjects

CCHC were targeted for participation in this project because they are an established group of health professionals located in counties across North Carolina. In August 2005, All CCHC in North Carolina received a letter of invitation to participate in the research study from the state agency responsible for their training and support, and potential participants were asked to call the study coordinator if they were interested in obtaining more information about the project. Thirty-eight participants were recruited through this method, while word-of-mouth (one CCHC to another) yielded an additional 13 participants. A total of 54 CCHC were recruited for this project, which represents approximately 70% of the active CCHC in North Carolina. Figure 2 outlines recruitment and attrition rates for this study. Prior to

randomization by the study coordinator (using sealed envelopes with a randomization sequence developed by the study biostatistician), participants were asked to complete a brief telephone interview to provide background and demographic information (Table 9). Participants in the in-person and web-training groups were given a $100 incentive for participation in the study, which included completion of the initial telephone interview, 5 questionnaires, and the training. Control participants were entered into 2 drawings to win $25 for completion of the telephone interview and the pre- and post- knowledge and skill tests. All procedures were approved by the University of North Carolina--Chapel Hill Biomedical Institutional Review Board on May 20, 2005, and all participants gave informed consent to participate in the study.

Figure 2 Participant Flow Diagram

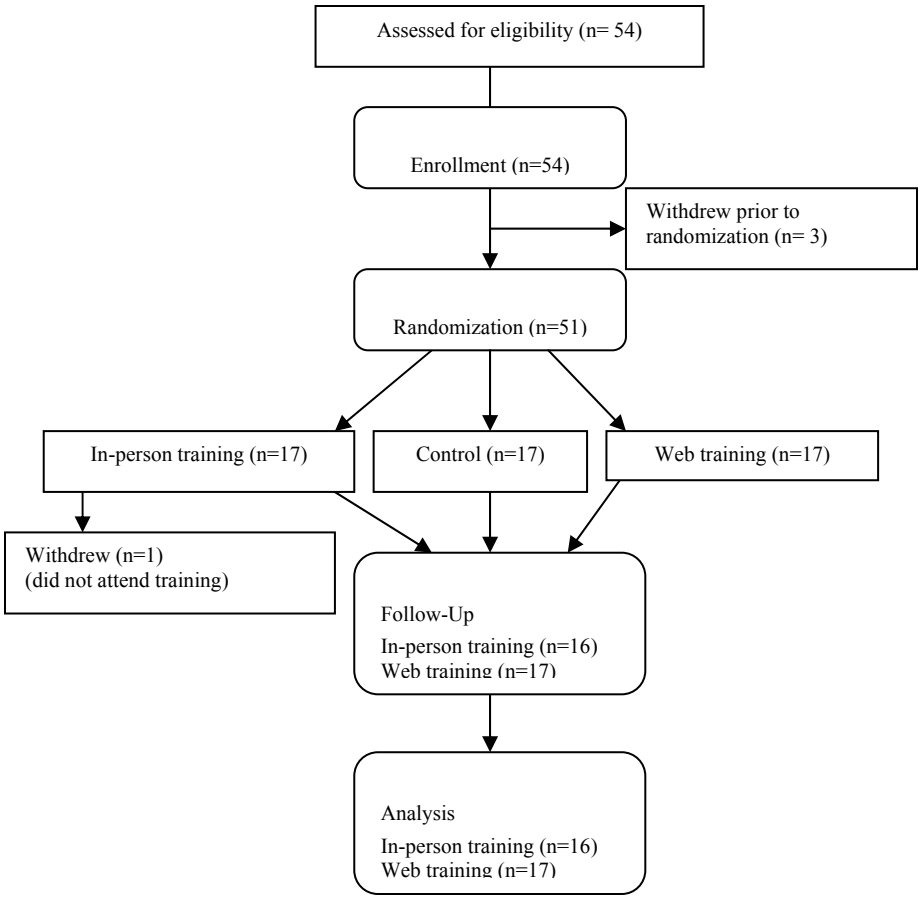


Table 9 Community Health Professional Characteristics

	Control (n=17)	Web (n=17)	In-person (n=16)
Age in yrs (SD)	46.9 (8.79)	41.9 (11.82)	39.8 (12.14)
Gender	16 F; 1 M	17 F	17 F
Race/Ethnicity	1 Asian/PI Not Hispanic/Latina 2 Black Not Hispanic/Latina 0 Hispanic/Latina 14 White Not Hispanic/Latina	0 Asian/PI Not Hispanic/Latina 4 Black Not Hispanic/Latina 1 Hispanic/Latina 12 White Not Hispanic/Latina	0 Asian/PI Not Hispanic/Latina 3 Black Not Hispanic/Latina 0 Hispanic/Latina 13 White Not Hispanic/Latina
# Years CCHC (SD)	3.5 (2.24)	4.4 (4.66)	2.7 (1.82)
Work Hrs/Wk (SD)	38.8 (3.32)	35.9 (9.45)	39.5 (2.00)
Professional degree	0 Associates 11 3 Yr RN Cert 4 Bachelors 2 Masters 0 PhD	1 Associates 4 3 Yr RN Cert 11 Bachelors 1 Masters 0 PhD	3 Associates 5 3 Yr RN Cert 6 Bachelors 2 Masters 1 PhD
Nursing degree (RN or LPN)	15 (88%)	16 (94%)	14 (87%)
Preference for in-person training	9 (53%)	9 (53%)	12 (75%)
Preference for web training	4 (23.5%)	4 (23.5%)	2 (12.5%)
Prefer web and in-person equally	4 (23.5%)	4 (23.5%)	2 (12.5%)
Prior web training	11 (65%)	13 (76%)	12 (75%)
Time using internet in months (SD)	85.9 (25.33)	81.1 (34.10)	86.2 (46.17)

Training Procedures

In-Person Training Procedures

Six in-person trainings were held across the state from December 2005 to March 2006. Each study participant attended one of the 6 trainings. In addition to study participants, these trainings were open to other CHP who were not participating in the research study, but class size was limited to 5 individuals per training. All trainings, facilitated by the study

coordinator, were delivered in a structured and consistent manner. A note taker was employed to document amount of time spent on each section of the training and record any issues or problems that arose. Participants completed the knowledge and skill tests prior to the onset and immediately following the training. Participants also completed a modified computer and internet use questionnaire,[33] which included questions on computer and internet use, prior experience with web-based training, and preferred format for learning new material. The training lasted 3 hours, with an additional 60 minutes allotted for lunch and completion of pre- and post-training questionnaires.

Web Training Procedures

CHP randomized to the web training group were emailed the knowledge and skill tests as well as the modified computer and internet use questionnaire. Once these instruments were completed and returned to the study coordinator, participants were given the URL for the training (http://www.napsacc.org), a log in ID, and a password. Participants were asked to complete the web training within three weeks and to alert the study coordinator of any problems logging in or accessing the training. Progress through the training and time spent on the overall training site were electronically tracked for each subject. Upon completion of the web training, participants were emailed the follow-up knowledge and skill tests and access to the training site was restricted. Participants were asked not to consult outside sources for answers to test questions.

Control Procedures

Control CHP were emailed the baseline knowledge and skill tests as well as the modified computer and internet use questionnaire. Upon receipt of the completed instruments by the study coordinator, participants were then mailed the follow-up knowledge and skill tests. Control CHP were asked to refrain from consulting outside sources while completing all tests. No more than 3 weeks elapsed between completion of the first and second knowledge and skill tests. Control CHP were offered web training upon completion of the study.

Statistical Analysis

To assess differences in post-training knowledge score, analysis of covariance (ANCOVA), with pretest scores as a covariate, was conducted. No demographic characteristics of participants were found to be significantly different by group, and therefore were not included in the model. Two-sided significance tests were used to assess differences in mean post-test knowledge score between in-person and web trained CHP compared to control. A one-sided non-inferiority test was used to assess whether mean post-test knowledge score of web trained CHP was within 5 points of the in-person training group. Paired sample *t* tests were conducted to assess differences between pre- and post-test scores within each group. All tests were conducted at the α=.05 significance level. Data were analyzed using SAS 9.1 (SAS Institute, Cary, NC, 2004) in July 2006.

V.D. Results

Baseline Variables

No significant differences in baseline characteristics were found among the three groups (Table 9). In addition, groups did not differ on prior nutrition or physical activity training, or current involvement in a nutrition or physical activity related project. Although these differences were not significant, 75% of in-person, 53% of web, and 53% of control CHP reported a preference for in-person training compared to web-based training at baseline.

Knowledge and Skill Assessment

Knowledge Score

Scores on the knowledge (Table 10) and skill tests did not significantly differ at baseline among groups. In-person knowledge scores at follow-up were compared to web-trained CHP scores. Results from the ANCOVA model suggest that web trained CHP performed similarly to CHP from the in-person trained group on the knowledge test. Thus, we reject the null hypothesis that in-person trained CHP would perform more than 5 points better than web trained CHP on the knowledge test ($p<.0001$). Additionally, both training groups improved significantly more than controls ($p<.0001$ for each group), demonstrating that both training methods were successful.

Table 10 Percent Correct Answers on the Pre- and Post- Knowledge Test

	Pre-Test (SD)	Post-Test (SD)	Difference (CI)	P Value*
Control	75.0 (8.28)	76.7 (5.93)	1.89 (-1.72, 5.50)	p=0.28
Web	75.2 (8.22)	91.4 (5.07)	16.18 (12.07, 20.29)	p<.0001
In-Person	74.6 (8.82)	91.1 (7.38)	16.53 (13.06, 19.99)	p<.0001

*Test of change from baseline to follow-up using within group paired *t*-tests

Additional exploratory analyses showed that when knowledge scores were broken down by content area (Table 11), some between group differences were observed. In-person trained CHP showed greater improvement than web trained CHP on the Physical Activity for Children and the Nutrition and Physical Activity for Adults sections of the knowledge test, while web-trained CHP showed greater improvement on the Childhood Overweight as well as the Nutrition for Children sections. However, ANCOVA models for Childhood Overweight (p=0.39), Nutrition for Children (p=0.88), Physical Activity for Children (p=0.13), and Nutrition and Physical Activity for Adults (p=0.48) demonstrated that after controlling for baseline score, these between group differences were not found to be significant.

Table 11 Percent Correct Answers on the Pre- and Post- Knowledge Test by Content Area

Group	Knowledge Content Area	Pre-Test (SD)	Post-Test (SD)	Difference (CI)	P Value*
Control	Childhood Overweight	57.3 (17.25)	56.0 (18.75)	-1.47 (-0.94, 7.00)	p=0.72
	Nutrition for Children	81.2 (11.11)	84.1 (8.70)	2.94 (-0.59, 6.47)	p=0.72
	Physical Activity for	69.9 (15.97)	73.5 (11.59)	3.68 (-4.44, 11.79)	p=0.10

	Children				
	Nutrition and Physical Activity for Adults	83.3 (13.16)	84.3 (10.97)	.97 (-4.67, 6.61)	p=0.35
Web	Childhood Overweight	50.0 (29.25)	89.8 (15.5)	39.71 (25.29, 54.12)	p<0.01
	Nutrition for Children	79.4 (12.98)	97.1 (5.88)	17.65 (11.47, 23.82)	p<0.01
	Physical Activity for Children	76.5 (13.89)	83.8 (8.57)	7.35 (1.32, 13.39)	p<0.05
	Nutrition and Physical Activity for Adults	87.2 (11.07)	95.1 (7.84)	7.85 (2.50, 13.20)	p<0.01
In-Person	Childhood Overweight	53.3 (27.25)	86.0 (18.25)	32.81 (20.20, 45.42)	p<0.01
	Nutrition for Children	81.3 (14.08)	97.5 (7.75)	16.25 (11.53, 20.97)	p<0.01
	Physical Activity for Children	71.1 (11.83)	87.5 (9.13)	16.41 (8.82, 23.99)	p<0.01
	Nutrition and Physical Activity for Adults	82.3 (11.32)	90.6 (12.12)	8.34 (1.86, 14.82)	p<0.05

*Test of change from baseline to follow-up using within group paired *t*-tests

Skill Score

The in-person training group mean for pre-test skill score (SD) was 87.0% (6.11) correct, which improved to 88.0% (6.85) correct after the training. The web training group mean for

pre-test skill score (SD) was 93.7% (5.60) correct, which decreased to 91.6% (7.99) correct after the training. The control training group mean for pre-test skill score (SD) was 90.5% (3.37) correct, which improved to 92.8% (4.28) correct at the second administration of the instrument.

Usage Tracking of Web Training

Documented time spent on web training included actual time spent completing modules and idle time (time spent away from the computer or working on other tasks). However, participants in the web training group were automatically logged out after 20 minutes of inactive time (no movement on the website for 20 minutes) and were required to log in again upon returning to the training. When participants were finished reviewing modules, they were asked to log out of the training.

Participants in the web training group spent a mean of 124 minutes (range 53-363 minutes) on the training modules, compared to the 180 minutes spent in training for the in-person group (not including travel time to the training site). All web trained participants viewed every page of each training module at least one time. It was not possible to ascertain the amount of time spent per training module, and time spent on the overall training is not necessarily indicative of time spent actively engaged in the web-based training.

V.E. Discussion

This study found no significant differences in post-training knowledge between in-person and web trained CHP. Moreover, scores on the post-training knowledge test were within 0.5 points for the in-person and web trained groups, which demonstrates the ability of the web

training to yield results nearly identical to the in-person training. When the knowledge test was broken down into four sections (Table 5), some differences between groups emerged. These differences were not significant after controlling for baseline score, suggesting that web trained CHP performed similarly to the in-person trained CHP on all content areas of the knowledge test. Control CHP showed a slight improvement on all four sections of the knowledge test from baseline to follow-up, which may be a function of repeat administration of the instrument, but these differences were not significant.

Despite reported preference by the majority of participants for the more traditional in-person training method, changes in knowledge were comparable among both training groups. Some CHP who participated in the in-person training had to travel great distances to attend the training, despite the fact that trainings were held in diverse geographic regions across the state. The mean distance for travel to and from the training site was 76.5 miles (range 2-244 miles). Given the possibility of long-distance travel to an in-person training, participants may prefer the convenience of web-based instruction. CHP assigned to the web training group were able to complete the training in much less time (mean 2 hours), which was expected given the lack of group discussion that was prevalent in the in-person trainings.

Using a cognitive measure (knowledge) as the main outcome to evaluate training is not without limitations. Increased knowledge does not necessarily translate into better performance at delivering interventions. Although skill was also assessed, measures of actual skill were not employed (e.g. incognito patients or video taped counseling sessions) as in previous studies.[20, 21] In this study all CHP, including controls, performed well on the pre-test for skill (mean 90.45% correct). This may be, in part, explained by the standardized statewide CCHC training that focuses heavily on skill in providing general health

consultation. It is, therefore, possible that CCHC in North Carolina are already highly skilled in providing consultation, leaving little room for improvement. Alternately, the measure may not have adequately discriminated varying levels of consultation skill among this group of trainees.

This randomized controlled trial aimed to examine differences in nutrition and physical activity knowledge and consultation skill between web and in-person trained community health professionals (CHP). Although previous studies have examined differences in web compared to in-person trained health professionals,[5, 20] only one included a control group in the design.[90] Other studies examined web training without comparison to a second training modality or a control group.[21, 34, 35]

Future studies may wish to employ a performance-based outcome measure to evaluate the effectiveness of training. In addition, this group of trainees may be different from other potential groups of community health professionals in that they had prior internet use and web-based training. Therefore, results may not be generalizable to other sample populations. Despite these limitations, this study presents a novel approach to training CHP to address childhood overweight and concludes that web-based instruction is comparable to in-person training on improving basic nutrition and physical activity knowledge.

CHAPTER VI

Evaluating an environmental nutrition and physical activity self-assessment instrument for use in child care settings[3]

Aim 3 – To test validity (criterion) and reliability (test-retest and inter-rater) of the Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) environmental assessment instrument.

Hypothesis 3A – The NAP SACC self-assessment instrument will prove to be a valid measure of the child care center environment as assessed by the following standards:

b) No question will have a correlation of less than 0.25 when compared to a researcher-administered gold standard evaluation of the child care center environment (criterion validity).

Hypothesis 3B – The NAP SACC self-assessment instrument will prove to be a reliable measure of the child care center environment as assessed by the following standards:

c) No question will have a kappa coefficient of less than 0.25 when compared to repeat measures of the same instrument completed by the child care center

[3] Benjamin S, Neelon B, Ball S, Bangdiwala S, Ammerman A, and Ward D. Reliability and Validity of a Nutrition and Physical Activity Self-Assessment for Child Care. (Submitted manuscript)

director at two points in time no more than two weeks apart (test-retest reliability).

d) No question will have a kappa coefficient of less than 0.25 when compared to repeat measures of the same instrument completed at the same time by the child care center director and a second key staff person at the center (inter-rater reliability).

VI.A. Abstract

Background: Few assessment instruments have examined the nutrition and physical activity environments in child care, and none are self-administered. Given the emerging focus on child care as a target for intervention, a valid and reliable measure of the nutrition and physical activity environment is needed.

Methods: A researcher-administered environmental assessment was conducted at 69 child care centers and was compared to center director self-assessments to assess criterion validity. Additionally, 59 center directors and 109 staff completed a self-administered environmental nutrition and physical activity assessment instrument to measure inter-rater reliability. A repeat self-assessment instrument was completed by a sub-sample of 38 center directors to assess test-retest reliability. The child care center directors and teachers were employed in child care centers from across North Carolina. A weighted kappa test statistic was calculated to assess agreement for each question.

Results: Test-retest reliability of the self-assessment instrument yielded kappa statistics that ranged from 0.07 to 1.00 across all questions. For inter-rater reliability, kappa statistics ranged from 0.20 to 1.00. When percent agreement was calculated, questions ranged from

34.29 to 100.00 for test-retest reliability and 52.62 to 100.00 for inter-rater reliability. Kappa statistics for validity ranged from -0.01 to 0.79, while percent agreement ranged from 0 to 93.65.

Conclusions: This study provides estimates of criterion validity, inter-rater reliability and test-retest reliability for an environmental nutrition and physical activity self-assessment instrument for child care. Results indicate that the self-assessment instrument may be a stable and accurate measure of the nutrition and physical activity child care environment.

VI.B. Introduction

Despite concerted efforts, rates of overweight among young children in the United States continue to rise. Data from the 2003-2004 NHANES reported 26.2% of 2-5 year olds were classified as either overweight or at risk for overweight.[1] Even in childhood, overweight is associated with a variety of deleterious health outcomes that can include Type II diabetes mellitus,[4, 6] hypertension and hyperlipidemia,[4, 5] asthma and sleep apnea, [19] early maturation, and psychosocial stress.[3]

Exact causes of childhood overweight are still unknown, although behavioral and environmental influences are thought to play a significant role.[20] Child care settings have recently become a focus for environmental intervention efforts. A large percentage of US children are in some form of child care, and duration of time in care has increased in recent years.[8] The 2001 National Household Education Survey found that 74% of all children ages three to six are in some form of non-parental care and 56% are in center-based child care.[9]

A small number of studies have addressed or assessed nutrition, physical activity, and healthy weight in child care facilities.[29, 41, 43, 47, 50, 91-94] While these studies provide some

guidance for intervention, they also highlight the need to examine environmental influences on child weight. Though there are instruments to assess the home,[95, 96] school,[97, 98] and built environment,[99] few measures of child care environments exist. The Early Childhood Environment Rating Scale (ECERS) and the Infant and Toddler Environment Rating Scale (ITERS), developed by the University of North Carolina at Chapel Hill Frank Porter Graham Child Development Center, include a small number of nutrition and physical activity assessment questions, but are not specifically designed to promote healthy weight in children. Moreover, the instruments were designed to be administered by an outside rater, and are often tied to a regulatory or licensing assessment. Thus, a child care-directed assessment that allows child care providers to evaluate their nutrition and physical activity environments was developed. The purpose of this paper is to report results from reliability and validity testing of a nutrition and physical activity self-assessment instrument for child care environments.

VI.C. Methods

Development of the Self-Assessment Instrument

The self-assessment instrument was developed for the Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) intervention. The NAP SACC intervention was designed to allow child care facilities to self-assess their nutrition and physical activity environments, select areas for improvement, and make environmental changes with the help of a local health consultant. Trained NAP SACC Consultants provided technical assistance and support for environmental improvements at child care facilities.

Key NAP SACC nutrition areas of focus included: Fruits and Vegetables; Fried Foods and High Fat Meats; Beverages; Menus and Variety; Meals and Snacks; Foods Outside of

Regular Meals and Snacks; Supporting Healthy Eating; Nutrition Education for Children, Parents and Staff; and Nutrition Policy. Key NAP SACC physical activity areas of focus included: Active Play and Inactive Time; TV Use and TV Viewing; Play Environment; Supporting Physical Activity; Physical Activity Education for Children, Parents, and Staff; and Physical Activity Policy. The self-assessment instrument included 38 nutrition and 18 physical activity questions that had a demonstrated relationship to childhood overweight, or were likely contributors to an unhealthy environment. Each question had four possible response options ranging from minimum standard to best practice.

Sample

Ninety-six child care centers from across North Carolina were recruited to participate in the NAP SACC intervention. Thirty-two Child Care Health Consultants (CCHC) were recruited to serve as NAP SACC Consultants for the project, and were then asked to provide a list of child care centers from their local area. Employed in a number of states, CCHC are typically Registered Nurses who provide health consultation to child care facilities.[28-31] Child care facilities were eligible to participate if they had at least 20 children enrolled and were classified as a child care center and not a family child care home. Child care centers that met eligibility requirements received a telephone call from the study coordinator inviting them to participate in the research study. Of the 96 centers that enrolled in the study, 70 were randomly assigned to a treatment arm that included completion of the self-assessment instrument.

Table 12 provides descriptive characteristics of the child care centers used for each analysis. Descriptive personal information was not collected for child care center directors or

staff members. All procedures were approved by the University of North Carolina--Chapel Hill Biomedical Institutional Review Board, and all participants gave informed consent to participate in the study.

Table 12 Characteristics of the Child Care Centers

Child Care Center Characteristic	Sample Mean (SD) n=69
Years in operation	17.0 (11.53)
Number of children enrolled	79.4 (53.64)
Number of classrooms	6.0 (3.28)
Number of staff members	16.1 (13.29)
CACFP participant (%)	81.2 (39.39)
NAEYC accredited (%)	6 (2.84)
African American or Black children (%)	20.5 (26.86)
Asian or Pacific Islander children (%)	3.6 (1.70)
Native American children (%)	5.8 (21.24)
White children (%)	61.7 (33.7)
More than one race children (%)	2.8 (6.06)
Ethnicity Hispanic or Latino/a children (%)	3.5 (7.45)

CACFP = Child and Adult Care Adult Food Program
NAEYC = National Association for the Education of Young Children

Reliability Testing

Test-retest and inter-rater reliability testing was conducted on the NAP SACC self-assessment instrument to assess the ability of the instrument to yield consistent results with repeat administration and with multiple raters. Two self-assessment instruments were completed by child care center directors over a three week period of time, which is a method consistent with other studies that measured test-retest reliability.[100,101] To assess inter-rater reliability, the child care center director and two additional staff members were asked to completed the initial self-assessment instrument concurrently, but independently. In 50 centers, two additional staff members completed the self-assessment, while in 9 child care centers only one additional staff member completed the self-assessment instrument. Thus, 50 triad and 9 dyads were created to assess inter-rater reliability.

Self-assessment instruments were mailed to all 70 child care center directors, 69 (99%) of which returned the completed instrument. Three weeks after the initial self-assessment instruments were received, center directors were asked to complete a second self-assessment instrument to assess test-retest reliability. Of the 69 center directors that completed the initial instrument, 38 (55%) returned the second self-assessment instrument.

Validity Testing

NAP SACC Self-Assessment Instrument

Criterion validity of the NAP SACC self-assessment instrument was evaluated for this project. Face, although its worth has been contested,[102] and content validity were reasonably established in a comprehensive literature and resource review that was conducted prior to the development of the self-assessment instrument (Ammerman, 2001, unpublished data). In addition, construct validity was assessed in a national expert review that took place in January through April of 2004. Overall, the reviewers found the instrument to be an accurate and comprehensive measure of the nutrition and physical activity child care center environment; however, a number of revisions were made to the instrument based on reviewer recommendations.

The Environment and Policy Assessment and Observation (EPAO) System

To assess criterion validity, the NAP SACC self-assessment instrument was compared to observation and document reviews at the child care center. The Environment and Policy Assessment and Observation (EPAO) system was developed to objectively assess the diet and physical activity environment of child care centers (Ward, 2005, unpublished data). A

main component of the EPAO is the one-day observation conducted at the child care center. The observation sections of the EPAO were divided into 7 sections: 1. Eating occasions-Foods; 2. Eating Occasions-Beverages; 3. Eating Occasions-Staff Behaviors; 4. Physical Activity-Child Behaviors; 5. Sedentary Activities-Child; 6. Physical Activity-Staff Behaviors; and 7. Center Environment. Additionally, completion of the EPAO included a review of lesson plans, fundraising documents, menus, parent handbooks, staff training documents, playground safety check policies, physical activity and nutrition education training documents, and overall nutrition and physical activity policies.

A group of five field observers were trained during a one-day intensive workshop by the developers of the EPAO system. One observer held a bachelor's degree in nutrition and four had completed or were in the process of completing a master's or doctorate degree in a health-related field. Training included a review of the EPAO system components as well as lessons on general observation techniques, types of play equipment and space, instruction and demonstration of record keeping, and an overview of general child care center rules, regulations, and state mandates. Additionally, each field observer completed a practice observation in a child care center. Prior to beginning data collection, each field observer was required to attain 85% agreement with the gold standard observer who assisted in the development the EPAO. Inter-rater reliability testing was also conducted throughout the data collection period and all field observers periodically underwent retraining to prevent observer drift.

The EPAO was used as the gold standard comparison for the NAP SACC self-assessment instrument. The EPAO, however, could not be used to assess validity for 8 of the 38 (21%) nutrition and 4 of the 18 (22%) physical activity questions (Table 3). These questions

assessed practices that could not be measured in a one-day observation or through review of the documents.

Sixty-nine child care centers were visited by field observers to assess the nutrition and physical activity environments using the EPAO. Immediately following this visit, child care center directors and staff were asked to complete the NAP SACC self-assessment instrument. Results from the EPAO were compared to the self-assessment instrument completed by the center directors to assess criterion validity.

Statistical Analyses

The test-retest reliability comparison between time 1 and time 2 was conducted on self-assessment instruments from 38 child care center directors. Inter-rater reliability was calculated using time 1 data from 59 child care centers (9 child care center director/teacher dyads and 50 child care center director/teacher triads). The proportion in exact agreement (percent agreement) and a weighted kappa statistic were calculated to assess overall agreement for each question on the self-assessment instrument. A weighted kappa statistic[103] was calculated to assess agreement for each question on the self-assessment instrument compared to the EPAO using data from the 69 child care centers. Percent agreement was also calculated for each question.

VI.D. Results

Reliability

Results for all reliability measures are reported in Table 13. Test-retest reliability of the self-assessment instrument yielded kappa statistics that ranged from 0.07 to 1.00 across all

questions (Figure 3). The least reliable question asked how often nutrition education was provided to parents of the children in care (N8D). For inter-rater reliability, kappa statistics ranged from 0.20 to 1.00 across all questions. The question that yielded the lowest kappa statistic asked how often fat was added to cooked vegetables (N1F). The most reliable question for both test-retest and inter-rater reliability yielded a kappa of 1.00 for the question that assessed how often food was used to control behavior (N5F). The inter-quartile ranges for test-retest and inter-rater reliability were 0.27 to 0.45 and 0.45 to 0.63, respectively. When percent agreement was calculated, questions ranged from 34.29 to 100.00 for test-retest reliability and 52.62 to 100.00 for inter-rater reliability.

Table 13 Reliability Measures Using Weighted Kappa Test Statistics and Percent Agreement

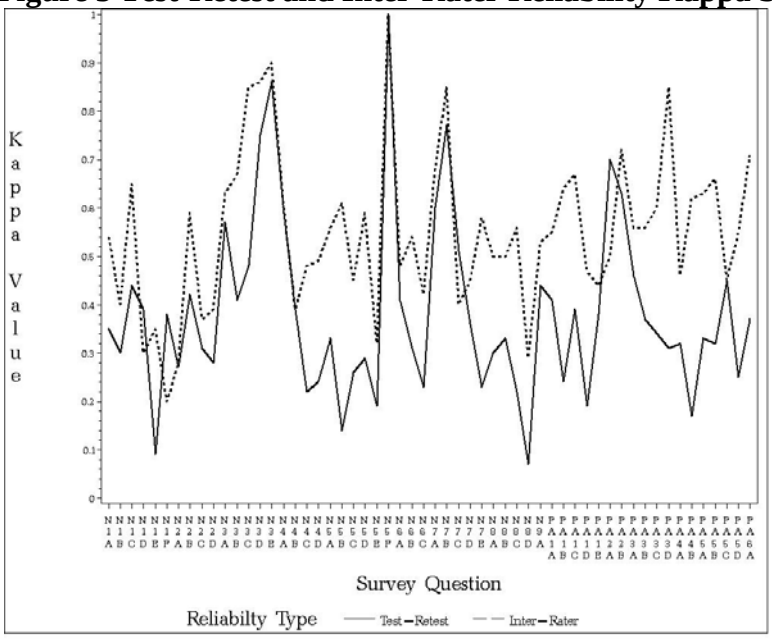
Self-Assessment Question	Test-Retest Reliability			Inter-Rater Reliability		
	Kappa	95% CI	Percent Agreement	Kappa	95% CI	Percent Agreement
Nutrition						
N1A. Fruit (not juice)	0.35	0.20-0.51	57.01	0.54	0.30-0.79	68.42
N1B. Fresh, frozen, or canned in juice fruit	0.30	0.08-0.51	73.39	0.40	0.06-0.73	76.31
N1C. 100% fruit juice	0.44	0.30-0.58	60.19	0.65	0.44-0.86	75.68
N1D. Vegetables (not including fried potatoes)	0.39	0.23-0.55	65.09	0.30	0.02-0.58	61.11
N1E. Dark green, red, orange, or yellow vegetables	0.09	-0.05-0.24	50.00	0.35	0.11-0.59	58.34
N1F. Vegetables and added fat	0.38	0.23-0.52	55.34	0.20	-0.06-0.47	54.29
N2A. Fried or pre-fried meats	0.27	0.11-0.42	62.14	0.28	0.05-0.51	62.16
N2B. Fried or pre-fried potatoes	0.42	0.27-0.58	69.81	0.59	0.34-0.83	78.38
N2C. High fat meats	0.31	0.16-0.46	62.62	0.37	0.09-0.62	67.57
N2D. Lean meats	0.28	0.14-0.43	53.40	0.39	0.15-0.63	55.55
N3A. Outdoor drinking water	0.57	0.45-0.68	60.75	0.63	0.42-0.83	69.44
N3B. Indoor drinking water	0.41	0.26-0.57	66.36	0.67	0.47-0.87	73.69
N3C. Sugar-sweetened beverages	0.48	0.10-0.87	96.15	0.85	0.54-1.00	97.29
N3D. Type of milk for children ages 2 and older	0.75	0.64-0.87	83.33	0.86	0.74-0.98	86.85
N3E. Soft-drink vending machines	0.86	0.79-0.94	89.81	0.90	0.79-1.00	92.10
N4A. Cycle menu length	0.59	0.44-0.73	71.84	0.60	0.36-0.84	78.94
N4B. Whole grain, high fiber	0.39	0.25-0.53	53.33	0.39	0.16-0.62	52.63
N4C. Introduction of new foods	0.22	0.08-0.37	50.47	0.48	0.26-0.70	60.52
N4D. Foods from other cultures	0.24	0.08-0.40	53.33	0.49	0.29-0.70	60.53
N5A. Satiety	0.33	0.17-0.49	54.63	0.56	0.36-0.75	60.52

N5B. Hunger	0.14	0.00-0.28	34.29	0.61	0.42-0.80	63.16
N5C. Encouraging children to eat	0.26	0.10-0.41	59.63	0.45	0.18-0.72	68.42
N5D. Sweets, high fat, high salt	0.29	0.13-0.44	65.14	0.59	0.35-0.83	78.95
N5E. Food as reward	0.19	-0.09-0.46	88.99	0.32	0.06-0.58	94.74
N5F. Food used to control behavior	1.00	1.00-1.00	100.00	1.00	1.00-1.00	100.00
N6A. Parent guidelines for holidays or celebrations	0.41	0.27-0.55	54.46	0.48	0.23-0.72	61.11
N6B. Holidays and celebrations	0.31	0.16-0.46	48.60	0.54	0.34-0.74	60.53
N6C. Fundraising	0.23	0.09-0.36	42.00	0.42	0.16-0.68	61.76
N7A. Children and staff sit together for meals	0.60	0.49-0.71	62.39	0.68	0.51-0.85	68.41
N7B. Meals served family style	0.77	0.67-0.88	81.48	0.85	0.73-0.97	86.83
N7C. Staff consume the same foods and drinks as children	0.51	0.40-0.62	54.13	0.40	0.18-0.62	60.53
N7D. Staff consume less healthy foods in front of children	0.36	0.18-0.53	73.83	0.45	0.17-0.73	75.68
N7E. Staff talk with children about healthy foods	0.23	0.08-0.37	46.30	0.58	0.39-0.77	68.42
N8A. Training opportunities on nutrition for staff	0.30	0.14-0.45	51.40	0.50	0.28-0.71	56.76
N8B. Nutrition training provided by qualified professional	0.33	0.19-0.47	44.04	0.50	0.29-0.72	60.52
N8C. Staff provide nutrition education for children	0.22	0.08-0.36	41.51	0.56	0.35-0.77	60.53
N8D. Nutrition education offered to parents	0.07	-0.11-0.24	54.90	0.29	0.01-0.57	67.56
N9A. Written policy on nutrition and food service	0.44	0.28-0.61	65.56	0.53	0.29-0.78	67.65
Physical Activity						
PA1A. Active (free) play time	0.41	0.27-0.56	66.06	0.55	0.32-0.78	71.05
PA1B. Structured physical activity	0.24	0.09-0.39	57.80	0.64	0.48-0.80	76.31
PA1C. Outdoor active play	0.39	0.22-0.56	75.23	0.67	0.40-0.94	89.47
PA1D. PA as punishment	0.19	0.04-0.34	48.15	0.47	0.21-0.74	72.22
PA1E. Sedentary time	0.38	0.18-0.57	77.06	0.44	0.09-0.79	78.94
PA2A. Presence of television	0.70	0.54-0.86	87.38	0.50	0.29-0.72	72.97
PA2B. TV, videos, video games	0.63	0.50-0.76	76.92	0.72	0.49-0.94	83.80
PA3A. Fixed play equipment	0.46	0.30-0.63	63.30	0.56	0.30-0.81	65.79
PA3B. Equipment safety checks	0.37	0.20-0.54	69.81	0.56	0.29-0.83	78.95
PA3C. Portable play equipment	0.34	0.20-0.48	52.29	0.60	0.42-0.78	65.79
PA3D. Indoor play space	0.31	0.16-0.47	61.47	0.85	0.68-1.00	92.10
PA4A. Staff join in active play	0.32	0.18-0.46	50.93	0.46	0.25-0.67	57.89
PA4B. Support for PA	0.17	0.04-0.31	37.14	0.62	0.43-0.81	64.87
PA5A. Training opportunities on PA for staff	0.33	0.19-0.47	44.76	0.63	0.45-0.81	60.52
PA5B. PA training by qualified professional	0.32	0.17-0.48	50.00	0.66	0.51-0.82	62.16
PA5C. Staff provide PA education for children	0.45	0.31-0.58	52.34	0.45	0.23-0.67	52.62
PA5D. PA education offered to	0.25	0.08-0.43	73.08	0.55	0.30-0.79	81.08

parents						
PA6A. Written policy on PA	0.37	0.19-0.54	62.37	0.71	0.50-0.93	82.35

PA=Physical activity

Figure 3 Test-Retest and Inter-Rater Reliability Kappa Statistics by Question



Validity

Kappa statistics across all questions for validity ranged from -0.01 to 0.79 (Figure 4), while percent agreement ranged from 0 to 93.65 (Table 14). The only question with a negative kappa, and the least valid question, asked how often child care providers assessed hunger before providing additional helpings of food to children (N5B). The most valid question with a kappa statistic of 0.79 asked about a written policy on physical activity (PA6A). Additionally, the companion nutrition policy question (N9A) yielded a kappa of 0.76. When direct observation was used to validate questions, kappa statistics ranged from -0.01 to 0.78. Questions that were validated using the document review ranged from 0.03 to 0.79. The inter-quartile range for overall validity was 0.08 to 0.34 for kappa statistics and 35.38 to 67.20 for percent agreement.

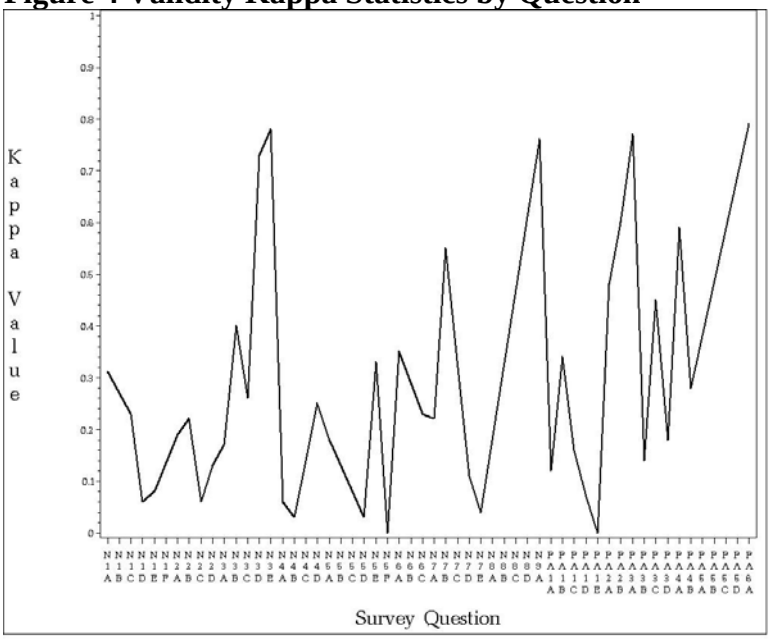
Table 14 Validity Measures Using Weighted Kappa Test Statistics and Percent Agreement

Self-Assessment Question	Validity			
	Validation Method	Kappa	95% CI	Percent Agreement
Nutrition				
N1A. Fruit (not juice)	Document	0.31	0.15-0.47	43.75
N1B. Fresh, frozen, or canned in juice fruit	--	---	---	---
N1C. 100% fruit juice	Document	0.23	0.06-0.41	42.19
N1D. Vegetables (not including fried potatoes)	Document	0.06	-0.10-0.02	47.62
N1E. Dark green, red, orange, or yellow vegetables	Document	0.08	-0.08-0.24	12.90
N1F. Vegetables and added fat	---	---	---	---
N2A. Fried or pre-fried meats	Document	0.19	-0.03-0.40	59.38
N2B. Fried or pre-fried potatoes	Document	0.22	0.04-0.40	53.84
N2C. High fat meats	Document	0.06	-0.03-0.15	26.16
N2D. Lean meats	Document	0.13	-0.04-0.30	41.54
N3A. Outdoor drinking water	Observation	0.17	-0.01-0.35	33.33
N3B. Indoor drinking water	Observation	0.40	0.23-0.58	60.00
N3C. Sugar-sweetened beverages	Document	0.26	-0.12-0.64	93.65
N3D. Type of milk for children ages 2 and older	Observation	0.73	0.59-0.88	82.09
N3E. Soft-drink vending machines	Observation	0.78	0.67-0.90	83.09
N4A. Cycle menu length	Document	0.06	-0.17-0.29	41.82
N4B. Whole grain, high fiber	Document	0.03	0.00-0.05	26.57
N4C. Introduction of new foods	Observation	---	---	---
N4D. Foods from other cultures	Document	0.25	0.10-0.41	56.06
N5A. Satiety	Observation	0.18	0.02-0.34	36.11
N5B. Hunger	Observation	-0.01	-0.12-0.10	27.45
N5C. Encouraging children to eat	Observation	0.08	0.02-0.14	30.15
N5D. Sweets, high fat, high salt	Document	0.03	0.00-0.06	17.19
N5E. Food as reward	Observation	0.33	-0.08-0.73	92.54
N5F. Food used to control behavior	Observation	0.00	0.00-0.00	87.88
N6A. Parent guidelines for holidays or celebrations	Document	0.35	0.19-0.50	47.46
N6B. Holidays and celebrations	Document	---	---	---
N6C. Fundraising	Document	0.23	-0.09-0.55	33.34
N7A. Children and staff sit together for meals	Observation	0.22	0.10-0.35	32.83
N7B. Meals served family style	Observation	0.55	0.30-0.80	82.08
N7C. Staff consume the same foods and drinks as children	Observation	0.32	0.17-0.47	47.45
N7D. Staff consume less healthy foods in front of children	Observation	0.11	-0.11-0.34	55.93
N7E. Staff talk with children about healthy foods	Observation	0.04	-0.07-0.14	22.50
N8A. Training opportunities on nutrition for staff	---	---	---	---
N8B. Nutrition training provided by qualified professional	---	---	---	---
N8C. Staff provide nutrition education for children	---	---	---	---
N8D. Nutrition education offered to parents	---	---	---	---
N9A. Written policy on nutrition and food service	Document	0.76	0.60-0.92	88.13
Physical Activity				
PA1A. Active (free) play time	Observation	0.12	-0.05-0.30	44.62
PA1B. Structured physical activity	Observation	0.34	0.10-0.59	59.71
PA1C. Outdoor active play	Observation	0.16	0.02-0.31	52.24

PA1D. PA as punishment	Observation	0.07	-0.04-0.17	36.36
PA1E. Sedentary time	Observation	0.00	0.00-0.00	0.00
PA2A. Presence of television	Observation	0.48	0.30-0.65	67.20
PA2B. TV, videos, video games	Observation	0.60	0.42-0.77	75.39
PA3A. Fixed play equipment	Observation	0.77	0.63-0.90	83.58
PA3B. Equipment safety checks	Observation	0.14	-0.14-0.24	65.85
PA3C. Portable play equipment	Observation	0.45	0.29-0.60	59.70
PA3D. Indoor play space	Observation	0.18	0.03-0.32	40.31
PA4A. Staff join in active play	Observation	0.59	0.43-0.75	69.69
PA4B. Support for PA	Observation	0.28	0.15-0.42	35.38
PA5A. Training opportunities on PA for staff	---	---	---	---
PA5B. PA training by qualified professional	---	---	---	---
PA5C. Staff provide PA education for children	---	---	---	---
PA5D. PA education offered to parents	---	---	---	---
PA6A. Written policy on PA	Document	0.79	0.63-0.95	90.64

PA=Physical activity

Figure 4 Validity Kappa Statistics by Question



A kappa statistic, proposed by Cohen in 1960,[103] is generally a very conservative measure and takes into consideration agreement due to chance. Landis and Koch suggest the following arbitrary guidelines for interpreting kappa statistics: <0=poor agreement, 0 to 0.2=slight agreement, 0.2 to 0.4=fair agreement, 0.4 to 0.6=moderate agreement, 0.6 to 0.8= substantial agreement, and 0.8 to 1=almost perfect agreement.[104] Applying this method for interpretation, 34% of questions for test-retest reliability, and 81% of questions for inter-rater

reliability had kappa statistics greater than or equal to 0.40 (at least moderate agreement). Additionally, 25% of the questions for validity yielded kappa statistics representing at least moderate agreement.

Muñoz and Bangdiwala,[105] however, conducted simulations of the behavior of kappa and suggest the following alternate interpretation of the kappa statistic: <0=poor agreement, 0 to 0.20=fair agreement, 0.20 to 0.45=moderate agreement, 0.45 to 0.75=substantial agreement, 0.75 to 1.00=almost perfect agreement. Using this method, 89% of test-retest, 100% of inter-rater, and 52% of validity kappa statistics show at least moderate agreement (0.20 or above). Table 15 presents the number of questions that fall into each of the above categories for interpreting the strength of agreement.

Table 15 Number of Questions per Strength of Agreement Labels for Interpretation[105]

Strength of Agreement	Test-Retest Reliability	Inter-Rater Reliability	Validity
Almost Perfect	3	5	5
Substantial	11	38	6
Moderate	36	13	13
Fair	6	0	19
Poor	0	0	1
Total	56	56	44

VI.E. Discussion

This paper reports on the evaluation of a self-assessment instrument designed for use with child care providers. Test-retest and inter-rater reliability, as well as criterion validity, were assessed using a weighted kappa statistic. Interpreting these data using the method proposed by Muñoz and Bangdiwala,[105] overall reliability and validity of the instrument indicate it is an accurate and stable measure of the child care environment. This approach provides non-arbitrary, simulation-based interpretation guidelines for the kappa test statistic, and improves upon the conventional method proposed by Landis and Koch in 1977.[104]

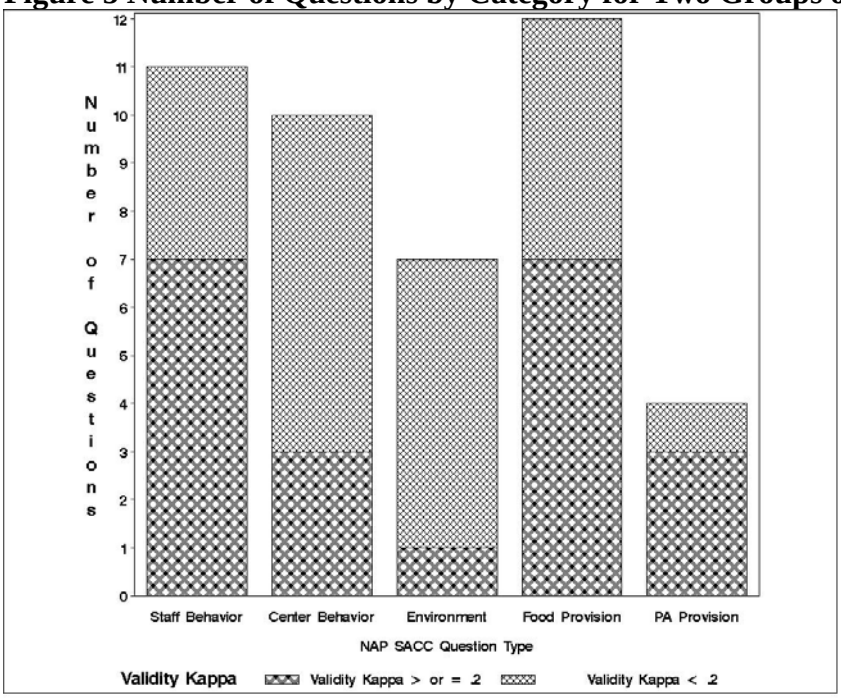
A limitation of the kappa statistic as a measure of concordance was demonstrated when analyzing these data. Question N5F assessed food used to control behavior, and yielded a kappa statistic of 0.00. Given that there was no variability in the scores reported on the self-assessment instrument for that question (all center directors reported a score of "4"), the weighted kappa (Cicchetti and Allison[106] weight used) was unable to yield a meaningful test statistic and therefore did not accurately represent agreement between the two measures. Percent agreement for this question was 87.88%, which provided some indication of reasonable concordance. In this specific case, an alternate test of agreement would be more appropriate. Thus, in addition to weighted kappa statistics, percent (exact) agreement is also presented for these data. Although this measure does not consider agreement due to chance, and therefore may report inflated agreement, it provided a more appropriate interpretation for question N5F and is not without overall merit.

Regardless of statistical test used, scores on the self-assessment instrument were generally higher than those found on the EPAO for validity. This was expected, given that self-report may be associated with social desirability. Child care center directors may wish to describe their center in the best possible light, which is a limitation of the self-assessment approach. The original intent of the NAP SACC self-assessment instrument, however, was to raise awareness and spark interest in the child care staff completing the instrument. Use of the instrument as a primary outcome measure for research studies should be limited, or approached with caution. A more objective measure, such as the EPAO may be more appropriate if researchers hope to accurately capture policies and practices at the child care facility. The EPAO, however, is not without limitations. Observation that takes place over one day will capture only those behaviors and practices that occur regularly, or happen to

coincide with the day of observation. In addition, child care center staff may behave or interact differently with children in the presence of an outside observer. Repeated day observation may yield more accurate results since behaviors that happen sporadically could be observed and staff may be less likely to alter behavior after a number of observation days. In general, questions that assessed the behaviors of staff (N1D, N1E, N2C, N4A, N4B, N5B, N5C, N5D, N7E, PA1D, and PA1E) had lower kappa statistics than questions that examined more concrete outcomes. The questions that had the highest kappa statistics for both types of reliability assessed fixed, or tangible aspects of the child care center environment (N3E, N7B, N9A, PA2B, PA3A, and PA6A), although this pattern did not hold when applied to validity kappa test statistics. Review of documents (e.g., menus, lesson plans, policies) may help to supplement information gleaned from observation, but there is some evidence, however, that menus may not always accurately reflect food served at the child care center.[107]

When questions on the NAP SACC instrument were broken down by category and separated by a kappa test statistic of less than .20 compared to those questions with a kappa test statistic of greater than or equal to .20, some within category patterns emerged (Figure 5). Questions related to staff behavior and provision of food were fairly evenly split, while questions that assessed center behavior and the overall environment tended to have more questions with a lower kappa test statistic. The category that yielded the highest percentage of kappa test statistics at or above .20 was provision of physical activity.

Figure 5 Number of Questions by Category for Two Groups of Kappa Test Statistics



Despite some limitations, results for validity testing in this sample of child care centers were not without merit. Validity testing yielded kappa statistics lower than those found for reliability, but still provided evidence for reasonable agreement among the two measurement instruments. Reliability testing generally yielded higher kappa statistics, and inter-rater reliability results were slightly better than those for test-retest reliability. Raters from the same child care centers may have worked together and answered questions similarly, despite instructions to complete the self-assessment instruments independently, which is a limitation of this study. On the other hand, given that kappa statistics were excellent but not perfect, raters could be accurately reporting the same behaviors and policies seen at their child care center.

Future studies may wish to employ both an objective measure of the child care environment, as well as the self-assessment instrument pre- and post-intervention to see if the instruments perform in a similar, or parallel manner. Further assessment of the validity of

the self-assessment instrument should be conducted using multiple days of observation, with less reliance on menus for documentation of actual food served.

Overall, the NAP SACC self-assessment instrument demonstrated above average test-retest and inter-rater reliability, and reasonable validity based on the inter-quartile ranges and percent of questions with at least moderate agreement. Although results should be interpreted with some caution, the NAP SACC self-assessment instrument is recommended as a valid and reliable measure of the nutrition and physical activity environments in child care settings. Evaluation of its use to spark change in the child care environment is currently under study.

CHAPTER VII

SUMMARY OF AIMS, RECOMMENDATIONS, AND FUTURE RESEARCH

A. Summary of Aims

Child care facilities provide a unique opportunity for interventions to address and promote healthy weight in children, but environmental intervention efforts that target both nutrition and physical activity policies and practices are needed to support child level change. Few preschool interventions have addressed nutrition and physical activity, and of those that have, the interventions were implemented by research staff and not by existing community health professionals. [41, 50] The overarching goal of this dissertation was to promote the health of young children in child care settings using a nutrition and physical activity environmental intervention. This dissertation consisted of three distinct projects including pilot testing of a recently developed nutrition and physical activity environmental intervention, comparison of two methods to train implementation staff, and reliability and validity testing of the self-assessment instrument used in the intervention.

Results from the NAP SACC pilot study report that the child care centers that participated in the intervention improved their scores on the self-assessment instrument, and made tangible nutrition and physical activity environmental improvements, while comparison centers demonstrated minimal change.[108] These results suggest that the NAP SACC program has potential as a novel approach to promoting healthy weight environments in child care settings.

Based on feedback from the NAP SACC Consultants who participated in the pilot intervention, a more convenient training method and approach was needed. Web-based training was developed and compared to the traditional in-person NAP SACC training. Participants were tested pre- and post-training on basic nutrition and physical activity knowledge related to childhood overweight. Potential skill in delivering the NAP SACC intervention was also assessed. This randomized controlled trial examined differences in nutrition and physical activity knowledge and consultation skill between web and in-person trained community health professionals (CHP), or NAP SACC Consultants. As hypothesized, this study found no significant differences in post-training knowledge between the in-person and web trained participants. Moreover, scores on the post-training knowledge test were within 0.5 points for the in-person and web-trained groups, which demonstrates the ability of the web training to yield results nearly identical to the in-person training. Despite reported preference by the majority of participants for the more traditional in-person training method, changes in knowledge were comparable among both training groups. Although previous studies have examined differences in web compared to in-person trained health professionals,[5, 20] no control group was included in these designs. Other studies examined web training without comparison to either a second training modality or a control group.[21, 34, 35] This study tested both web-based and in-person training compared to control and concludes that web-based instruction is comparable to in-person training on improving basic nutrition and physical activity knowledge of CHP; however, skill changes were similar among the groups. Therefore, both web and in-person training may be appropriate to prepare CHP to deliver the NAP SACC intervention. Given that twelve additional states are

currently using the NAP SACC program, further evaluation of additional program components was warranted to accommodate its use in community settings.

Although the process of self-assessment is inherently an intervention change strategy, the extent to which social desirability inflates responses is not known. The NAP SACC program includes a self-assessment instrument designed to raise awareness, assist in planning for change, and spark interest in the child care staff completing the instrument. However, in applied settings, the self-assessment instrument has potential for use as an outcome when implementation of the NAP SACC program is evaluated. Use of the instrument as a primary outcome measure for research studies should be approached with caution, although reliability and validity testing yielded positive results that suggest that the instrument may be a stable and accurate measure of the nutrition and physical activity environment in child care centers. Test-retest reliability, inter-rater reliability, and criterion validity of the NAP SACC self-assessment instrument were assessed using a weighted kappa statistic. Overall, the instrument demonstrated above average test-retest and inter-rater reliability, and reasonable validity based on the inter-quartile ranges and percent of questions with at least moderate agreement. Validity testing yielded kappa statistics lower than those found for reliability, but still provided evidence for reasonable agreement among the two measurement instruments. Reliability testing generally yielded higher kappa statistics, and inter-rater reliability results were slightly better than those for test-retest reliability. The NAP SACC self-assessment instrument is recommended as a valid and reliable measure of the nutrition and physical activity environments in child care settings.

All three aims of this dissertation were designed to promote healthy eating and increased physical activity within child care settings and focus on the broader issue of preventing

childhood overweight. Child care has recently been cited as an important setting for addressing childhood overweight,[40, 51] and researchers and policy makers alike are beginning to turn their attention to this area. More than half of all children in the United States are now in some form of child care,[9, 109] making child care providers equally responsible for the health and well-being of young children. This shared duty, that was once solely the responsibility of each individual family, comes at a significant time for children both developmentally and socially. Preschool-aged children are beginning to adopt what may be lifelong dietary and physical activity patterns and are laying the groundwork for future health issues. Child care settings represent unique and timely opportunities to address the growing overweight epidemic. This dissertation work contributes to the growing body of evidence that highlights child care as an important setting for intervention.

B. Recommendations

Although the NAP SACC pilot project was well received by both the child care centers and the NAP SACC Consultants, the primary outcomes of the project were based heavily on self-report. In addition, the small sample size of intervention and especially comparison group limits our ability to draw major conclusions from the study. Despite these limitations, this pilot project demonstrates the need for additional research in this area and helps to establish child care centers as an important setting for healthy weight interventions for children. Recent NAP SACC research efforts include minor revision to the intervention, a more comprehensive and objective evaluation of the intervention using a researcher-administered environmental assessment system (Environment and Policy Assessment and Observation, under review), as well as measures of child dietary intake and physical activity

behaviors (Ball et al., in press; Ward et al., under review) dietary intake and physical activity), and body mass index.. An additional project linking child care centers to the home is currently underway.

Additionally, modifications to the NAP SACC training and future training evaluation may be warranted. Using a cognitive measure (knowledge) as the main outcome to evaluate training is not without limitations. Moreover, knowledge should be measured at some point post intervention (e.g., three to nine months) to determine the long-term ability of the NAP SACC consultants to retain the nutrition and physical activity information learned in the training. Increased knowledge, however, does not necessarily translate into better performance at delivering interventions.

Although potential skill was assessed in this project, measures of actual skill were not employed. Previous studies have used incognito patients and video taped counseling sessions to determine actual skill in delivery and application of health information.[20, 21] Future research efforts should include a more tangible outcome measure of actual skill in delivering the NAP SACC intervention.

Additional improvements to the NAP SACC self-assessment instrument and subsequent reliability and validity testing in a sample of child care centers may yield a more robust instrument. Future studies may wish to employ both an objective measure of the child care environment, such as the Environment and Policy Assessment and Observation (EPAO), as well as the self-assessment instrument pre- and post-intervention to see if the instruments perform in a parallel manner. These studies and ongoing initiatives will help determine the extent to which the training, instruments, and overall NAP SACC intervention can be recommended for widespread use.

C. Future Research

A number of opportunities exist for nutrition and physical activity research in child care settings. Intervention efforts have only begun to scratch the surface of preventing childhood overweight, and more research is needed to identify causes and predictors of overweight. Little is known about the best way to intervene, although we do know that child care settings should provide regular opportunities for active play, healthy food and beverages, and appropriate interactions between staff and children.

A recent publication[40] highlights four main areas for future research in child care: 1) develop, implement, and evaluate innovative programs focused on promoting healthful eating and physical activity and on preventing obesity in child care facilities; 2) conduct descriptive environmental studies in child care centers, Head Start, and licensed day care homes to assess the food environment (the types and amounts of foods and beverages served for meals and snacks), the physical activity environment (the amount and type of physical activity), and media use; 3) conduct a national study of child care programs on the dietary quality of meals and snacks served and how they compare to the Dietary Guidelines for Americans;[110] and 4) evaluate methods to increase parental involvement, to change parental behavior, and to change the home environment through child care-based overweight prevention initiatives. These and other recommendations provide guidelines for future research efforts in child care to prevent and mitigate childhood overweight.

APPENDIX A: Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) Key Areas

Nutrition 1	***Fruits and Vegetables (1-10)***
Nutrition 2	Fried Foods and High Fat Meats (2, 3, 6, 11-14)
Nutrition 3	Beverages (1, 2, 7, 10, 13-19)
Nutrition 4	Menus and Variety (1-3, 6, 14, 20, 21)
Nutrition 5	Meals and Snacks (1, 2, 6, 14, 22-30)
Nutrition 6	Foods Outside of Regular Meals and Snacks (1-3, 14, 21, 29)
Nutrition 7	Supporting Healthy Eating (1, 2, 6, 7, 14, 31, 32)
Nutrition 8	Nutrition Education for Children, Parents and Staff (1, 2, 6, 14, 21, 29, 33, 34)
Nutrition 9	Nutrition Policy (1, 10, 18, 21)
Physical Activity 1	Active Play and Inactive Time (3, 10, 29, 35-46)
Physical Activity 2	TV Use and TV Viewing (7, 10, 47-49)
Physical Activity 3	Play Environment (37, 39, 40, 46, 50, 51)
Physical Activity 4	Supporting Physical Activity (37, 39, 40, 46, 52, 53)
Physical Activity 5	Physical Activity Education for Children, Parents, and Staff (29, 35, 37, 38, 40, 46, 54)
Physical Activity 6	Physical Activity Policy (35, 40, 46, 55)

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APPENDIX B: Environment and Policy Assessment and Observation (EPAO) Questions by Content Area

EPAO Question		Observer Agreement	References Supporting Recommendation
Eating Occasions: Foods			
1	How is breakfast served? *Recommendation: Family style*	Excellent	1,4,6,11,31
2	How is a.m. snack served? *Recommendation: Family style*	Moderate	1,4,6,11,31
3	How is lunch served? *Recommendation: Family style*	Moderate	1,4,6,11,31
4	How is p.m. snack served? *Recommendation: Family style*	Excellent	1,4,6,11,31
5	How many times was fruit served the day of observation? *Recommendation: 2 or more*	Perfect	1,2,3,4,5,6,7
6	How many times was fruit served fresh, frozen, or canned in its own juice the day of observation? *Recommendation: All of the time*	Perfect	4,6
7	How many times was 100% fruit juice served the day of observation? *Recommendation: 1 time per week or less*	Perfect	1,2,4,7,8,9,10
8	How many times were vegetables (not including French fries or fried potatoes) served the day of observation? *Recommendation: 2 or more times per day*	Excellent	1,2,3,4,5,6,7
9	How many times were dark green, red, orange, or yellow vegetables served the day of observation? **Recommendation: 1 or more times per day**	Excellent	2,6
10	Is margarine, butter, or meat fat visible on vegetables? Are vegetables typically prepared with margarine, butter or fat? How many times were vegetables prepared with added fat for the day of observation? *Recommendation: Less than 1 time per week*	Perfect	4,6
11	How many times were fried or pre-fried meats served the day of the observation? *Recommendation: Less than once a week*	Perfect	2,4,6,11,12,13

	or never.		
12	How many times were fried or pre-fried potatoes served the day of the observation? *Recommendation: Less than once a week or never.*	Perfect	2,4,6,11,12,13
13	How many times were high fat meats served the day of the observation? *Recommendation: Less than once a week or never.*	Perfect	2,4,6,11
14	How many times were lean meats served the day of the observation? *Recommendation: One or more times per day.*	Perfect	2,4,6,11,14
15	How many times were sweets or high fat, high salt foods served the day of the observation? *Recommendation: Less than one time per week.*	Moderate	4,6,11,26,27

Eating Occasions: Beverages			
16	Is water easily visible inside? *Recommendation: Water is easily visible inside*	Perfect	1,4
17	Water is available…? *Recommendation: Available for self-serve.*	Excellent	1,4
18	Where is water available?	Excellent	
19	How many times were sugar drinks (Kool-aid™, sports drinks, sweet tea, punches, or soda) served the day of the observation? *Recommendation: Less than one time per week.*	Perfect	4,7,10,11,15,16,17
20	How many times was milk served the day of observation?	Excellent	
21	What type of milk is served most often to children? *Recommendation: Milk is usually skim or 1%t.*	Excellent	2,4,7,11,14
22	Note other types of milk served to children:	Perfect/ Excellent	

Eating Occasions: Staff Behaviors			
23	Do staff determine fullness before removing a plate less than half eaten?	Poor	1,11,22,23

	Recommendation: All of the time		
24	Do staff determine hunger before serving second helpings when they are requested? *Recommendation: All of the time*	Poor	4,23
26	Is food used to reward behavior? *Recommendation: Rarely or never*	Perfect	1,11,21,22,28,29
27	Is food used to control behavior or withheld as punishment? *Recommendation: Rarely or never*	Perfect	1,21,22,28,30
28	Do staff sit with children during meals? *Recommendation: All meals all of the time*	Perfect	1,6,7
29	Are meals served family style? *Recommendation: All of the time*	Perfect	1,4,6,11,31
30	Do staff consume the same food and/or drinks as children? *Recommendation: All of the time*	Excellent	1,6,7,11,56
31	Do staff eat and/or drink less healthy foods in front of children? *Recommendation: Rarely or never*	Excellent	6,7
32	Do staff talk with children about healthy foods? Recommendation: All of the time	Poor	1,4,6,7,11
33	Is any nutrition education for kids observed? *Recommendation: 1 time per week or more*	Perfect	1,4,6,11,21,26,32

Physical Activity: Child Behaviors			
34	How many minutes of active play time is observed? *Recommendation: More than 60 minutes each day*	Moderate	10,26,35,41,47,49,51,52, 55
35	Is structured physical activity observed? *Recommendation: Provided to all children daily*	Perfect	10,45,47,49,52
36	Did you observe any outdoor active play? *Recommendation: 2 or more times per day*	Perfect	10,36,38,39,48,49,53
37	Is water easily visible outside? *Recommendation: Easily visible*	Perfect	1,4
38	Water is available outside… *Recommendation: Available for self serve*	Moderate	1,4

Sedentary Activities: Child			
39	Did you observe children seated for more than 30 minutes at a time (excluding nap)? *Recommendation: Less than one time per week or never*	Perfect	10,47,49
40	Is a TV present in the room? Recommendation:	Perfect	
41	Is a VCR/DVD present in the room?	Perfect	
42	Is a computer visible in the room for use by children?	Perfect	
43	Is TV viewing observed? *Recommendation: 1 time per week or less, for educational purposes only*	Perfect	10,34,42,43
44	Is there a video game system in the room?	Perfect	
45	Is video game playing observed? *Recommendation: 1 time per week or less, for educational purposes only*	Perfect	7,10,34,42,43
Physical Activity: Staff Behaviors			
46	Did you observe restricting active play as punishment? *Recommendation: Never*	Perfect	41
47	Did you observe increasing active play as a reward? *Recommendation: Staff provide more active play as a reward*	Perfect	41
48	Did staff join in active play? *Recommendation: Often or always*	Excellent	41,45,49,52,54
49	Were any positive statements made about physical activity? *Recommendation: Often or always*	Perfect	41,45,49,52,54
50	Did staff provide prompts to increase physical activity?	Perfect	
51	Did staff provide prompts to decrease physical activity?	Moderate	
52	Was any physical activity education for kids observed? *Recommendation: 1 time per week*	Excellent	26,35,41,46,49

Center Environment			
53	Where are soda and other soft-drink vending machines located? *Recommendation: Not located on site*	Perfect	4,18,19
54	Are climbing structures (jungle gyms,	Perfect	44,45,49

	ladders, slides, etc.) present at the site? Recommendation: *Available and accommodates the needs of all children.*		
55	Are balancing surfaces (balance beams, boards, etc.) present at the site?	Excellent	
56	Are running spaces (open space to run and play) present at the site?	Perfect	
57	Is swinging equipment (swings, ropes, etc.) present at the site? *Recommendation: Available and accommodates the needs of all children.*	Excellent	44,45,49
58	Are miscellaneous play structures (sand boxes, slides, tunnels, etc.) present at the site? *Recommendation: Available and accommodates the needs of all children.*	Perfect	44,45,49
59	Is floor play equipment (tumbling mats, carpet squares, etc.) present at the site? *Recommendation: Available for all children to use at the same time*	Moderate	44,45,49,52
60	Is jumping play equipment (jump ropes, hoops, etc.) present at the site? *Recommendation: Available for all children to use at the same time*	Excellent	44,45,49,52
61	Is twirling play equipment (ribbons, scarves, batons, etc.) present at the site? *Recommendation: Available for all children to use at the same time*	Moderate	44,45,49,52
62	Is miscellaneous play equipment (shovels, scoops, buckets, sand toys, etc.) present at the site? *Recommendation: Available for all children to use at the same time*	Moderate	44,45,49,52
63	Is indoor play space suitable for all activities? *Recommendation: Available for all activities, including running.*	Moderate	40,49
64	Are any posters, pictures, or books about physical activity displayed in the observation room? *Recommendation: Posters, pictures, or books about physical activity are displayed in every room.*	Moderate	37

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